To: **THE APPEAL AUTHORITY: THE HONOURABLE MINISTER OF ENVIRONMENTAL AFFAIRS, REPUBLIC OF SOUTH AFRICA**

**Authorisation Registration Number: (12/12/20/994)**

Ex Parte:

**GREENPEACE AFRICA** **Appellant**

**EARTHLIFE AFRICA – JOHANNESBURG** **Appellant**

**SOUTHERN AFRICAN FAITH COMMUNITIES' ENVIRONMENT INSTITUTE** **Appellant**

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**SUPPLEMENTARY APPEAL: ENVIRONMENTAL AUTHORISATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998: GN R. 386/387:**

**APPEAL IN TERMS OF REGULATION 60 OF THE NEMA ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, 2010**

**PROPOSED CONSTRUCTION OF A NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (NUCLEAR 1) AT DUYNEFONTEIN, WESTERN CAPE PROVINCE**

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## A. INTRODUCTION AND EXECUTIVE SUMMARY

1. This is an appeal against the authorisation granted by the Chief Director: Integrated Environmental Authorisations, Department of Environmental Affairs (**DEA**) on 11 October 2017 to **ESKOM HOLDINGS (SOC) LIMITED** ("**ESKOM"**) for the construction of a nuclear power station and associated infrastructure ("**Nuclear 1**") at Duynefontein, Western Cape province ("**authorisation**").

2. On 1 December 2017, the appellants' submitted an appeal against the authorisation. Subsequently, a condonation decision dated 1 December 2017 was issued by the DEA granting all appellants an extension of time within which to submit their grounds of appeal, namely 5 March 2018 (paragraph 4.5.4). In terms of this condonation decision, appellants who had already submitted their appeals were afforded the opportunity to elect to supplement those appeals and submit any supplementary appeals on or before 5 March 2018 (paragraph 4.5.5). Accordingly, the appellants have elected to supplement their appeal, and this supplementary appeal replaces the appeal submitted on 1 December 2017 in its entirety.

3. The authorisation was granted in terms of section 24 of the National Environmental Management Act, 1998 ("**NEMA**") and the Environmental Impact Assessment Regulations, 2006[1] ("**EIA Regulations**").

4. This appeal is brought in terms of the relevant provisions of chapter 7 of the NEMA Environmental Impact Assessment Regulations, 2010[2] ("**EIA Regulations, 2010**"), read with the transitional arrangements set out in Regulation 10(2)(b) of the National Appeal Regulations, 2014.[3]

5. The appellants contend that the Final Environmental Impact Report ("**Final EIA Report**") is fatally flawed, and cannot serve as a lawful basis for an environmental authorisation decision. The authorisation granted by the Chief Director of the DEA ("**decision-maker**") is thus defective and falls to be set aside in this appeal.

6. A failure to do so will render any appeal decision similarly flawed and subject to being set aside on review in Court.

7. The appellants made extensive submissions during the EIA process to the independent consultants appointed by ESKOM ("**Arcus GIBBS**"). These written submissions contain the appellant's detailed objections to the application, and in turn inform the reasons for this appeal because it is apparent that the successive Environmental Impact Reports, including the Final EIA Report, did not deal with all of the issues in a lawful and/or meaningful manner. These included the

[1] Namely GN R. 385, 386 and 387 of 21 April 2006, which regulations were applicable at the time when the application for authorisation was made.
[2] GN R.543 of 18 June 2010 (as amended).
[3] GN R.993 of 8 December 2014 (as amended). In terms of the transitional provisions contained in the National Appeal Regulations, 2014, an appeal lodged after 8 December 2014 against a decision taken in terms of the Environmental Impact Assessment Regulations, 2006 must despite the repeal of the regulations… be dispensed with in terms of the Environmental Impact Assessment Regulations, 2010 as if those regulations have not been repealed.

following submissions, and their contents should be read with this appeal memorandum as if specifically incorporated herein:

7.1. Greenpeace submission on Nuclear 1 – Revised Draft EIA Report – August 2011 (attached hereto marked Annexure **"A"**);

7.2. Earthlife Africa – Johannesburg submission on the Nuclear 1 Revised Draft EIA report (LRC) dated 5 August 2011 (attached hereto marked Annexure **"B"**);

7.3. Earthlife Africa – Johannesburg submission on the Nuclear 1 Revised Draft EIA report (LRC) dated May 2015 (attached hereto marked Annexure **"C"**);

7.4. Earthlife Africa – Johannesburg and Greenpeace submission on Nuclear 1 Draft EIA report Version 2 (LRC) dated 9 December 2015 (attached hereto marked Annexure **"D"**); and

7.5. Earthlife Africa – Johannesburg, Southern African Faith Communities' Environment Institute and Greenpeace submission on Nuclear 1 Final EIA Report (LRC) dated 12 May 2016 (attached hereto marked Annexure **"E"**). The LRC was assisted in making this submission by Dr Mark Chernaik PhD,[4] and Professor Stephen Thomas.[5]

## B. DECISION AND SUMMARY OF APPEAL GROUNDS

7. The decision provides that the following were "key factors" in approving ESKOM's Nuclear 1 application:

[4] Staff Scientist, E Law (Environmental Law Alliance World Wide), Eugene, Oregon, USA
[5] Professor of Energy Policy, Public Services International Research Unit (PSIRU), Business School, University of Greenwich 30 Park Row London SE10 9LS UK

7.1. The need for increased baseload electricity generation capacity in particular in the Eastern or Western Cape to underpin the economic prosperity and development objectives of South Africa.

7.2. Generation of electricity by means of nuclear power (as well as energy efficiency advancements and the development of a renewable generation capacity) is supported by South African government policy including the Integrated Resources Plan ("**IRP**");

7.3. The Final EIR is adequate and meets the requirements of NEMA and the EIA Regulations; and

7.4. The specialist studies undertaken were of a high standard and satisfy the requirements of the plan of study for EIR as approved by the Department.

8. In this appeal memorandum, it will be shown that:

8.1. The overall justification presented in the EIA for the proposed nuclear power station ("NPS") is that the need and desirability for the project is firmly rooted in the IRP2010,[6] an outdated and incomplete policy - flaws that were brought to the attention of the EAP (and thus the decision-maker) by the appellants in numerous submissions. When the decision on authorisation was made on 11 October 2017, the 2016 Draft IRP Update process was still in the process of being finalised by the Department of Energy following extensive public participation. Rather than wait for the IRP to be finalised and gazetted (and for subsequent nuclear determinations to be made under section 34 of the Electricity Regulation Act) before making a decision on authorisation, the

[6] GNR.400 of 6 May 2011: Electricity Regulations on the Integrated Resource Plan 2010-2030.

decision-maker 'jumped the gun' and authorised the proposed activity. Coupled with the EIA's unlawful and/or irregular reliance on various assumptions and failure to adequately assess social, environmental and economic impacts of the proposed NPS (and in particular worst-case scenario impacts), reliance on the outdated IRP2010 prevented the decision-maker from complying with its legal duty to select the best practicable environmental option and ensure that the proposed NPS is socially, economically and environmentally sustainable. Given that these flaws and the fact that the IRP2016 update process was underway were brought to the attention of the EAP, the decision-maker must have been aware of these flaws. Within this context, the decision on authorisation made on 11 October 2017 invites the irresistible inference that the decision was taken for an ulterior purpose.

8.2. The Final EIA Report failed to adequately describe and evaluate the need and desirability for the construction and operation of a Generation III PWR type nuclear power station of up to 4000 MWe (comprising of two or three reactor units) at Duynefontein, and as a consequence the decision on authorisation were fatally flawed and stand to be set aside for the following reasons:

8.2.1. The Final EIR Report did not comply with regulation 32(2)(f) of the EIA Regulations;

8.2.2. The decision on authorisation was made because irrelevant considerations were taken into account (outdated IRP2010) and relevant considerations were not considered (up-to-date information on lower electricity demand, changed international prices and market

situations for nuclear power, renewable generation and energy efficiency developments); and

8.2.3. The Final EIA Report and decision on authorisation failed to ensure that the authorised activity is socially, environmentally and economically sustainable, and in so doing failed to comply with section 2 of NEMA and section 24 of the SA Constitution.

8.3. The Final EIA Report failed to adequately describe and evaluate power generation alternatives to the proposed NPS, and in particular renewable energy alternatives combined with energy efficiency and demand management measures. As a consequence, the decision on authorisation does not comply with regulation 32(2)(h) of the EIA Regulations.

8.4. The proposed NPS presents a number of uncertainties and inherent risks that have not been adequately addressed in the EIA, or in respect of which unjustified assumptions are made. In light of these shortcomings, the Final EIA Report should have recommended that the "no go" option be selected, and the decision-maker should have refused the authorisation. By failing to do so, the decision maker failed to ensure that the proposed NPS development meets the requirements of sustainable development, and breached the appellants' environmental rights as contained in the SA Constitution.

8.5. The EIA process for the proposed Nuclear 1 NPS is fatally flawed as a result of its failure to adequately assess the health and socio-economic impacts of a radiological release as a consequence of a catastrophic nuclear incident, including a failure to adequately assess the significance of: the cumulative impacts; the extent and duration of the impacts; the degree to which the

impacts can be reversed; and the degree to which the impacts may cause irreplaceable loss of resources. As a result, the decision on authorisation is also fatally flawed and falls to be set aside in this appeal.

8.6. The Final EIA report failed to adequately assess the potentially significant negative socio-economic consequences associated with the high cost of building, operating and ultimately decommissioning a NPS (4000 MWe comprising of two to three units), and in particular failed to address the following key concerns:

8.6.1. That the proposed NPS is not affordable to South Africa;

8.6.2. That the high costs associated with the proposed NPS could result in higher electricity costs (impacting negatively on consumers, especially vulnerable and disadvantaged consumers), and that this would in turn have significant negative impacts for growth, employment and welfare in South Africa, alternatively these costs would be provided through state aid, putting an unsustainable burden on state finance, while at the same time distorting the electricity market in a way that puts other sources for electricity generation - clean renewable sources, and energy efficiency measures - at a disadvantage, and would effectively bind the South African electricity system for a period of 60 years to nuclear power when cheaper, cleaner and safer alternatives exist.

8.6.3. That the high costs associated with management, storage and disposal of nuclear waste, as well as the high cost of decommissioning the NPS

at the end of its life-cycle, will impact negatively on current and future generations (inter-generational impacts).

8.7. The Final EIA report fails to adequately assess all potential impacts of nuclear waste, in violation of NEMA, the EIA Regulations and section 6(2)(e) of the Promotion of Administrative Justice Act (PAJA).

8.8. The Final EIA Report fails to address the impact that the construction of future nuclear power stations at Duynefontein would have on the development and expansion of Cape Town and surrounding areas such as Atlantis. The report therefore failed to place this relevant consideration before the decision maker, a matter of high importance to the City of Cape Town and its residents.

8.9. The authorisation is based on outdated demographic information pertaining to the description of the receiving environment – that is, the demographics of the people living in the vicinity of the reactor now and in the future who could potentially be affected if there was a major release of radiation.

8.10. Various international law obligations in respect of the EIA were not complied with.

8.11. All the listed activities triggered by the project are not applied for in a single application, in violation of regulation 15(1) of the 2006 EIA Regulations.

8.12. The DEA excluded Bantamsklip from contention on the basis that the transmission lines did not form part of the EIA, and Duynefontein ought to have been excluded on the same basis.

## C. THE STRUCTURE OF THIS MEMORANDUM

9. The appellants appeal against the decision on a number of grounds which are dealt with in more detail below. Before considering that detail however, it is necessary to traverse the applicable legal principles so that the appeal grounds can be appreciated in their proper context. To that end:

10. **PART D** deals with the legal framework in terms of which the decision-maker acted, and the powers of the appeal authority considering this appeal;

11. **PART E** sets out the appeal grounds raised by the appellants.

12. **PART F** contains the conclusion – that is, that the appeal should be upheld and the decision set aside.

## D. LEGAL FRAMEWORK

13. For ease of reference, the applicable legislation and principles are set out briefly, which includes:

    13.1. The National Environmental Management Act, 1998 ("**NEMA**") and the EIA Regulations published under NEMA;[7]

    13.2. The National Nuclear Regulator Act, 1999 ("**NNR Act**"); and

    13.3. The process and powers of the appeal authority considering this appeal.

### *D.1 <u>National Environmental Management Act</u>*

14. The National Environmental Management Act[8] ("**NEMA**") requires all decision-makers to secure sustainable development while promoting justifiable economic

[7] Environmental Impact Assessment Regulations, 2006 – GNR385 of 21 April 2006 (as amended).
[8] Act 107 of 1998 (as amended).

and social development, as required by section 24 of the Constitution of the Republic of South Africa ("**the Constitution**") (environmental clause).[9]

15. NEMA defines sustainable development as meaning "the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations".[10] An integrated approach requires that the decision-maker has all of the relevant facts before him or her, and can consider and balance these considerations to ensure sustainable and justified development.

16. In addition, all decision-makers are obliged to consider applications and act in accordance with *inter alia* the following relevant principles set out in section 2 of NEMA, which apply throughout the Republic to the actions of all organs of state that may significantly affect the environment:

    16.1. Development must be socially, environmentally and economically sustainable.[11]

    16.2. Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable

[9] Section 24 provides that everyone has the right:
(a) to an environment that is not harmful to their health or well-being; and
(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that-
(i) prevent pollution and ecological degradation;
(ii) promote conservation; and
(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

[10] Section 1.

[11] Section 2(3).

environmental option.[12] The "best practicable environmental option" is defined as meaning the one that "provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term."[13]

16.3. Sustainable development requires the consideration of all relevant factors, including (among other things):

16.3.1. that waste is avoided, or where it cannot be altogether avoided, is minimised and remedied;[14]

16.3.2. that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions;[15] and

16.3.3. that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.

16.4. Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.[16]

16.5. The "social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and

[12] Section 2(4)(b) of NEMA.
[13] Section 1 of NEMA (definition of "best practicable environmental option").
[14] Section 2(4)(a)(iv) of NEMA.
[15] Section 2(4)(a)(vii) of NEMA.
[16] Section 2(4)(e) of NEMA

decisions must be appropriate in the light of such consideration and assessment".[17]

17. South African legislation, case law and international best practice require an EIA to be based on a consideration of scientific and technical reports. The environmental practitioner is required to compile reports on the basis of expertise (and by implication, not merely on the basis of opinion).[18] In this regard, our courts have held that:

> "[30] Section 22(2) of the ECA, requires the functionary who has to decide whether the necessary environmental authorisation should be granted, to consider reports "concerning the impact of the proposed activity and of alternative proposed activities on the environment". This duty is mandatory as section 22 (2) expressly states that the authorisation "shall only be issued after" consideration of such reports."[19]

18. Finally, there is a duty on the applicant (in this case ESKOM) to submit "all information necessary for the competent authority to consider the application and reach a decision".[20]

### *D.2 EIA Regulations*

19. Environmental authorisation is provided for in section 24 of NEMA and is given content to in the EIA Regulations. Regulation 32(2) of the EIA Regulations sets out the requirements for EIA reports, which stipulates (among other things) as follows:

> "An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the

[17] Section 2(4)(i) of NEMA.
[18] EIA Regulations, regulation 18(b).
[19] See *Sea Front For All and Another v the MEC: Environmental and Development Planning Western Cape Provincial Government and Others* 2011 (3) SA 55 (WCC) paragraph 30; and NEMA section 24(1). S24(1A)(f) … Every applicant must comply with the requirements prescribed in terms of this Act in relation to… (f ) the undertaking of any specialist report, where applicable.
[20] EIA Regulations, regulation 32(2).

application and to reach a decision contemplated in regulation 36, and must include:

…

(d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;

…

(f) a description of the need and desirability of the proposed activity and identified alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;

(h) a description and comparative assessment of all alternatives identified during the environmental impact assessment process;

(j) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;

(k) an assessment of each identified potentially significant impact, including-

(i) cumulative impacts;
(ii) the nature of the impact;
(iii) the extent and duration of the impact;
(iv) the probability of the impact occurring;
(v) the degree to which the impact can be reversed;
(vi) the degree to which the impact may cause irreplaceable loss of resources; and
(vii) the degree to which the impact can be mitigated;

(l) a description of any assumptions, uncertainties and gaps in knowledge

…."

20. A decision-maker makes the decision in terms of Regulation 36, having regard to a comprehensive suite of information placed before him or her in the EIA.

21. Regulation 15(1) guards against a phased circumvention of the EIA regime by requiring that all activities must be applied for together:

> "If an applicant intends undertaking two or more activities as part of the same development, a single application on one application form must be submitted in respect of all those activities."

### *D.3 National Nuclear Regulator Act, 1999 ("NNR Act")*

22. The NNR Act established the National Nuclear Regulator ("**NNR**") whose functions include granting nuclear authorisations.[21] In terms of section 5 of the NNR Act, the objectives of the Regulator are to:

> "(*a*) provide for the protection of persons, property and the environment against nuclear damage through the establishment of safety standards and regulatory practices;
> (*b*) exercise regulatory control related to safety over-
> (i) the siting, design, construction, operation, manufacture of component parts, and decontamination, decommissioning and closure of nuclear installations…
> …
> (*e*) fulfil national obligations in respect of international legal instruments concerning nuclear safety; and
> (*f*) ensure that provisions for nuclear emergency planning are in place."

23. The object of the NNR relates, *inter alia*, to nuclear hazards and includes protecting persons, property and the environment against nuclear hazards.

24. In terms of the Regulations on Licensing of Sites for New Nuclear Installations,[22] factors to be considered by the NNR in evaluating an application for a nuclear installation site licence will include, but not be limited, to:

24.1. Factors relating to all nuclear installations in the vicinity.

24.2. The proposed nuclear installation design(s), and the characteristics specific to the site. New nuclear installation(s) must reflect through their design, construction and operation an acceptably low probability of postulated events that could result in release of quantities of radioactive material.

[21] Section 7 of the NNR Act.
[22] GN R927 of 2011.

24.3. The site location and the engineered safety features of all nuclear installations, included as safety measures against the hazardous consequences of postulated events, must ensure an acceptably low risk of public exposure.

24.4. The site must be such that radiological doses and risks from normal operation and postulated events associated with all nuclear installations in the vicinity will be acceptably low.

24.5. Natural phenomena and potential man-made hazards must be appropriately accounted for in the design of the new nuclear installation(s), and that adequate emergency plans and nuclear security measures can be developed.

24.6. The cumulative radiological impact of all nuclear installations and actions, in the vicinity, for which authorisations have already been granted by the Regulator, including the potential impact of nuclear installation(s) referred to in the scope of the nuclear installation site licence to be granted by the Regulator.

25. An application for a nuclear installation site licence has been made by Eskom but at the time of finalising this appeal had not yet been granted.[23] SAFCEI have objected to this application as irregular and unlawful (a copy of this objection is attached hereto marked "**Annexure F**").[24]

### *D.4 Appeal authority*

26. The appeal authority considering this appeal does so in terms of section 43 of

[23] http://www.nnr.co.za/nnr-receives-application-for-a-nuclear-installation-site-licence-nisl-for-the-thyspunt-and-duynefontein-sites/

[24] In a letter preceding the application dated 22 February 2016 Eskom advised the NNR Chief Executive Officer that 'nuclear installations or prescribed equipment do not form part of this application. The purpose of this application is to license the *site* as a nuclear installation site'.

NEMA. The decision-maker's letter dated 11 October 2017 - in which it conveyed the decision - makes reference to the appeal provisions in EIA Regulation, 2010.

27. The appeal grounds are now set out.

## E. GROUNDS OF APPEAL

### *E.1 Failure to adequately describe and evaluate need and desirability of the proposed NPS*

28. The appellants submit that the Final EIA Report failed to adequately describe and evaluate the need and desirability for the construction and operation of a Generation III PWR type nuclear power station of up to 4000 MWe (comprising of two or three reactor units) at Duynefontein.

29. This failure flows from a key assumption made in the EIA, namely that:

> "The need and desirability for the Nuclear Power station is adequately defined by the current IRP. If [in] the future IRP does not include the option for nuclear power as a result of a change in demand patterns and supply option then the need and desirability will fall away."[25]

30. It is submitted that the EIA's reliance on the IRP2010 to make the assumption that need and desirability is adequately defined constitutes a fatal flaw in the EIA, for the following reasons:

30.1. The EIA fails to correctly characterise the IRP as policy. Rigid adherence to policy in making an administrative decision fetters the decision-maker's discretion, in violation of basic principles of just administrative action (it is a fundamental rule of administrative law that the decision-maker vested with a discretionary power may not fetter its discretion by rigid adherence to a pre-

[25] Final EIA Report, Executive Summary, p3.

determined policy). What is required of an administrator is that he or she is independently satisfied that the policy is appropriate to the circumstances of the particular case. The decision-maker cannot elevate principles or policies into rules that are considered to be binding with the result that no discretion is exercised at all. While policies in keeping with the empowering legislation may be used to assist decision making, they may not inevitably determine the outcome of the decision, lest they "*preclude the person exercising the discretion from bringing his mind to bear in a real sense on the particular circumstances of each and every individual case coming up for decision*."[26]

30.2. Importantly, the Final EIA Report also fails to draw the decision-maker's attention to section 34 of the Electricity Regulations Act, 2006 (ERA). In the *Earthlife* case, the Western Cape High Court held that section 34 of the ERA "*operates as the legislative framework by which any decision that new electricity generation capacity is required"*.[27] By relying on the IRP2010 to make the assumption that need and desirability is adequately defined, the Final EIA Report makes an error of law. By relying on the IRP as one of the key factors considered in making the decision on authorisation,[28] the decision-maker was in turn materially influenced by this error of law,[29] rendering the decision on authorisation liable to be set aside.

30.3. What is relevant, and what the decision-maker ought to have taken into account but did not, is that at the time of making its decision on authorisation

[26] *Richardson v Administrator, Transvaal* 1957 (1) SA 521 (T) at 530.
[27] *Earthlife Africa, Johannesburg and another v Minister of Energy and others* [2017] 3 All SA 187 (WCC).
[28] Nuclear 1 EIA authorisation, Annexure 1 paragraph 2(b).
[29] See PAJA, section 6(d).

there was no nuclear section 34 Determination in place (the nuclear section 34 Determinations made in December 2013 and December 2016 having been reviewed and set aside in the *Earthlife* case). This highly relevant consideration was not brought to the attention of the decision-maker, and thus a relevant consideration was not taken into account in the decision on authorisation.

31. Even if the IRP2010 could conceptually serve as a lawful basis to make the assumption that need and desirability is adequately defined in the EIA (which the appellants dispute), the IRP2010 is incomplete and outdated, and cannot serve as a rational basis for a decision on authorisation. It is stated in the IRP2010 itself that:

> "It is relevant to note that the IRP2010-2030 acknowledges that <u>further research is required on the full costs relating to specific technologies (including nuclear) around the costs of decommissioning and managing waste (in the case of nuclear specifically spent fuel)</u>."[30]

32. In 2013 the Department of Energy draft update to the IRP 2010-2030 ("**2013 Draft IRP Update**") was posted on its website inviting public comment, in which it was acknowledged that there have been a number of developments in the energy sector in South and Southern Africa since the IRP2010 was promulgated, and in which it was stated that the <u>electricity demand outlook has changed markedly from that expected in 2010, dropping from a projected demand of 454 TWh to a figure in the range of 345-416 TWh</u>. In effect it predicted that 6.6 GW less capacity is required in terms of reliable generating capacity. In other words, the demand projections that

[30] IRP2010 paragraph 7.11.

were used to justify 9600 MW of additional nuclear energy in the IRP2010 had been reduced by 6600 MW, eliminating the need for the nuclear fleet.

33. Unsurprisingly, the 2013 Draft IRP Update recommended in 2013 that a more cautious, smaller scale and phased-in approach to nuclear energy, with cost limitations, be adopted.

34. The 2013 Draft IRP Update indicates further that in the shorter term there are clear guidelines arising from the scenarios, including that the nuclear decision can be delayed and that there are indeed alternative options:

> 'The nuclear decision can possibly be delayed. The revised demand projections suggest that no new nuclear base-load capacity is required until after 2025 (and for lower demand not until at earliest 2035) and that there are alternative option, such as regional hydro, that can fulfil the requirement and allow further exploration of the shale gas potential[31] before prematurely committing to a technology that may be redundant if the electricity demand expectations do not materialise.'[32]

35. The 2013 Draft IRP Update was never finalised, and was superseded by an update process that commenced in 2016 ("**2016 Draft IRP Update**"). At the time of finalising this appeal, the 2016 Draft IRP Update process had still not been finalised.

36. In the 'need and desirability' component of the Final EIA Report, it is conceded that:

> "the case for nuclear power needs to be supported by the revised IRP which is expected to be published in 2016. This chapter on need and desirability is based on the 2010 IRP. The demand in electricity has not increased as predicted in the IRP 2010. If the revised IRP dictates the

[31] It is recorded that the appellants do not support and are opposed to the development of shale gas. The appellants support renewable energy and demand-side management strategy alternatives.
[32] 2013 Draft IRP Update.

> requirement for nuclear power as part of the generation technology mix then the need and desirability will be confirmed."[33] (emphasis added)

37. Furthermore, the Final EIA Report recognised that:

> "A key argument presented in these discussions was that demand for electricity has simply not followed the projected growth demand that is contained in IRP 2010. The 2010 IRP is the underpinning document of the need and desirability for the proposed NPS, and as such the fact that the current demand does not meet that projected in IRP 2010 questions the need for the proposed NPS."[34] (emphasis added)

38. The Final EIA Report deals with this issue as follows:

> "From the CSIR publication, it is clear that the 2010 IRP is outdated and must be updated as a function of currently projected demand for it to be defendable in defining the need and desirability for nuclear power. However, until such policy updates are made this document remains the reliable and official reference document for this project."[35]

39. In its response to the appellants 2016 EIA submission by the LRC, the EAP states as follows:

> "Forecasts for electricity demand in South Africa (2010-2035) using the CSIR sectorial regression model June 2010) (show that) projected demand was modelled to be well below the projected demand contained in the IRP 2010" … comments (public) on lower demand are fully acknowledged and recognized…"
> …
> It is expected that a revised IRP will be issued with updates to reflect the change in electricity demand since 2010 and projected requirement onto the future. **If the revised IRP still provides for nuclear power then the need and desirability will remain, if not then the need and desirability will fall away or will be moved out to a later date**." [36]

40. These concessions by the EAP are telling:

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[33] Final EIA Report 4. Need for and Desirability of the Project, p4-20.
[34] Final EIA Report 5.9, at page 5-39, and Final EIA Report, Executive Summary, p41.
[35] Final EIA Report 5.9, at page 5-40, and Final EIA Report - Executive summary p42.
[36] Gibb Response to LRC 12 May 2016 submission, Response 8 at p5.

40.1. The EAP admits that the case for nuclear power 'needs to be' supported by the revised IRP. Given that the 2016 Draft IRP Update was not finalised at the time the decision on authorisation was made, the case for nuclear power was not supported by an updated IRP;

40.2. The EAP agrees that that demand in electricity has not increased as predicted in the IRP2010. The EAP admits that the IRP2010 is the underpinning document for need and desirability of the NPS, and as such the fact that current electricity demand does not meet the demand projected in the IRP2010 questions the need for the NPS. This supports appellants' contentions that the proposed NPS is not needed and that the decision on authorisation took irrelevant considerations into account and failed to take into account relevant considerations; and

40.3. The EAP concedes that the if the revised IRP does not provide for nuclear power, then the need and desirability will fall away. This is fatal to the EIA authorisation, and supports the appellants' contention that the decision-maker 'jumped the gun' by approving the proposed NPS in the absence of an updated IRP2016 (and valid nuclear ERA section 34 determination).

41. On 4 April 2017, the South African Council for Scientific and Industrial Research (CSIR) published its comments on the 2016 Draft IRP Update.[37] The CSIR

[37] CSIR, *Formal Comments on the Integrated Resource Plan (IRP) Update Assumptions, Base Case and Observations 2016*, available online at https://www.csir.co.za/sites/default/files/Documents/IRP_Update_Assumptions_1904.pdf.

determined the least cost, unconstrained electricity mix by 2050 as input into the IRP 2016 public consultation process, which mix did not include nuclear:

> "the result of this is that it is least cost for any new investment in the power sector to be solar PV, wind or flexible power… South Africa has the unique opportunity to decarbonise its electricity sector without pain. By this, the authors mean that clean and cheap are no longer trade-offs anymore. The Least Cost scenario run is the mix that is cheapest, emits less $CO_2$, consumes less water and creates more jobs in the electricity sector than both Draft IRP 2016 Base Case and Carbon Budget scenarios…. The Least Cost scenario is also adaptable and resilient to a range of input changes relative to other scenarios and therefore more robust against unforeseen changes in demand and cost."[38]

42. On 16 September 2016, the [then] Minister of Energy appointed a working group to analyse certain concerns expressed by members of the Ministerial Advisory Council on Energy (MACE) on a number of assumptions used to derive the IRP scenario "Base Case A1" and to report back to the Minister on their findings. On 31 October 2016 the MACE report (see "**Annexure G**") was submitted to the Minister of Energy. The report was created on 16 September 2016 to analyse certain concerns.

43. The main finding of the MACE report was as follows:

> *"A least cost IRP model, free of any artificial constraints and before any policy adjustments does not include any new nuclear power generators. The optimal least cost mix is one of Solar PV, wind and flexible power generators with relatively low utilisations:"*[39]

44. Having regard to recent political changes in South Africa, and with a recent Cabinet reshuffle, which has seen a new Minister of Energy appointed, it is unclear whether

[38] Id, at pages i and ii.
[39] *Report of the Ministerial Advisory Council on Energy (MACE) Working Group on Analysis and Recommendations on the Assumptions and Methodologies Adopted in the IRP 2016 Base Case Scenario*, p1.

a revised and gazetted IRP will include nuclear power, and if so to what extent. In this regard it is relevant to note that on 25 January 2018 at the World Economic Forum in Davos, Switzerland, [then] Deputy President Cyril Ramaphosa was quoted in the media as stating that:

> "We have excess power right now and we have no money to go for a major nuclear plant building".[40]

Having regard to the EAP comments cited above, it is self-evident that if the revised IRP does not include nuclear, on the EAP's own reasoning the need and desirability will fall away.

45. It is unclear what motivated the decision-maker to approve the NPS in these circumstances, and it is submitted that the approval invites the irresistible inference that the decision was taken for an ulterior purpose.

46. By failing to adequately describe and evaluate the need and desirability of the NPS, the Final EIA Report and the decision on authorisation were fatally flawed and stand to be set aside for the following reasons:

46.1. The Final EIR Report did not comply with regulation 32(2)(f) of the EIA Regulations;

46.2. The decision on authorisation was made because irrelevant considerations were taken into account (outdated IRP2010) and relevant considerations were

[40] See for example: https://www.timeslive.co.za/politics/2018-01-26-no-money-for-nuclear-says-ramaphosa/; http://ewn.co.za/2018/01/25/ramaphosa-sa-has-no-money-for-major-nuclear-plant; https://businesstech.co.za/news/energy/221329/ramaphosa-says-south-africa-has-no-cash-for-nuclear/

not considered (revised IRP and up-to-date information on lower electricity demand); and

46.3. The Final EIA Report and decision on authorisation failed to ensure that the authorised activity is socially, environmentally and economically sustainable, and in so doing failed to comply with section 2 of NEMA and section 24 of the SA Constitution.

### *E.2 Failure to adequately describe and evaluate power generation alternatives*

47. It is submitted by the appellants' that the EIA failed to adequately describe and evaluate renewable power generation alternatives to the proposed NPS.

48. As a consequence, and for the reasons set out below, the EIA does not comply with regulation 32(2)(h) of the EIA Regulations (which requires a description and comparative assessment of all alternatives identified during the EIA process), and prevented the decision-maker from ensuring that the authorised activity is socially, environmentally and economically sustainable.

49. It is stated in the Final EIA Report that:

> The alternative activity type assessment was undertaken during the Scoping Phase and the results thereof are captured in Chapter 9 of the Final Scoping Report (SR) (As approved by the DEA)… The reader is once again reminded that there are no Activity Alternatives, as defined by NEMA, considered for the application as this application for Environmental Authorisation relates specifically to the establishment of a Nuclear Power Station…
>
> In order for Eskom to achieve its objectives, it requires a reliable source of power generation that will supply a consistent base load power supply that can be efficiently integrated into the existing South African power network…
>
> …the DEA's approval of the Final Scoping Report and the Plan of Study for Scoping accepted that power generation alternatives do not need to be investigated in the EIA phase of the project. It has also been

> made clear in this Revised Draft Version 2 that nuclear power is not being pursued as an alternative to any form of renewable power generation, but that all forms of power generation have an appropriate role in the mix of generation alternatives, the relative contributions of which are to be determined by the Integrated Resources Plan (IRP) 2010.[41]

50. It is submitted that the Final EIA Report is incorrect when it states that there are "*no Activity Alternatives, as defined by NEMA, considered for the application as this application for Environmental Authorisation relates specifically to the establishment of a Nuclear Power Station."* As the DEA (2017) Guideline on Need and Desirability (which is an update of previous Guidelines on Need and Desirability[42]) suggests, the Final EIA Report should not only describe and evaluate whether there is a need for a nuclear power station, but also describe and evaluate alternatives to decide whether a nuclear power station represents the "most practicable environmental option", namely the option that provides the most benefit for and causes the least damage to the environment as a whole, at a cost acceptable to society, in the long-term as well as in the short-term. Financial viability must also required be considered within the context of justifiable economic development, measured against the broader societal short-term and long-term needs, and the specific needs of the broader community considered together with the opportunity costs and distributional consequences, in order to determine whether or not the development will ensure that the development will be socially, economically and environmentally sustainable. Such consideration cannot be made in the absence of

[41] Final EIA Report 5 Project Alternatives Considered, at pages 5-11 and 5-12.
[42] DEA (2010) *Guideline on Need and Desirability*, Integrated Environmental Management Guideline Series 9, Department of Environmental Affairs; DEA&DP *EIA Guideline and Information Document Series Guideline on Need and Desirability.*

an assessment of power generation alternatives to nuclear (and in particular renewable power generation alternatives).

51. It is submitted that the Final EIA Report errs when it states that "[i]*n order for Eskom to achieve its objectives, it requires a reliable source of power generation that will supply a consistent base load power supply that can be efficiently integrated into the existing South African power network".* This theme goes back to the Revised Plan of Study (Revision May 2009), in which it was stated that *'[g]iven the urgent power demand based on economic growth in South Africa, the no go option is not considered to be a logical alternative, as Eskom must provide power'*.[43] It was stated further that *'[i]dentified renewable forms of energy are inadequately developed to provide large scale power generation facilities that can supply reliable base load and easily integrate into the existing power network in South Africa'*.[44] These assumptions go back almost a decade, failing to take into account changing circumstances and advances in renewable energy, as well as new approaches to the concept of meeting power demand without having 'base load' plants with a specific capacity available 24 hours a day, 7 days a week, year-on-year (see section E.3 of this appeal below). As a result, the Final EIA Report also does not provide an adequate comparative assessment of renewable power generation alternatives to nuclear.

52. As has been noted above, the Final EIA Report claims that "*nuclear power is not being pursued as an alternative to any form of energy, but that all forms of energy have an appropriate role to play in the mix of generation alternatives, the relative*

[43] Nuclear 1 Revised Plan of Study (Revision May 2009, page 37, para 53.
[44] Id.

*contributions of which are to be determined by the IRP2010*". It is submitted that this approach is flawed for the following reasons:

52.1. As has been discussed in section E.1 of this appeal, the IRP 2010 is policy, is out-of-date and incomplete. In addition, the IRP 2010 did not, at the outset, preclude the consideration of a non-nuclear option. In response to public concern, the IRP2010 generated a non-nuclear option, at a time of far greater predicted electricity demand than at the current time.[45] The IRP 2010 was subjected to a "policy adjustment" to select a nuclear fleet option (9600MWe from nuclear sources).

52.2. The suggestion that there is no need for the EIA to investigate alternative forms of power because the (policy adjusted and outdated) IRP2010 had already established the optimal energy mix is flawed. It fails to take into account that the IRP is non-binding policy, and that nuclear determinations made in terms of section 34 of ERA have been reviewed and set aside by the Western Cape High Court. It also fails to take into account the evolving policy context, including the 2013 Draft IRP Update process, the uncompleted 2016 Draft IRP Update process, and recent public statements by government officials that nuclear power is not needed (due to excess electricity generation) and is not affordable to Eskom or South Africa (see section E.5 of this appeal below).

52.3. It is submitted further that the pursuit of nuclear power does have an impact on new generation capacity available for allocation to renewable power

[45] Purpose and need study, page 4-1 and 4-2 provide demand projections used in the IRP 2010-2030,

alternatives, especially in the current context of excess electricity generation capacity,[46] as it could have the effect of "crowding out" available new generation capacity that could be allocated to less risky, more flexible and increasingly more affordable renewable power alternatives, while locking South Africa into expensive nuclear power for decades to come (with associated inter-generational impacts).

53. In light of the above and the EAP's contention that the environmental impact assessment process is a "*project specific environmental management tool does not have the mandate, neither is it equipped to revisit the strategic analysis of power generation alternatives that was completed in the IRP*,"[47] it is submitted that the decision on authorisation cannot lawfully be made until such time as: nuclear power is comparatively assessed with renewable energy alternatives; the IRP 2016 update process has been finalised and the revised IRP gazetted; and a lawful nuclear determination is made under section 34 of the ERA.

54. It is also relevant to note within the context of alternatives that the failure of the Final EIA Report to undertake an impact assessment of the radiological, social and economic impacts of a catastrophic incident also makes it impossible for a proper assessment of the relative merits of the various power generation options to take place, as required in regulation 32(2)(h).[48] It cannot be disputed that renewable energy alternatives simply do not pose a risk of significant environmental and socio-

[46] It is relevant to note that the Final EIA Report *4 Need for and Desirability the Project* concedes that *"There has… been a significant reduction in demand for electricity in South Africa since the publication of the IRP (2010)"*, at page 4-10.
[47] Letter from Gibb to Legal Resources Centre dated 5th August 2015.
[48] Regulation 32 (2)(h) stipulates that an environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in regulation **36,** and must include… a description and comparative **assessment of all alternatives** identified during the environmental impact assessment process.

economic impacts in the event of a "worst-case scenario" incident, while it is also admitted in the Final EIA Report that such an event would be untenable. However, this comparison does not take place by virtue of the fact that renewable energy alternatives were not comparatively assessed in relation to the proposed NPS. It is submitted that this is a fatal flaw in the EIA assessment and subsequent decision-making process.

55. While the (flawed) argument is presented in the EIA that future design requirements within an NNR nuclear authorisation process render this risk "highly unlikely", the consequences of such an incident remain untenable. It is relevant to note that in Europe in relation to the Hinkley Point C nuclear project, the Aarhus Convention Compliance Committee (ACCC) declared new nuclear power stations "ultra-hazardous activities" on the basis of the fact that though the chance of a severe accident is small, the impact is enormous. Both the ACCC and the Espoo Convention Implementation Committee (Espoo IC) concluded that impacts over many thousands of kilometres have to be considered.[49]

56. In relation to the consideration of alternatives (within the context of the closely related "no-go' option), the DEA (2017) Guideline on Need and Desirability

[49] See the findings of the Espoo IC concerning the lack of international notification by the UK of the Hinkley Point C project: UNECE Espoo Convention Implementation Committee, Thirty Fifth Session, Geneva, 15-17 March 2016, Annex - Findings and recommendations further to a Committee initiative concerning the United Kingdom of Great Britain and Northern Ireland (EIA/IC/CI/5), especially III. Main issues and IV. Findings. Available online at:
http://www.unece.org/fileadmin/DAM/env/documents/2016/EIA/IC/REPORT_ENG_ece.mp.eia.ic.2016.2_e.pdf
See also the ACCC concerning the same project:
UNECE Aarhus Convention Compliance Committee, Fifty-eighth meeting, Budva, 10–13 September 2017, Findings and recommendations with regard to communication ACCC/C/2013/91 concerning compliance by the United Kingdom of Great Britain and Northern Ireland, Adopted by the Compliance Committee on 19 June 2017 - point 75, 76, 77 and point 89(a). Available online at:
https://www.unece.org/fileadmin/DAM/env/pp/compliance/CC-58/ece.mp.pp.c.1.2017.14.e.pdf

indicates as follows:

> "In order to properly interpret the EIA Regulations' requirement to consider "need and desirability", it is necessary to turn to the principles contained in NEMA… With regard to the issue of "need", it is important to note that the "need" is not the same as the "general purpose and requirements" of the activity. While the "general purpose and requirements" of the activity might to some extent relate to the specific requirements, intentions and reasons that the applicant has for proposing the specific activity, the "need" relates to the interests and needs of the broader public…
>
> The consideration of "need and desirability" in EIA decision-making therefore requires the consideration of the strategic context of the development proposal along with the broader societal needs and the public interest. The government decision-makers, together with the environmental assessment practitioners and planners, are therefore accountable to the public and must serve their social, economic and ecological needs equitably. Ultimately… the proposed actions… must be measured against the short-term and long-term public interest in order to promote justifiable social and economic development. Considering the merits of a specific application in terms of the need and desirability considerations, it must be decided which alternatives represent the "most practicable environmental option", which in terms of the definition in NEMA and the purpose of the EIA Regulations are that option that provides the most benefit for and causes the least damage to the environment as a whole, at a cost acceptable to society, in the long-term as well as in the short-term".[50]

57. It is submitted that the failure of the EIA to adequately identify and comparatively assess renewable power alternatives to the proposed NPS makes it impossible for the decision-maker to decide which alternatives represent the most practicable environmental option, and prevents the decision-maker from measuring the proposed NPS against the long-term and short-term public interest in order to make a decision that ensures justifiable social and economic development. As a result, the EIA is fatally flawed, and the decision on authorisation falls to be set aside.

[50] DEA (2017) *Guideline on Need and Desirability*, pp 9-10.

58. In summary, the appellants' submit that:

58.1. The EIA does not comply with regulation 32(2)(h) of the EIA Regulations (which requires a description and comparative assessment of all alternatives identified during the EIA process), and the decision on authorisation falls to be set aside; and

58.2. The failure of the EIA to provide a comparative assessment of the proposed NPS and renewable energy alternatives prevented the decision-maker from ensuring that the authorised activity is socially, environmentally and economically sustainable (as the decision-maker is obliged to do in terms of section 24 of the SA Constitution and section 2 of NEMA). As a result, the EIA is fatally flawed, and the decision on authorisation falls to be set aside.

59. To the extent that DEA's approval of the Final Scoping Report and the Plan of Study for Scoping accepted that power generation alternatives do not need to be investigated in the EIA phase of the project, it is submitted that, for the same reasons set out above, this decision is also fatally flawed, and falls to be set aside.

### *E.3 Failure to adequately investigate, assess and select the "no-go" option*

60. It is shown in this appeal that the proposed NPS presents a number of uncertainties and inherent risks that have not been adequately addressed in the EIA, or in respect of which unjustified assumptions are made. It is submitted that in light of these shortcomings, the Final EIA Report should have recommended that the "no-go" option be selected, and the decision-maker should have refused the authorisation. By failing to do so, the decision maker failed to ensure that the proposed NPS

development meets the requirements of sustainable development, and breached the appellants environmental rights as contained in the SA Constitution.

61. Section 24(4)(b)(i) of NEMA requires investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity. Furthermore, Regulation 29(1)(i)(iii) of the EIA Regulations requires the plan of study for an environmental impact assessment to indicate the proposed method of assessing the environmental issues and alternatives, including the option of not proceeding with the activity.

62. The Western Cape High Court in *Langebaan Ratepayers and Residents Association v. The Western Cape Provincial Minister for Local Government, Environmental Affairs and Developmental Planning*[51] held:

> "The adequacy of the alternatives considered must also in my view be considered in the light of the considerations given to the "no-go" option. In the Guidelines on Alternatives (EIA Guidelines and Information Document Series August 2010) with reference to NEMA principles and sections 24(4)(b) and 24(4A) of NEMA it is stated: "The assessment of alternatives must at all times include the "no-go" option as a baseline against which all other alternatives must be measured. The option of not implementing the activity [for which authorization is sought] must always be assessed and to the same level of detail as the other feasible and reasonable alternatives." (our emphasis).

63. The Final EIA Report states that the purpose of the no-go option is to compare the benefits and detriments of not going ahead with the project.

> "In terms of the benefits of the proposed activity, these centre principally around the provision of sustainable, reliable and affordable

[51] High Court of South Africa (Western Cape Division, Cape Town), Case No. 4917/2013 (19 August 2014) at Para. 88, available at: http://www.saflii.org/za/cases/ZAWCHC/2014/212.pdf

> baseload power within the overall energy supply mix needed for South Africa. "[52]

64. This glib statement of opinion, unsupported by up-to-date information and independent expert analysis, cannot go unchallenged:

64.1. Firstly, it is disputed that nuclear technology is sustainable, given that (as has been demonstrated elsewhere in this appeal): nuclear power is not needed due to lower electricity demand; nuclear power has significant cost implications and is not affordable; the impacts of a catastrophic nuclear incident have not been adequately assessed; and the storage and disposal of nuclear waste (and in particular spent nuclear fuel), and the decommissioning of the NPS in the future, presents long-term, intergenerational cost, liability and danger risks. The project is not sustainable as required by section 2 of NEMA and section 24 of the South African Constitution.

64.2. Secondly, there is no justification for the EIA's sweeping statement regarding reliability. This is because nuclear reactor reliability would be dependent on a number of variables including design, technology type, the waste management system, skill of personnel, and overall management systems. Furthermore, reliability in manufacturing of nuclear parts is also an important issue. For example, in the case of the French nuclear power company Areva (now EdF/Framatom), it has recently come to light that as a result of an investigation at the instance of the French nuclear safety regulator (Autorite de Surete Nuclear (ASN)), up to 400 irregularities in manufacturing checks

[52] 5.9 Final EIA Report.

were found at its forge plant where parts for the Flamaville reactor are to be manufactured.[53]

> "On 25th April 2016, AREVA informed ASN of the initial results of this additional analysis. They revealed irregularities in the manufacturing checks on about 400 parts produced since 1965, about fifty of which would appear to be in service in the French NPPs. These irregularities comprise inconsistencies, modifications or omissions in the production files, concerning manufacturing parameters or test results"[54]

64.3. Thirdly, the claimed affordability of the proposed NPS is a "key assumption" in the EIA, while up-to-date and relevant information shows that South Africa cannot currently afford nuclear power (see section of this appeal below).

64.4. Fourthly, it is disputed that security of electricity supply requires a set of baseload power plants to meet baseload demand for electricity. Professor Stephen Thomas (see "**Annexure H**" hereto) explains as follows:

> "There is frequent reference to dispatchable and non-dispatchable technologies and on base-load. The tacit assumption is that there must be 'base-load' power plants. It is clear there is a 'base-load' demand for electricity, in short the level of demand for electricity below which demand never falls. However, there is no justification for the assumption that there needs to be a set of base-load plants whose job it is to meet this demand. This makes no more sense than assuming that factory that operates seven days a week round the clock must be staffed by one set of workers who also work round the clock seven days a week. What is required is a set of plants that together can, with a high level of confidence, meet this base-load demand. The Chief Executive Officer, Steve Holliday, of UK National Grid Company, the company with the responsibility to dispatch UK power plants and plants in NE USA in such a way as to ensure security of supply, expressed this very clearly.[55] When asked what the future of base-load generation was, he stated: "That's asking the wrong question" and that "The idea of baseload power is already outdated. From a consumer's point of view, the solar

[53] http://www.french-nuclear-safety.fr/Information/News-releases/Irregularities-concerning-components-manufactured-in-its-Creusot-Forge-plant
[54] id
[55] http://www.energypost.eu/interview-steve-holliday-ceo-national-grid-idea-large-power-stations-baseload-power-outdated/

> on the rooftop is going to be the baseload. Centralised power stations will be increasingly used to provide peak demand."

This new approach is also discussed a published article by energy expert Chris Yelland, who states that:

> "With the cost of energy from new wind and solar PV now dramatically lower than that of new coal or nuclear power, the new approach to meet growth in electricity demand at least cost in the years ahead entails sourcing and giving preferential first grid access to as much energy from wind and solar PV generation plant as possible. In this way, the average cost of electricity produced is reduced…
>
> The variable output of wind and solar PV plant – which is affected by wind patterns, the length of daylight hours and the weather – is dealt with to a significant degree by siting wind and solar PV plant widely across the country at a number of identified renewable energy development zones (REDZ), as close as possible to major areas of electricity consumption.
>
> The remaining variability in average output from the distributed wind and solar PV plant is backed up by "flexible" power generation sources such as open and closed cycle gas turbines, together with local and imported hydro power, pumped water storage and other emerging energy storage technologies.
>
> While the cost of gas as primary energy for flexible OCGT [open cycle gas turbines] and CCGT [closed cycle gas turbines] power plants is relatively high compared to the primary energy for coal and nuclear power plants, the capital costs are very much lower, and the OCGT and CCGT plants operate at low load factors, with low associated gas utilisation.
>
> The combination of widely distributed variable wind and solar PV generation, backed up with flexible power generation, provides reliable, flexible, dispatchable, quasi-baseload power at least cost (10–20% cheaper) when compared to the alternatives of coal and nuclear power. At the same time it delivers lowest $CO_2$ emissions (65% less emissions than the current IRP 2016 base case), least water usage (70% less fresh water consumption) and the most jobs (10–20% more jobs).
>
> This new approach to power generation not only ensures operational flexibility, but also provides construction flexibility in small chunk sizes to meet the uncertain future demand for electricity, using simple, proven technology that lends itself to localisation.
>
> Short, reliable and proven construction times eliminate the risk of cost and time overruns associated with complex coal and nuclear mega-

> projects, reduce the risk of future demand uncertainty, and avoid the need for long-term contractual commitments with foreign countries and governments."[56]

65. The methodology for assessing the no-go option should involve a consideration of scientific and technical reports together with up-to-date policies in order to ascertain the consequences of not implementing the project. Notwithstanding the requirement[57] the Final EIA "no go option" report contains no such reports. The opinions of the EIA authors, if not supported by such reports, constitutes an irrelevant consideration, which was taken into account by the decision-maker.

66. In relation to the no go option, the Final EIA Report refers back to questions raised by stakeholders on the need for the proposed NPS given that electricity demand had not followed the projected growth demand as set out in the IRP2010. The Final EIA Report concedes that *"the fact that current demand does not meet that projected in the IRP2010 questions the need for the proposed NPS".* The Final EIA Report seeks to justify (unconvincingly) that *"while these various comments on the lower demand are fully acknowledged and recognised, it is beyond the remit of an EIA to second-guess national policy decisions… [t]he "no-go" alternative, with respect to energy mix is thus firmly rooted in the dictates of the IRP, and not in the EIA process".*[58] As has been shown above, not only is reliance on the outdated IRP2010 irregular, the requirement to investigate and assess the option of not implementing the activity is a mandatory requirement of section 24(4)(b)(i) of NEMA.

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[56] Chris Yelland (2 August 2017) *'The end of 'baseloadism' in South Africa*, available online at: https://www.moneyweb.co.za/news/south-africa/the-end-for-baseloadism-in-south-africa/
[57] See *Sea Front For All and Another v the MEC: Environmental and Development Planning Western Cape Provincial Government and Others* 2011 (3) SA 55 (WCC), paragraph 30; and NEMA section 24(1).
[58] Final EIA Report, 5.9 p5-39.

67. The Final EIA Report acknowledges that the *"proposed NPS has a range of inherent risks, which have severe potential consequences",* and concedes that while the low likelihood of these consequences reduces the residual risk to tolerable levels, "*under no circumstances can it be guaranteed that the inherent risks will not materialise*". The Final EIA Report goes no to admit that *"[i]t is only the "No development option" that can provide that guarantee. Especially important is the risk of abnormal (beyond design) radioactive release that would have severe potential consequences for human health and safety".*[59] It is submitted that these admissions are fatal to the decision on authorisation, a flaw that is compounded by the Final EIA Report's failure to adequately investigate and assess the consequences of a catastrophic nuclear incident (see section E.4 of this appeal below).

68. In the context of the management of high level radioactive waste (HLW), the Final EIA Report admits that *"[t]he principal forms of disposal of disposal of HLW are therefore geological storage (deep underground) or reprocessing, with neither option being available currently in South Africa. As such the plan for HLW from the proposed NPS is storage on site (as is done at Koeberg)."*[60] The Final EIA Report goes on to acknowledge stakeholder concerns over such storage, including impacts on future generations. Instead of simply acknowledging that the no-go option would resolve the dilemma of what to do with HLW waste to be produced by the proposed Nuclear 1 NPS, the Final EIA Report obfuscates the issue by stating that *"[t]he "No-go" option would mean no such nuclear waste notwithstanding the*

[59] Final EIA Report, 5.9 p5-39.
[60] Final EIA Report, Executive Summary, p42.

*fact that such wastes would continue to be generated for the lifetime of the Koeberg NPS".*[61] Not only is the continued generation of HLW by Koeberg an irrelevant consideration for the purposes of authorising the Nuclear 1 NPS, the Final EIA Report fails to investigate or evaluate the cumulative impact of storing such waste at Koeberg and Duynefontein. It also fails to draw it to the attention of the decision-maker that:

> "…because there is nowhere else to put the waste, Koeberg is running out of space in its cooling ponds (due to be full by the end of 2018) and Eskom is buying more casks at R30m each to put into a new storage building. However, there are substantial problems and dangers with long-term cooling pond storage and dry cask storage. As Eskom's planning application revealingly notes, these casks are only a "temporary, interim measure". They are designed to last no more than 60 years, and then the high-level waste will need to be moved again – and needs to be safely contained for at least 10,000 years. Most worrying, however, is that nuclear power station sites are not designed to store high-level nuclear waste.[62]

69. The Final EIA Report acknowledges that stakeholders have raised concerns about the risks associated with the costs of the proposed NPS. Significantly, the following is stated:

> "the exact costs of the NPS are not known at this stage, but are known to be significant. Stakeholder concerns are whether the country can actually afford the financial costs of nuclear power and there is no direct assessment of the same in the EIA itself. It is one of the assumptions underpinning the EIA that the project is affordable to the country".[63]

The absence of an assessment of the costs of the proposed NPS, the likelihood of cost escalations and whether South Africa can afford it is signally a failure of the EIA process (which is discussed in more detail elsewhere in this appeal).

[61] Final EIA Report, Executive Summary, p42.
[62] See: https://www.businesslive.co.za/bd/opinion/2016-09-20-where-will-sa-put-lethal-nuclear-waste/
[63] Final EIA Report, 5.9 p5-40.

Importantly, the Final EIA Report admits that these costs "are known to be significant", and that the no-go alternative would mean that the risk of unaffordability would not manifest itself.

70. In its summary, the Final EIA Report presents the opinion of the EAP that the proposed NPS is a mechanism for generating baseload power, and concludes with the following statement:

> "The key issue is whether nuclear power remains part of the generation options contained within the IRP, and if it does then the "No-go" option would not be considered tenable. From the CSIR publication, it is clear that the 2010 IRP is outdated and must be updated as a function of currently projected demand for it to be defendable in defining the need and desirability for nuclear power. However, until such policy updates are made this document remains the reliable and official reference document for this project.[64]"

71. Having regard to the admissions outlined above, all of which relate to significant inherent impacts and risks that the Final EIA Report failed to satisfactorily resolve, it is submitted that the EAP should have applied a risk averse and cautious approach (taking into account the admitted limits of its current knowledge about the consequences of an approval decision)[65] and reached a conclusion that the option of not implementing the activity is the best practicable environmental option.[66] Instead, the Final EIA Report presents the proposed NPS as a *fait accompli*, rejecting the no-go option in favour of a fatally flawed approach that relies on nuclear being part of the energy mix referred to in the outdated IRP2010 policy, and on its own opinion that baseload power cannot be met through anything other than coal and nuclear power. The glaring contradiction inherent in this approach is

[64] Final EIA Report 5.9, at page 5-40, and Final EIA Report - Executive summary p42.
[65] NEMA, s2(4)(a)(vii).
[66] NEMA, s2(4)(b).

self-evident, with the Final EIA Report admitting that it is clear that the IRP2010 is outdated and must be updated as a function of currently projected demand for it to be defendable in defining the need and desirability for nuclear power. Even if the IRP is updated, it is policy and but one relevant consideration that the decision-maker would be entitled to have regard to.

72. In addition, section 2(4)(b) of NEMA requires that the best practical environmental option be pursued in decision-making. The failure to consider the no no-go option within the suite of alternatives precludes the decision-maker from selecting the best practical environmental option as only one energy source option is presented.

73. The decision on authorisation for the construction and operation of the NPS indicates under the heading *'Key factors considered in making the decision'* that one of the issues of most significance was '*the need for increased baseload electricity generation capacity…'*.

74. It has been demonstrated above that the claim made in the EIA that baseload generation capacity is required is based on the EAP's opinion, unsubstantiated by independent expert analysis, and that while there is a level of demand for electricity below which demand never falls, there is no justification for the assumption that there needs to be a set of baseload plants (that generate power continuously) whose job it is to meet this demand. This demand can be met by a set of plants that together can, with a high level of confidence, meet this demand. In making its decision on authorisation, the decision-maker has taken into account an irrelevant consideration, and has failed consider relevant considerations.

75. In addition, it is submitted that the selection of the no-go option is the "best practical environmental option" having regard to a number of significant unresolved issues,

impacts and inherent risks associated with a NPS, including (but not necessarily limited to) the following:

75.1. That nuclear power is not needed due to lower electricity demand;

75.2. That nuclear power has significant cost implications and is not affordable to South Africa;

75.3. That the health and socio-economic impacts of a catastrophic nuclear incident have not been adequately assessed; and

75.4. That the storage and disposal of nuclear waste, and the decommissioning of the NPS in the future, presents long-term, intergenerational cost, liability and danger risks.

76. By failing to select the no-go option, the decision maker has failed to ensure that the authorised activity is socially, environmentally and economically sustainable, and in so doing failed to comply with sections 2 and 24(4)(b)(i) of NEMA and section 24 of the SA Constitution. As a consequence, the decision on authorisation falls to be set aside.

### *E.4 Failure to adequately assess the health and socio-economic impacts of a radiological release as a consequence of a catastrophic nuclear incident*

77. The appellants' submit that the EIA process for the proposed Nuclear 1 NPS is fatally flawed as a result of its failure to adequately assess the health and socio-economic impacts of a radiological release as a consequence of a catastrophic

nuclear incident,[67] including a failure to adequately assess the significance[68] of: the cumulative impacts; the extent and duration of the impacts; the degree to which the impacts can be reversed; and the degree to which the impacts may cause irreplaceable loss of resources. As a result, the decision on authorisation is also fatally flawed and falls to be set aside in this appeal.

78. The EAP attempts to 'confess and avoid' this fatal flaw by:

78.1. Conceding that the health consequences and the social and economic consequences of a beyond design radiological release are untenable (nature and reversibility of the impact) and cannot be authorised under any circumstances (expressed as a fatal flaw) regardless of the spatial extent of the release; [69]

78.2. Averring that an assessment of the number of people that would die, or the social and economic consequences of a radiological release, is academic because it is already presented in the EIA that even a small scale beyond design release of radioactivity would be untenable;[70]

78.3. Claiming that the design of the proposed Generation III NPS will 'practically eliminate' large releases of radioactivity, and that the suitability of the design will be approved in a separate NNR licensing process, which

[67] Reference to a catastrophic incident in this Appeal includes accidents with a core melt and containment failure.
[68] "Significant impact" is defined in the EIA Regulations as meaning "*an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment".*
[69] Gibb 19 July 2016 response to LRC's 12 May 2016 submissions, page 27.
[70] Gibb 19 July 2016 response to LRC's 12 May 2016 submissions, page 27.

it claims is in accordance with a co-operative agreement entered into between the DEA and the NNR.

79. In this part of the appeal we will show that:

79.1. While the Final EIA Report included a Radiological Assessment Report, this assessment was restricted to normal operations and did not include an assessment of the health impacts of a catastrophic nuclear incident as required by NEMA and the EIA Regulations;

79.2. While the Final EIA Report included a Beyond Design Accident Report, this report focusses on how a severe accident with potentially large public health and environmental impacts can be avoided, rather than assessing the consequences of a catastrophic nuclear incident as required by NEMA and the EIA Regulations. It furthermore does not investigate the question whether the population can be sufficiently protected in the case of a severe, beyond design accident with substantial emissions of radioactive substances;

79.3. While the Final EIA Report included an Economic Impact Assessment Report, this report does not provide any detail on what the socio-economic impacts of a radiological release as a consequence of a catastrophic nuclear incident would be; and

79.4. Reliance on future NNR processes and safety standards fails to cure the EIA's fatal flaw of failing to assess the health and socio-economic consequences of a catastrophic nuclear incident, and amounts to an unlawful delegation of authority and/or an unlawful fettering of the DEA's statutory powers and obligations. In addition, the co-operative agreement between the DEA and

NNR is misrepresented by the EIA, and does not provide a lawful justification for the EIA's failure to assess the significance and impacts of a catastrophic nuclear incident.

**Failure to assess health and socio-economic impacts of a radiological release as a consequence of a catastrophic nuclear incident**

80. The appellants' submit that the Final EIA Report upon which the environmental authorisation is based is fatally flawed in that it failed to adequately assess the health and socio-economic impacts of a radiological release as a consequence of a catastrophic nuclear incident proposed NPS.

81. It is relevant to note at the outset that the approach of the EIA up to and including the Revised Draft EIR was that radiological issues would not be addressed in detail in the EIA, an approach the EAP says was in accordance with a co-operative agreement concluded between the DEA and the NNR (gazetted on 18 July 2008) and a statement was issued by the Director General (DG) of the DEA in January 2009 in an attempt to 'clarify' the purpose of this agreement. Instead, issues relating to nuclear safety, radiation and radiology would be addressed in the NNR process to avoid unnecessary duplication.[71]

82. According to the EAP, the approach taken in the Final EIA Report 'departs substantially' from the approach in previous versions of the EIR in terms of the consideration of radiological impacts. It is stated in the Final EIA Report that, in recognition of the applicable legislation and case precedent that require the consideration of all relevant socio-economic factors in the EIA process, an assessment of radiological impacts of the proposed power station is included in the

[71] Final EIA Report, 1. Introduction, at page 1-4.

current version of the EIR. It is stated that while this risks a duplication between the EIA and the NNR licensing processes "*the risk to the EIA in terms of possible appeals, based on an exclusion of substantive issues such as health issues from the EIA process, is regarded as greater than the risk of duplication*."[72]

83. The EAP goes on to state that the approaches of the EIA process and the NNR licensing processes differ substantially:

> "The focus of the EIA process is to assess the potential impacts of radiological releases (including normal operational releases and upset conditions). However, the focus of the NNR licensing process is to demonstrate beyond reasonable doubt that defence-in-depth measures… employed in the proposed power station design and operation are sufficient to reduce the probability of a failure leading to a core meltdown or a failure of reactor containment to acceptable and highly-unlikely levels. Thus, the EIA process focusses on the consequences of radioactive releases. The NNR process also focuses on consequences but is also designed to reduce the probability of such releases."[73]

84. Notwithstanding the EAP acknowledging that the EIA process and the NNR licensing processes differ substantially, an analysis of the Radiological Assessment Report (Appendix E32), Beyond Design Basis Accidents Report (Appendix E33) and Economic Impact Assessment Report (Annexure E17) included in the Final EIA Report shows that the EAP misconstrued what was required of them by NEMA by failing to adequately assess the health and socio-economic impacts of a radiological release as a consequence of a catastrophic nuclear incident involving the proposed NPS.

[72] Id.
[73] Id.

**Radiological Assessment Report**

85. As is evident from the quotation below, instead of assessing the nature, extent and duration (consequences) of a catastrophic nuclear incident, it is 'assumed' in the Radiological Assessment Report that, by having to meet NNR regulatory requirements, the radiological impact of the proposed NPS is of low significance:

> The structure of this report is based on a prospective radiological impact assessment as required at an early stage of a nuclear authorisation process in terms of the National Nuclear Regulator Act (NNR Act). This report, therefore, does not follow the typical structure of an EIA specialist report as it applies to non-radiological impact assessments. These EIA reports include qualitative significance ratings for environmental impacts that are categorised as High, Medium or Low. The significance category of an impact depends on the nature, intensity, extent, duration, consequence and probability of the impact. The fact that the radiological impacts and an assessment of their cumulative effects have to meet NNR regulatory criteria that are based on internationally recognised and accepted systems of radiological protection, result in a low significance of a NPP's radiological impact for normal operations. The result of the cumulative radiological impacts where more than one facility could impact on the receiving environment, must also meet specific dose and risk criteria equivalent to a low impact.[74]

86. With regard to nuclear accidents, the approach taken in the Radiological Assessment Report is to report on what risk there is of a nuclear accident occurring, rather than to assess the nature, extent and duration (consequences) of a catastrophic nuclear incident. The report indicates that the *"environmental impact of nuclear power is largely determined by the radioactive releases in case of severe accidents involving reactor fuel damage and in extreme cases, melting of the reactor core consisting of the support structures and nuclear fuel inside the reactor vessel".*[75] The Radiological Assessment Report goes on to provide an overview of the nuclear

[74] Nuclear 1 Specialist Study, *Assessment of the Potential Radiological Impact on the Public and the Environment*, August 2015, J Slabbert, (Appendix E32) at p11.
[75] Id, page 77.

safety criteria applicable to accidents and some safety assessment methodologies, and discusses the safety features of Generation III reactors (which it contends practically eliminate large releases of radioactivity, while admitting that *'[p]ublic radiological exposure may occur if confinement is lost*[76]). The report makes reference to the NNR nuclear authorisation process, and a safety analysis report (SAR) that will be required to be submitted as part of this NNR process.

87. In its responses to the LRC's 12 May 2016 submissions, the EAP echoes the above approach, stating that:

> …radiological safety issues lies firmly within the ambit of the NNR process (as stipulated within the cooperative agreement between the NNR and DEA)… the Radiological Risk Assessment (Appendix E32) has been included to assess the **normal operations** of the NPS and illustrates that the NPS can meet the NNR's normal operations safety standards, and is thus acceptable for the EIA process. **Any assessment beyond normal operations lie firmly within the NNR's mandate**… It should be noted that there is a distinction between the [NNR] process and the EIA process. A detailed safety case will be presented to the NNR. It is the mandate of the NNR to ensure that the proposed nuclear power station meets the safety regulations and limits as set out by the NNR. This EIA process has placed a lot of store within the NNR process and is thus a key assumption of this EIA process. Should any of the assumptions made within the EIA process not hold true, then the EIA may have to be revisited.[77]

**Beyond Design Basis Accident Report**

88. With regard to the Beyond Design Basis Accidents Report, it is also clear that the nature, extent and duration (consequences) of a catastrophic nuclear incident are not assessed in the report. The report states that *"[a]ccidents at NPPs have always been a concern of the public… [t]his report provides an overview of some of the important safety concepts that address this concern in the case of GEN III NPP*

[76] Id, p78.
[77] Gibb 19 July 2016 response to LRC's 12 May 2018 submissions, at pages 2 to 3.

*designs".*[78] As with the Radiological Assessment Report, the approach is taken that safety analysis techniques are applied, and that *"the results of safety analysis show that beyond design basis accidents that present a significant risk to the public and environment are practically eliminated as a result of provisions for design extension conditions".*[79]

89. The report seeks to answer the question "*how will a severe accident with potentially large public health and environmental impacts be avoided at the NPP"*,[80] rather than assessing the health and socio-economic consequences of a catastrophic nuclear incident. The report thus only addresses likelihood, and fails to assess the significance, nature, extent and duration of the radiological impacts in the event of a catastrophic nuclear incident.

90. As with radiological impact assessment, the approach taken in the Final EIA Report is that *"…radiological safety issues lies firmly within the ambit of the NNR process (as stipulated within the cooperative agreement between the NNR and DEA). The Beyond Design Accidents Report (Appendix E33) has been included for information purposes and in an effort to show how the three (3) major radiation release events from NPS's have been taken into consideration within the design of Nuclear-1".*[81]

91. As pointed out earlier in this appeal, while the (flawed) argument is presented in the EIA that future design requirements within an NNR nuclear authorisation process render this risk "highly unlikely", the consequences of such an incident remain untenable. In Europe in relation to the Hinkley Point C nuclear project, the

[78] Nuclear 1 Specialist Study, *Beyond Design Basis Accidents*, September 2015, J Slabbert, (Appendix E33) at p5.
[79] Id.
[80] Id, p11.
[81] Gibb 19 July 2016 response to LRC's 12 May 2018 submissions, Response 4, at p 2 to 3.

ACCC declared new nuclear power stations "ultra-hazardous activities" on the basis of the fact that though the chance of a severe accident is small, the impact is enormous. Both the ACCC and the Espoo IC concluded that impacts over many thousands of kilometres have to be considered.

92. Furthermore, the EIA did not contain an assessment of possible emergency preparedness and response measures that would be required to adequately protect the population in the case of a severe beyond design accident with a substantial release of radioactive materials, or to ascertain whether such measures are even possible. The proposed NPS is less than 30 km from the centre of Cape Town, and there are considerable concentrations of population within 20 km from the site. Without adequate protection (in the form of evacuation, timely indemnification of damage (liability) etc.), the application for approval should have been refused.

**Economic Impact Assessment Report**

93. The Final EIA Report includes an Economic Impact Assessment Report[82] that poses two questions relating to a catastrophic nuclear incident:

- What are the odds of a serous event occurring?

- What would be the results if a serious event were to occur?

80. The Economic Impact Assessment report indicates that it "seems that" (under normal operating conditions) a nuclear disaster is "extremely unlikely" (because the NNR's regulations conform to the highest international standards), and that because of technological and safety differences between Soviet and Western technologies the likelihood of a Chernobyl-type incident occurring at Nuclear 1 is "negligible".

[82] Final EIA Report, Appendix E17 *Economic Impact Assessment* (September 2014).

The report states that an assessment of the results of a nuclear disaster is rendered academic as a consequence, but concedes that the economic consequences for South Africa would be greatest at the Duynefontein site (and would affect the economy of the entire Cape Town Metropolitan region and large parts of the neighbouring municipalities).[83]

81. The appellants are dismayed that only some reference to Chernobyl has been made and that inadequate attention has been paid to the Fukushima catastrophe and the severe limitations to adequate protection of citizens in that case, as well as the lack of money to provide for timely compensation to victims. The reality is that Japan is still counting the costs of Fukushima, and that levels of liability are inadequate in South Africa – placing significant risks on taxpayers should the South African government be required deal with a nuclear disaster through the fiscus.

**Reliance on NNR process amounts to unlawful delegation of authority and/or fettering of the DEA's discretion**

82. Stated concisely, the approach taken in the Final EIA Report is that it is unnecessary to assess the nature, extent and duration (consequences) of a catastrophic nuclear incident in the EIA process because:

- By having to meet NNR regulatory requirements the radiological impact of the proposed NPS is assumed to be of low significance;

- The results of the Safety Analysis Assessment show that beyond design basis accidents that present a significant risk to the public and environment are

[83] Id, pages 58 to 59.

practically eliminated as a result of provision for design extensions (which will have to meet NNR regulatory requirements); and

- Under normal operating conditions a nuclear disaster is "extremely unlikely" because the NNR's regulations conform to the highest international standards, rendering the results of an assessment of a nuclear disaster academic.

82. Thus while the EAP acknowledged that the EIA process and the NNR licensing processes differ substantially, the EIA persists in its failure to adequately assess the health and socio-economic impacts of a radiological release as a consequence of a catastrophic nuclear incident involving the proposed NPS, relying instead on the future NNR process and safety standards (including design requirements) to provide assurance that these risks are of low significance and are highly unlikely to materialise.

83. This approach flies in the face of jurisprudence that confirms that functionaries with decision-making powers arising from their own respective empowering statutes are each required to discharge their respective statutory obligations, the basic principle being that the exercise of discretionary power (such as the DEA's power to issue or refuse an EIA authorisation and the NNR's power to issue or refuse a nuclear license) rests with the authorised body and no one else. As the Constitutional Court held in *Minister of Public Works v Kyalami Ridge Environmental Association*,[84] which considered functionaries in different fields of planning and environmental authorisation, an "organ of state with decision making authority must consider the application before it from its own particular perspective". In *Wary Holdings (Pty)*

[84] 2001 (3) SA 1151 (CC).

*Ltd v Stalwo (Pty) Ltd*[85] the Constitutional Court held that this is so because "each has "its own constitutional and policy considerations". As a result of this difference in focus, authorities at different levels of government are engaged in functions which are substantially different in nature and there is no duplication.[86]

84. In the *Fuel Retailers* case, the Constitutional Court (CC) held that the environmental authorities had misconstrued what was required of them by NEMA (the duty to consider the socio-economic impact of a proposed development, which the CC equated to need and desirability) by relying on a local authority's town-planning decision that considered need and desirability. The CC pointed out that a proposed development may satisfy the need and desirability criteria from a town planning perspective and yet fail from an environmental perspective. The CC held that the environmental authority's approach amounted to unlawful delegation of their duties to the local authority, that they had thus failed to comply with a mandatory and material condition for the granting of the authorisation.[87]

85. As a consequence of relying on the future NNR process, the Final EIA Report does not adequately assess the health and socio-economic consequences of a radiological release as a consequence of a catastrophic nuclear incident proposed NPS, and thus failed to comply with the relevant provisions of NEMA and the EIA Regulations. It therefore failed to consider and assess:

- the cumulative impact of a catastrophic event;
- the nature of the impact of a catastrophic event

[85] 2009 (1) SA 337 (CC)
[86] *Maccsand v City of Cape Town* 2012 (4) SA 181 (CC)..
[87] *Fuel Retailers Association of Southern Africa v Director-General Environmental Management, Department of Agriculture, Conservation and Environment, Mpumalanga Province and Others, 2007 (10) BCLR 1059 (cc)* at paragraphs 85 to 89.

- the extent and duration of a catastrophic event;
- the degree to which the impact of a catastrophic event could be reversed or mitigated
- the possibility of adequate protection of South Africans in the case of a catastrophic event; and
- the serious loss of resources resulting from a catastrophic event.

As a consequence, the Final EIA Report failed to provide stakeholders and the decision-maker with a quantitative and qualitative description of worst-case scenario impacts, including an estimate of the extent of radiation dispersal, the number of radiation exposure and cancer cases and all other injuries and fatalities among the local population, the degree to which these impacts can be reversed, or a realistic estimate of socio-economic costs (including contamination of land and loss of agricultural land).[88]

86. Reliance on future NNR processes and safety standards fails to cure the EIA's fatal flaw of failing to assess the health and socio-economic consequences of a catastrophic nuclear incident, and the DEA's acceptance of this approach amounts to an unlawful delegation of authority and/or an unlawful fettering of the DEA's statutory powers and obligations. The Final EIA Report and the decision on

[88] These costs have been assessed with reference to recent serious accidents by competent institutions - See the European Commission estimates contained in COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT - Accompanying the document - Proposal for a Council Directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations - {COM(2013) 343 final} - {SWD(2013) 200 final} - {SWD(2013) 201 final})
http://eur-lex.europa.eu/resource.html?uri=cellar:f15c5932-a8c5-4f00-b681-dc132ce667cb.0001.02/DOC_1&format=PDF
Another important recent study was that of the French nuclear institute IRSN , which calculated that the total costs of a typical large scale nuclear accident in France would cost around 430 Billion Euro
http://www.irsn.fr/FR/Actualites_presse/Actualites/Documents/EN_Eurosafe-2012_Massive-releases-vs-controlled-releases_Cost_IRSN-Momal.pdf
http://www.reuters.com/article/2013/02/07/us-france-nuclear-disaster-cost-idUSBRE91603X20130207#UFuKLRqw62Wtmyh4.97

authorisation are thus fatally flawed, and the decision on authorisation falls to be set aside.

**NNR DEAT Co-operative agreement**

87. In the event that the EIA applicant and/or decision-maker seek on appeal to persist with the view that it was not required to assess the health and socio-economic impacts of a radiological release as a consequence of a catastrophic nuclear incident in the EIA process due to the co-operative agreement entered into between the DEA and the NNR (gazetted on 18 July 2008), it is submitted by the appellants that, on a proper interpretation of the co-operative agreement, this approach cannot be lawfully sustained.

88. The co-operative agreement entered into by the DEA and the NNR was in respect of the monitoring and control of radioactive material and ionising radiation, and was published in terms of section 6(4) of the NNR Act. The salient provisions of this agreement are as follows:

88.1. It is stated in the Preamble that:

88.1.1. The NNR has responsibilities in respect of the monitoring and control of radioactive material or exposure to ionising radiation in terms of the NNR Act;

88.1.2. DEAT also has responsibilities with regard to 'the regulation environmental management" (sic) associated with radiation hazards in terms of NEMA;

88.1.3. The parties acknowledge and respect each others' autonomy and statutory responsibilities while recognising the NNR as the lead

authority in the regulation of radiation hazards with a view to protecting persons, property or the environment against nuclear damage;

88.1.4. The agreement is concluded in terms of the requirement for co-operative governance as provided for in terms of the provision of section 6 of the NNR Act,[89] section 35 of NEMA[90] and section 41 of the SA Constitution.

88.2. The agreement provides for a working relationship with regard to "issues Environmental impact" (sic) between the DEA and NNR with regard to:

(i) Ensuring the effective monitoring and control of nuclear hazards;

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[89] Section 6(1) states that to give effect to the principles of co-operative government and intergovernmental relations contemplated in Chapter 3 of the Constitution of the Republic of South Africa…, all organs of state… on which functions in respect of the monitoring and control of radioactive material or exposure to ionizing radiation are conferred by this Act or other legislation, must co-operate with one another in order to-

(a) ensure the effective monitoring and control of the nuclear hazard;
(b) co-ordinate the exercise of such functions;
(c) minimise the duplication of such functions and procedures regarding the exercise of such functions; and
(d) promote consistency in the exercise of such functions.

[90] Section 35(1) of NEMA provides that the Minister and every MEC and municipality may enter into environmental management agreements with any person… for the purpose of promoting compliance with the principles laid down in [NEMA]. Section 35(3) provides that Environmental management co-operation agreements may contain-

(*a*) an undertaking by the person or community concerned to improve on the standards laid down by law for the protection of the environment which are applicable to the subject matter of the agreement;
(*b*) a set of measurable targets for fulfilling the undertaking in (*a*), including dates for the achievement of such targets; and
(*c*) provision for-
  (i) periodic monitoring and reporting of performance against targets;
  (ii) independent verification of reports;
  (iii) regular independent monitoring and inspections;
  (iv) verifiable indicators of compliance with any targets, norms and standards laid down in the agreement as well as any obligations laid down by law;
(*d*) the measures to be taken in the event of non-compliance with commitments in the agreement, including where appropriate penalties for non-compliance and the provision of incentives to the person or community."

(ii) Co-ordinating the exercising of functions;

(iii) Minimising the duplication of functions and procedures regarding the exercise of such functions; and

(iv) Promoting consistency in the exercise of such functions.[91]

88.3. Article II sets out a table relating to the co-ordination of functions "with respect of" the monitoring and control of radioactive material and exposure to ionising radiation. One of the activities listed in the table under the heading 'Specific Activity' is the issuing of EIA authorisations (for construction and operation, where applicable, of nuclear installations under NEMA), with the DEA indicated as having 'Lead responsibility', and the NNR as having 'Support responsibility'. In the same line item under the heading 'Mechanisms & procedures for co-operation', it is indicated that this will be '[t]hrough a mechanism to be established'.

88.4. Article IV is headed 'Safety standards' and stipulates that GNR.388 of 28 April 2006[92] shall be applicable to all relevant provisions for the regulation, monitoring and control of radiation hazards falling within the respective responsibilities of the parties.

88.5. Article 8 states that no delegations have been made in terms of s238 of the Constitution.

[91] *Co-operative in Respect of the Monitoring and Control of Radioactive Material and Exposure to Ionising Radiation*, published in GN759 of 18 July 2008, Scope.
[92] *Regulations in terms of section 36, read with section 47 of the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999), on safety standards and regulatory practices.*

89. It is relevant to note that the co-operative agreement states clearly that the DEA has the 'lead responsibility' and the NNR has 'support responsibility' in the issuing of EIA authorisations for nuclear installations under NEMA (while the converse is stipulated in respect of nuclear authorisations in terms of the NNR Act). Nowhere does this agreement stipulate that the NNR would undertake a NEMA-type assessment of the health and socio-economic impacts of a radiological release as a consequence of a catastrophic nuclear incident. In addition, the agreement clearly states that no delegations have been made, and as a consequence the DEA cannot lawfully delegate its NEMA EIA obligations to the NNR.

**DEA Letter and Press Statement**

90. On 10 February 2009, the DEA wrote to the EAP advising that the DEA and NNR had reached consensus on the need for streamlining in terms of radiological issues raised or identified within the EIA process, in order to:

- Prevent unnecessary and unavoidable duplication of effort;
- Ensure that the mandates and independence of the respective authorities are not compromised;
- Facilitate the integration of processes; and
- Contribute to effective and efficient decision-making.

91. A statement by the DG of the DEA dated 30 January 2009 is also provided in the DEIR, which indicates that it concerns the consideration of matters pertaining to nuclear safety in environmental impact assessment processes on nuclear installations. The DG acknowledges:

- That nuclear safety, radiation and radiology are matters of concern in an environmental impact assessment process;

- The mandate and role of the NNR in the consideration and regulation of nuclear safety, radiation and radiology; and

- That consideration of these issues in an EIA process would result in unnecessary and avoidable duplication in regulatory requirement. (sic)

The DG concludes by stating:

> I have considered the provisions of the NNRA… and the NEMA EIA Regulations thereto… and am satisfied that the NNRA and Regulations thereto are administered by experts in the field of nuclear safety, radiation and radiology through and (sic) administratively just process. I am further of the view that these issues are better placed within the regulatory process of the NNRA and that consideration of the same issues in an EIA process will result in unnecessary and avoidable duplication. I therefore have decided that, as detailed in the agreement between DEAT and the NNR of 15th June 2006[93]…. these issues would fall outside the ambit of the EIA process and that the Department would not make a pronouncement on the acceptability of these impacts. Any authorisation granted for Nuclear installations would accordingly be conditional on the necessary nuclear licence being in place.

92. Chapter 6 of the Revised Draft EIR indicated that the DEA would not make a decision on the acceptability of radiological impacts issues pertaining to the nuclear power station EIA, and that the EAP had requested written clarification on the difference between the co-operative agreement and the explanatory statement issued by the DEA on the content of this agreement on 10 February 2009 – but at the time had not received clarification.[94]

93. Chapter 6 of the Final EIA Report shows that at the time of updating the report, such clarification had not yet been issued and attempts to arrange a meeting between the NNR and the DEA to explore the implications of the legislation and the co-

[93] This 2006 agreement is not provided, and it is assumed that the agreement being referred to is the *gazetted* CGA provided in the FEIR.
[94] Revised Draft EIR Chapter 6, page 6-15 paragraph 6.3.5(b).

operative agreement had been unsuccessful. As has been mentioned earlier in this appeal, this culminated in a significant shift in the EIA process in terms of which, in recognition of requirements in the NEMA, associated legislation such as the PAJA[95] and other legal precedents that require the consideration of all relevant socio-economic factors in an EIA process (even if they are being considered in other approval processes), an assessment of radiological impacts of the proposed power station was included in the EIR (Version 2) – albeit an inadequate assessment, as we have shown above.

94. It is evident from the above that even on the EAP's version, significant uncertainty prevails relating to the difference between the co-operative agreement and the explanatory statement issued by the DEA on the content of this agreement on 10 February 2009. As has been submitted above, the co-operative agreement was mischaracterised by the EAP and does not provide a lawful basis for the EIA decision-maker to fetter its discretion or delegate its statutory obligations. The correspondence between the EAP shows that clarification was sought but not received at the time the Final EIA Report was concluded. The contradictions between the co-operative agreement and the DEA statement have thus not been resolved, and do not come to the aid of the EAP or the EIA decision-maker.

### *E.5 Failure to adequately assess negative socio-economic impacts*

95. It is submitted that the Final EIA Report failed to adequately assess the potentially significant negative socio-economic consequences associated with the high cost of

[95] Promotion of Administrative Justice Act, Act No. 3 of 2000.

building, operating and ultimately decommissioning a NPS (4000 MWe comprising of two to three units).[96]

96. In this regard, the appellants (and other stakeholders) have the following key concerns:

96.1. That the proposed NPS will be costly and is not affordable to Eskom or South Africa;

96.2. That the high costs associated with the proposed NPS could result in higher electricity costs (impacting negatively on consumers, especially vulnerable and disadvantaged consumers), and that this would in turn have significant negative impacts for growth, employment and welfare in South Africa. Alternatively, in the event that the costs of construction of the NPS are not passed through to electricity prices, they will be provided in the form of one or another form of state aid, putting an unsustainable burden on State finances, while at the same time distorting the electricity market in a way that puts clean renewable energy sources and energy efficiency measures at a disadvantage while locking South Africa into more expensive nuclear power for a period of 60 years or more;

96.3. That the high costs associated with management, storage and disposal of nuclear waste, as well as the high cost of decommissioning the NPS at the end of its life-cycle, will impact negatively on current and future generations (inter-generational impacts); and

[96] As was noted in section E.3 of this appeal above, the Final EIA Report admits that ***"the exact costs of the NPS are not known at this stage, but are known to be significant."***

96.4. That the lack of certainty as to the specific type of plant, its design and safety mitigation features prevented an assessment of the socio-economic impacts of the proposed NPS.

**Cost and Affordability**

97. The Final EIA Report notes that stakeholders have raised concerns about the risks associated with the significantly high costs of the proposed NPS, and makes the following statement (and admissions):

> "The exact costs of the NPS are not known at this stage but are are known to be significant. Stakeholder concerns are whether the country can actually afford the financial costs of nuclear power and there is no direct assessment of the same in the EIA itself.[97] (emphasis added)

98. The Final EIA Report also notes that:

> "In a similar vein, it is known from Eskom's other megaprojects, notably Medupi and Kusile, that there have been significant cost escalations on the projects. Stakeholders have questioned that not only are the costs not known of the proposed NPS but that there has been no assessment of the likelihood of these costs escalating as the project unfolds." [98]

99. Notwithstanding the above, in response to stakeholder concerns regarding the "known to be significant costs" of a NPS, the Final EIA Report states that *"[i]t is however one of the assumptions underpinning the EIA that the project is affordable to the country*."[99] This assumption is also reflected in the *Key Assumptions and Limitations* section of the Final EIA Report, which states that

[97] Final EIA Report, 5.9 p5-40.
[98] Id.
[99] Id.

a key assumption relevant to the EIA was that "*the NPS will be financially feasible to the country*".[100]

100. There have been a number of recent developments that suggest that the nuclear build programme is not affordable:

100.1. On 25 January 2018 at the World Economic Forum in Davos, Switzerland, [then] Deputy President Cyril Ramaphosa was quoted in the media as stating that:

> "We have excess power right now and we have no money to go for a major nuclear plant building".[101]

100.2. On 21 February 2018, [then] Finance Minister Gigaba was reported as providing the following explanation for having made no allocation for nuclear energy in the budget documentation:

> "We can't afford it".[102]

100.3. On 22 February 2018, [then] Finance Minister Gigaba was again reported as stating that South Africa simply cannot afford to invest in nuclear energy at present, that Eskom has more than enough power supply to meet the economy's current demands, and that the renewable energy programme is also coming on stream. Gigaba was quoted as stating that:

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[100] Final EIA Report, Executive Summary, at p3.
[101] See for example: https://www.timeslive.co.za/politics/2018-01-26-no-money-for-nuclear-says-ramaphosa/; http://ewn.co.za/2018/01/25/ramaphosa-sa-has-no-money-for-major-nuclear-plant; https://businesstech.co.za/news/energy/221329/ramaphosa-says-south-africa-has-no-cash-for-nuclear/
[102] *'Budget 2018: Not enough money to go around, and especially not for nuclear',* available online at: https://www.dailymaverick.co.za/article/2018-02-21-budget-2018-not-enough-money-to-go-around-and-especially-not-for-nuclear/#.Wo10D2dG3mQ

> "There will come a time when SA reaches 6% to 7% growth and the economy - including mining and manufacturing - is kicking. We will also reduce coal power stations and focus more on renewable electricity generation… We would then have to look at base-load power supply and at that moment we might decide we need nuclear. It will be an open process, maybe in five years' time."[103]

100.4. Serious questions also arise over whether Eskom can afford a nuclear build. For example, on 16 November 2017 it was reported in the press that an Eskom report showed that the power utility was projecting a R3.55 billion loss by the end of its [then] current financial year, and that the power utility's poor governance had left it 'teetering on the edge of insolvency'.[104]

100.5. The Eskom acting chief financial officer, Calib Cassim, has also been reported in the media on 30 January 2018 as stating:

> "I can't go and commit to additional expenditure on a nuclear programme".[105]

It is curious that in the light of the above Eskom has not formally withdrawn its EIA application and/or abandoned the decision on authorisation to avoid further wasteful and unnecessary expenditure (in respect of it responding to appeals, the appeal authority having to process appeals, as well as probable future High Court review applications should the authorisation be upheld on appeal).

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[103] Available online at: https://www.fin24.com/Budget/gigaba-sa-could-look-at-nuclear-again-5-years-from-now-20180222

[104] *'To save Eskom from ruin, SA should ditch nuclear plan and cut coal power – study',* available online at: https://www.fin24.com/Economy/Eskom/to-save-eskom-from-ruin-sa-should-ditch-nuclear-plan-and-cut-coal-power-study-20171116

[105] https://www.cnbcafrica.com/zdnl-mc/2018/01/30/south-africas-eskom-cannot-commit-nuclear-expansion-acting-cfo/

101. In the premises, it is submitted that the EIA failed to comply with the mandatory requirements contained in section 2 of NEMA and in the EIA Regulations, and as a consequence is fatally flawed because:

101.1. It is admitted by the EAP that the exact costs of the NPS are not known, but are known to be significant, and that there was no direct assessment of costs in the EIA;

101.2. It is admitted by the EAP that it is known from Eskom's other mega-projects that there have been significant costs escalations, but that no assessment was conducted in the EIA of the likelihood of significant costs escalations arising in respect of the proposed NPS;

101.3. An assumption was made in the EIA that the NPS will be financially feasible, unsupported by research or economic analysis;

101.4. Recent public statements by Ramaphosa, Gigaba and Eskom's acting chief financial officer confirm that both South Africa and Eskom cannot afford a NPS;

101.5. The EAP concedes that the no-go option would mean that the risk of unaffordability and the risk of price escalations in respect of the NPS would not manifest/materialise.[106]

102. As a consequence of the above, by authorising the proposed NPS the decision-maker failed in its legal duty to ensure that the proposed NPS is socially, environmentally and ecologically sustainable, failed to apply a risk averse and

[106] Id.

cautious approach, was based on irrelevant considerations and failed to take relevant considerations into account. The decision on authorisation is fatally flawed and falls the be set aside.

**NPS could result in higher electricity costs, with potentially significant socio-economic consequences**

103. The absence of an adequate assessment of the costs of the proposed NPS, the likelihood of cost escalations, and the potentially significant negative impacts such high costs would have electricity prices or the fiscus is signally a failure of the EIA process.

104. In its Draft EIR (Version 2) Table 7-22 Common thematic issues and responses document, the EAP responded that *"it is not the purpose of the EIA process to deal with the impact of electricity prices and make a recommendation on this issue to the environmental decision maker*"[107].

105. In its responses to the LRC's submissions on behalf of the appellants on the Final EIA Report, the EAP comments regarding the above statement that *'[t]he argument made above does not state that the impact of electricity prices is acceptable, but rather that the EIA cannot assess a multifaceted aspect such as electricity price increases.*[108]

106. As a consequence, it is clear that the Final EIA Report has failed to assess the potentially significant negative impacts of the proposed NPS on electricity prices. As is shown below, higher electricity prices as a consequence of the NPS would

[107] Version 2 Draft EIA report 2 Table 7-22 Common thematic issues and responses page 7-64
[108] Gibb 19 July 2016 response to LRC submissions dated 12 May 2016, Response 27.

have significant socio-economic and environmental impacts, which should have been assessed in the course of this EIA.

107. In 2015, Earthlife Africa funded the University of Cape Town's Energy Research Centre (ERC) to research and report on the potential socioeconomic risks of South Africa's planned nuclear build programme (9600 MWe)[109] (a copy of which we annex hereto marked "**Annexure I**"). The key points arising from this analysis are as follows:

107.1. In a future with high growth, assuming low costs for nuclear and limited and expensive alternatives, the commitment to nuclear power could have no significant impact on the electricity price and the economy.

107.2. There is, however, a 94% chance that electricity prices will be higher in 2030 as a result of the commitment to nuclear power, which would have significant negative impacts for growth, employment and welfare in South Africa.

107.3. In a future with lower growth, higher nuclear costs, and availability of other supply options, the commitment to nuclear power could have significant negative implications for growth, employment and welfare in South Africa.

107.4. Consumers are likely to bear the burden of the investment through higher electricity prices and decreased employment.

[109] Energy Research Centre, UCT (2015) *South Africa's proposed nuclear build plan: An analysis of the potential socioeconomic risks.* Available online at: http://www.erc.uct.ac.za/sites/default/files/image_tool/images/119/Papers-2015/15-ERC-Nuclear_build_plan_Technical_report.pdf

108. It is submitted that the failure of the Final EIA Report to assess the investigate and assess the potentially negative socio-economic impacts of higher electricity prices is a fatal flaw in the EIA process. As a consequence, the decision on authorisation falls to be set aside.

109. In response to concerns raised that the Final EIA Report fails to assess economic impacts of the nuclear power station, including the impacts on the consumer, the Final EIA Report introduced the following assumption, namely:

> "The nuclear power station will be financially feasible to the country taking into account the risks associated with the technology including the possibility of a core meltdown."[110]

110. This is an assumption unsupported by research or economic analysis, contrary to EIA Regulation 32(2)(l) which requires that all assumptions and gaps in knowledge are fully explained. The Final EIA Report provided no legal authority for substituting the legal duty to assess social and economic impacts in an EIA with assumptions that impacts, such as financial or economic impacts, will be acceptable.

111. Furthermore, where assumptions are made, regard must be had to the principle in NEMA that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions. The decision-maker has failed to adopt such an approach.

112. In the event that the costs of construction of the NPS are not passed through to electricity prices, it is submitted that such costs will still need to be provided in the form of one or another form of state aid (e.g. intergovernmental loan; loan by

[110] Final EIA Report executive summary page 3

Eskom backed by a State guarantee etc.), putting an unsustainable burden on state finances, while at the same time distorting the electricity market in a way that puts clean renewable sources and energy efficiency measures at a disadvantage, while locking South Africa into more expensive nuclear power for a period of 60 years or more. The Final EIA Report fails to assess the negative socio-economic impacts that alternative funding models would have on both current and future generations, and as a consequence is fatally flawed and the decision on authorisation falls to be set aside.

**Nuclear waste management and NPS decommissioning costs**

113. The Final EIA report fails to adequately assess the potentially significant negative socio-economic consequences of the costs implicit in long-term management and storage of high level radioactive waste, as well as the costs of decommissioning the NPS when it reached its end of life.

114. In response to EIA submissions made on behalf of the appellants relating to the concern that the costs of disposal of nuclear waste will be borne by future generations for thousands of years (while the NPS will only supply electricity for approximately sixty years), the EAP concedes that the *"principle that future generations will have to live with that legacy is an important negative consequence of nuclear power".*[111]

115. In order to illustrate the point that the cost of safe disposal of waste may have very significant consequences, reference is made to a recent situation in Germany where the cost of management of hazardous nuclear waste created significant concerns as

[111] Gibb Response 3 to LRC submission dated 9th December 2015 to GIBB

to the viability of this source of power. Reference is made to a German newspaper, Handlesblatt report[112] which stated:

> "Germany's largest utility E.ON is now ready to accept a deal proposed by the government that makes nuclear power plant operators pay for a significant portion of the phase-out of nuclear energy in the country, Handelsblatt has learned, making it the first major utility to signal its willingness to co-operate. The move two weeks after a German government-backed commission proposed that utilities pay a total of €23 billion, or $26 billion, into a publicly-managed fund, which will cover the cost of the long-term storage of nuclear waste. The plan solicited resistance from Germany's four largest utilities E.ON, RWE, EnBW and Vattenfall, which have so far only set aside €17 billion to cover the cost of the phase out."

116. The IRP2010 (which the EAP describes as the departure point for the EIA) failed to provide a costing for the decommissioning of nuclear power stations and for the management of waste (and in particular spent nuclear fuel) for thousands of years into the future:

> "It is relevant to note that the IRP2010-2030 acknowledges that further research is required on the full costs relating to specific technologies (including nuclear) around the costs of decommissioning and managing waste (in the case of nuclear specifically spent fuel)."[113]

The costs of same were also not described or assessed in the EIA, and as a consequence an assessment of the socio-economic impacts of decommissioning and

[112] Report no 427 11 May 2016
Exclusive: E.ON Open to Government Deal on Financing Nuclear Waste Disposal - https://global.handelsblatt.com/breaking/exclusive-e-on-open-to-government-deal-on-financing-nuclear-waste-disposal
[113] IRP2010, at paragraph 7.11.

spent fuel storage and management costs arising from the proposed NPS is not possible.

117. In addition, it is pointed out that the liabilities of NECSA for cleaning up the contaminated sites in South Africa are now a matter of dispute between NECSA and the AG.[114] It is likely that future generations will have to pay for the costs of historical nuclear waste. Given that South Africa has the "polluter pays principle" in South African environmental legislation, the cost of future management of radioactive waste and remediation of contaminated sites needed to be included in the Final EIA Report, but was not.

118. It is submitted that the failure to assess the adequately assess the potentially significant negative socio-economic consequences of the costs implicit in long-term management and storage of high level radioactive waste, as well as the costs of decommissioning the NPS when it reached its end of life, is a fatal flaw in the EIA process, and that the decision on authorisation falls to be set aside.

**Lack of certainty as to the specific type of plant, its design and safety mitigation features**

119. In addition to the concerns canvassed in earlier submissions, it is not possible for the applicant to comply with the EIA Requirements for assessing the economic impacts of the project because of lack of certainty as to the specific type of plant, its design and safety mitigation features.[115] This is because different types of nuclear power plants, and their safety mitigation features, will generate different

[114] http://www.bdlive.co.za/business/energy/2016/01/28/necsa-now-embroiled-in-nuclear-waste-row
[115] The envelope approach affects all facets of the impact assessment process (not only the economic assessments). In particular: alternative technologies cannot be assessed if it is not clear what plant type will be used; and it is not possible to mitigate against the impact of the construction or an incident if the site design and type of plant is unclear.

consequences in a major accident which will in turn result in different economic impacts. The monetary value of such economic impacts will also be different for different sites, based on issues such as population densities and the nature of the surrounding economy. Factors which may determine the range of impacts include:

a. fuel storage options including alternatives;
b. waste facilities and disposal methods;
c. number of containment hulls and their quality;
d. whether a core catcher is implemented (such technology is dependent on the type of design);
e. the emergency zones that need to be determined;
f. the source term;
g. possible cost overruns;
h. labour, expertise and material required etc;
i. the nature of the adjacent economy, and population densities e.g. types of agriculture undertaken;
j. the extent of emergency zones

121. Furthermore, Guidelines published in 2005 by the Provincial Government of the Western Cape provide guidance on how economists are to be involved in the EIA process, and are clearly a relevant consideration which was not considered.[116]

122. The Guidelines state that the basic function of economic specialist input is to assist in the determination of whether a project will enhance the net social welfare. This involves considering the efficiency, equity and sustainability of the project. Input from an economic specialist is especially required if there is a chance that economic impacts are likely to influence the decision of whether or not a project is desirable.

123. The guidelines further state that macro-economic risks need to be taken into

[116] Van Zyl, H.W., de Wit, M.P. & Leiman, A. 2005. *Guideline for involving economists in EIA processes: Edition 1.* CSIR Report No ENV-S-C 2005 053 G. Republic of South Africa, Provincial Government of Western Cape, Department of Environmental Affairs & Development Planning, Cape Town. These guidelines are relevant to the extent that the nuclear power station will be built in the Western Cape.

account, and that where the size of the project is such that it could influence relative prices then further analysis is required to identify and assess potential risks.[117]

124. The guidelines go on to state that the report also needs to take into account the vulnerability of the groups impacted on. Part of the assessment should include a consideration of who benefits and who loses from the impacts associated with the project. This was not done.

### *E.6 Failure to assess all potential impacts of nuclear waste violates NEMA and the EIA regulations, read together with PAJA 6(2)(e).*

125. Radioactive waste is certainly a "significant impact" as defined in the 2006 EIA regulations,[118] and it has been identified as such by numerous public participants,[119] the DEA,[120] and the applicant itself.[121]

126. However, the Final EIA Report fails to undertake an environmental impact assessment of waste to be generated by the NPS. In its responses to submissions made on behalf of the appellants during the EIA, the EAP concedes that:

> "It is true that the impact of nuclear waste disposal has not been presented in the EIA… It is also true that the spent fuel is extremely long lived (several hundred thousand years before the radioactive decays to the level of the original ore) and that is an important consideration for decision-making by the authorities." [122]

[117] id page 35
[118] 2006 EIA Regulations, regulation 1
[119] Revised DEIR App D8 Combined IRR Volumes Final at 157–186.
[120] Letter from Ms. Joanne Yawitch, Deputy Director General of Environmental Quality and Protection, DEA, to Mr. Tim Liversage, Arcus Gibb (Nov. 19, 2008) (laying out conditions under which the scoping report was to be accepted, which included assessment of nuclear waste).
[121] Revised DEIR, Chapter 9, Impact Analysis 9.29 and APP E29.
[122] Gibb 4 January 2016 Response to LRC submission dated 9th December 2015, Response 52.

127. The EAP tries to circumvent the failure to assess the impacts of nuclear waste disposal (a fatal flaw in the EIA process) by explaining that:

> "This is because the NNR has strict requirements regarding the disposal of radioactive waste and the assessment would have inevitably simply presented those requirements, which are deemed by the NNR to result in the safe handling and disposal of radioactive waste. In the safety case the applicant would have to prove to the NNR that the waste management approach would be consistent with the requirements for safe disposal of radioactive waste."[123]

128. An exposition of the disposal requirements of the NNR for radioactive waste is obviously not an assessment of the impacts of the waste, and fails to comply with the EIA requirements contained in regulation 32(2) of the EIA regulations and section 2 of NEMA. As already stated earlier in this appeal, the function of the NNR is not to conduct EIAs as contemplated in NEMA, and the requirements of an EIA under regulation 32(2) are not fulfilled nor can they be lawfully fulfilled by the NNR. This again amounts to an unlawful delegation of authority and/or an unlawful fettering of the DEA's statutory powers and obligations.

129. Instead of ensuring that the EIA included an assessment of the impacts of high level radioactive waste, the EAP in its further responses to submissions made on behalf of the appellants during the EIA concedes that:

> "The no-go option has been updated to reflect on the fact that the spent fuel despite being relatively low volume will maintain high levels of radioactivity for several hundred thousand years. The principle that future generations will have to live with that legacy is an important negative consequence of nuclear power. Although there has not been a detailed assessment of nuclear waste given the fact that disposal is strictly governed by the requirements of the NNR, the assumption in the EIA is that such waste can be safely disposed despite its long-lived nature. Methods exist for reprocessing spent fuel and for deep geological disposal neither of which are yet practiced in South Africa.

[123] Id.

> The EIA is accordingly based on the assumption that by the time the NPS needs to be decommissioned that South Africa will have implemented an effective nuclear waste management approach that will ensure the safe disposal of radioactive waste in perpetuity but that circumstance does not currently prevail."[124]

130. We highlight the following from the above:

130.1. It is evident from the above that the no-go option is the only rational option, and submit that the EAP should have recommended that the application be refused, and that the decision-maker should in any event have refused to authorise the NPS;

130.2. By authorising the NPS notwithstanding that the EAP acknowledges that South Africa does not yet practice methods for reprocessing spent fuel or for deep geological disposal, and that assumptions (unsupported by any technical expertise) have been made in the EIA that such waste can be safely disposed despite its long-lived nature and that by the time the NPS needs to be decommissioned that South Africa will have implemented an effective nuclear waste management approach that will ensure the safe disposal of radioactive waste in perpetuity (a circumstance that "does not currently prevail", the decision-maker has failed to apply a risk averse and cautious approach as required by section 2(4)(vii) of NEMA. In doing so the decision on authorisation also fails to ensure that the NPS is socially, environmentally and economically sustainable;

130.3. By authorising the NPS notwithstanding that the EAP acknowledges that the principle that future generations will have to live with that legacy is an

[124] Gibb 19 July 2016 Response to LRC submission dated 12 May 2016, Response 28 at p17.

important negative consequence of nuclear power, the decision-maker has failed in its Constitutional obligation to protect the environment for the benefit of present and future generations;

130.4. The decision on authorisation also fails to meet other NEMA section 2 principles, including (but not necessarily limited to) that: the responsibility for environmental health and safety consequences of a project exists throughout its life cycle;[125] that the social, economic and environmental impacts of activities (including disadvantages and benefits) must be considered, assessed and evaluated; and that decisions must be appropriate in the light of such consideration and assessment.[126]

131. In light of the above the Final EIA Report is fatally flawed, and the decision on authorisation falls to be set aside.

### E.7 ***Failure to address impact on development expansion in Duynefontein***

132. The Final EIA Report fails to address the impact that the construction of future nuclear power stations at Duynefontein would have on the development and expansion of Cape Town and surrounding areas such as Atlantis. The report therefore fails to place this relevant consideration before the decision maker, a matter of high importance to the City of Cape Town and its residents.

132.1. The Koeberg nuclear power station is 30 (thirty) years old and due to be decommissioned over the next two decades.[127] Hence in the next two

[125] NEMA section 2(4)(e)
[126] NEMA section 2(4)(i).
[127]"It is accepted, however, that the Koeberg design in conjunction with the initiative contained in the station Life of Plant Plans, currently supports an operational life of 40 to 50 years. By 2014, unit 1 will have been

decades land closer to Koeberg Power station would become available for development. The building of a new nuclear power station at Duynefontein would place additional long-term constraints on the development of this land.

132.2. The Final EIA Report gives contradictory responses to this submission. In its response to our submission on 9th December 2016 it replies that the Koeberg Nature Reserve (i.e. land within the 5km PAZ) is a proclaimed protected area and does not automatically become available after decommissioning, ignoring the obvious concern of our submission, which relates to land close to, not next to the power station.[128] Clearly the concern relates to all land, not just nature reserve land in the vicinity of Koeberg. Land beyond the nature reserve will not be made available for development if more nuclear reactors are to be built on the site. This is a highly relevant consideration in Cape Town which has a critical land and housing shortage and is rapidly developing.

132.3. Elsewhere in the Final EIA Report it is conceded that land close to Koeberg will not be available for development if the nuclear power station is built.[129] Furthermore, the Final EIA Town Planning Assessment report recognises that "[t]he proposed development <u>will have an impact on future development of the region in terms of land that can be utilised for future development</u>. Areas around the site will need to be protected, densities

in operation for 30 years, with unit 2 reaching the equivalent operational age by 2015." Johannes Kotze, Project Director: Strategic Nuclear Projects at Eskom, http://www.pragmaworld.net/media-centre/news-articles/long-term-asset-management-of-koeberg-nuclear-power-station-to-be-addressed-at-physical-asset-management-conference.php

[128] Response 19 to LRC submission dated 9th December 2015 to GIBB

[129] Page 41

may need to be lower than if the development was not there and infrastructure upgrades will be required, especially roads."

132.4. The report however gives contradictory information on this impact, stating in Chapter 10 of the Final EIA Report:

> "It is therefore foreseen that the development of the power station is unlikely to result in the restriction of land uses, which cannot be appropriately dealt with through existing planning tools / legislation."[130]

132.5. The application for authorization of a further 4000MW of nuclear power envisages the construction of facilities which could generate 4000MW of nuclear power and which will have a life span of between forty and sixty years and perhaps longer.[131] Added to this would be the construction and decommissioning time. In total, the planned building of addition nuclear power will constrain development around the northern suburbs of Cape Town, a large metropolis, for another 80 (eighty) or more years (affecting many future generations).

132.6. This is a very significant socio-economic impact as the city has a rapidly increasing demand for housing and is landlocked by mountains and ocean, placing pressure for development on the zone to the north of the city between Cape Town and Duynefontein as well as to the north of Duynefontein. In addition, Atlantis, which is 23 km north of the Koeberg, has a critical need for investment in job creating industries in order to

[130] Chapter 10 p 236
[131] http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Power-Reactors/Nuclear-Power-Reactors/

address the legacy of apartheid planning which put this residential area very far from economic activity. According to the Cape Town City Council website:[132]

> "Job creation and economic development are two of Cape Town's biggest priorities. The unemployment rate in Atlantis is one of the highest in the metropole. [133]

132.7. In the experience of one of the appellants, Greenpeace, in the case of nuclear plant construction, that construction workers need to be certified for this work, and only a small fraction are usually sourced locally due to certification requirements.[134]

### *E.8 <u>The decision is based on outdated demographic and other information pertaining to the description of the receiving environment</u>*

133. The authorisation is based on outdated demographic information pertaining to the description of the receiving environment – that is, the demographics of the people living in the vicinity of the reactor now and in the future who could potentially be affected if there was a major release of radiation.

134. The issue of accurate demographic information for a decision when deciding to locate a nuclear reactor in an area is raised because of the nature of the site and its surrounds. When the Koeberg nuclear reactor was first established, the area for many kilometres around it was sparsely populated and rural. The Social Impact

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[132] http://www.capetown.gov.za/en/MediaReleases/Pages/CityReleasesIndustrialLand.aspx
[133] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000.

[134] This has been their experience on all of the roughly 20 construction projects that they have been involved in. In the case of Olkiluoto in Finland these workers came from Portugal, Poland and Ukraine, not from Finland. In the case of the Temelin in the Czech Republic, these workers came the entire republic, as well as from Ukraine and Russia, but not from Ceske Budejovice, the nearest major town. In Flamanville there were hardly any Bretons among the workers - they came from the entire country of France.

Assessment of the EIA describes Blaauberg (where the site is located) as one of the fastest growing districts in the City of Cape Town metropolitan area.[135]

135. It can therefore be expected that significant numbers of people currently, and in future, will live in close proximity to the reactors, and will be faced with various significant risks and the need to evacuate based on proximity to the site in the event of any potential nuclear disaster. For this reason, and based on the requirements of the plan of study for the EIA, there should have been a detailed up-to-date study of the demographics of the areas around the site, at different distances. These figures should have been linked to an assessment of the emergency response capability now and in the future.

136. The plan of study gives a detailed indication of what is required in the social and economic impact assessment[136] which is to be based on a specialist study. The description of the receiving environment, a requirement in terms of the EIA Regulations is discussed in chapter 2 of the social impact assessment which states:

> "The 2011 census figures have been utilised as the baseline data for the description of the population distribution within 80km of the Duynefontein site, with certain adjustments."[137] (our emphasis)

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[135] Environmental Impact Assessment For The Proposed Nuclear Power Station ('Nuclear 1') And Associated Infrastructure Social Impact Assessment January 2016 (Sia) At Parag 2.2.5

[136] Environmental Impact Assessment For The Proposed Nuclear Power Station ('Nuclear 1') And Associated Infrastructure Social Impact Assessment January 2016 (Sia)

[137] Id paragraph 2.2.1 at page 40 which states

" The 2011 census figures have been utilised as the baseline data for the description of the population distribution within 80km of the Duynefontein site.
However, figures used for the jurisdictional area of Cape Town have been obtained from the City of Cape Town. The City of Cape Town has made certain corrections to the 2011 census figures, based on household surveys. Census figures as obtained from Statistics South Africa were utilised for areas outside of the metropolitan area."

137. The environmental authorisation decision is dated October 2017, and hence is based on information that is at least six years old. Figures for more recent years are based on projections, and not actual data.[138]

138. Demographic information in the Duynefontein area can be expected to have changed rapidly over the past decade and will in all probability continue to do so into the future. This is clear from the Social Impact Assessment, which records that there has been a rapid and significant increase in the population of Cape Town in the last decades - see paragraph 2.2.1 of the Social Impact assessment which states:

> "It was estimated that about 3,5 million people resided in the 110 wards of the City of Cape Town in 2006, according to the Dorrington Report: Projection of the Population of the Cape Metropolitan Area 1996 – 2031 (Dorrington, 2000, Unpublished). This tally represents an increase of 935 000 over the 1995 headcount and over 1,9 million more than in 1985. Figures provided by the Centre for Actual Research (Population Projections for the Western Cape 2001 – 2025, 2005) indicated the total population for Cape Town as 2 994 779 for 2001, 3 239 768 for 2006 and 3 368 892 for 2010."

139. Significantly, the report states:

> "The 2011 Statistic South Africa indicated a total population, of 3 740 026 for Cape Town, 1 068 572 household units. The population for 2014 was estimated at 3 918 830."

140. Recognising this, up-to-date data should have been obtained in order to ensure compliance with Regulation 32(2). The social impact assessment was required to obtain a census for the 80km radius,[139] and therefore reliance on the 2011 census can only be the beginning of the assessment.

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[138] Table 7 page 42

[139] Plan of Study para 4.5.14 "Social" states "The appointed specialist will be required to undertake the following: obtain census data by enumerator area or smaller (in available) for the 80km annulus".

141. The EIA should have ensured that data was collected in the recent past, and consideration given to the growth of populations at different distances from the nuclear reactor site as these persons would be the first affected by a nuclear accident and the need to evacuate.

142. Simply taking the statistics within the entire 80 km radius in 2011 and multiplying them by different factors does not give the decision-maker a sufficient picture of changes in the recent past, of the demographics of in the receiving environment close to the proposed nuclear reactor. The data used is out-of-date, resulting in an environmental authorisation based on out-of-date information and a consequent failure to place relevant considerations before the decision maker.

143. The Final EIA Report relies on the 2011 census data with assumptions as to possible increases in population as its basic methodology. This is insufficient to comply with the requirement that a census for the 80 km radius be obtained.

144. The social impact assessment states that in 2011 there were an estimated 98 000 people living between 15 and 20 km of the Duynefontein site and 66 000 within 10 to 15 kilometres of the reactor site.[140] Table 7 predicts the population growth, on the basis of a range of different potential growth rates until 2030. There is however no census of populations more recently than 2011. The figures given are estimates based on possible percentage increases. It is assumed that the percentage increase in each sub-region or local municipality is evenly distributed.[141] Although there is reference to higher growth in areas like Parklands, this is not substantiated in any

[140] Table 6 page 41 SIA
[141] SIA page 42

way. There is some discussion of population in the 16 km radius but once again it is based on 2011 data.

145. Importantly, there is no discussion of planning changes over the past five years which have led to planned increases in densification of the areas around the Koeberg power station (see the 2014 decision of Anton Bredell (see Annexure "**J**") approving the WesCape Development, an approval which will, if it proceeds, significantly increase population densities in the vicinity of the Duynefontein site. This information should have been included and its impact on demographics in the area evaluated. The site is close to the Koeberg reactor and it is planned to house an additional 200 000 units. There is no reference to it in the Social Impact Assessment report.

146. Paragraph 2.2.9 of the Final EIA Report states that there are *"A total of 32 246 dwellings within 16km of Duynefontein (2001), with the majority of dwelling types (approximately 93%) being of a formal nature."* This paragraph seems to significantly downplay the extent of housing close to the site.

147. News reports indicate that the Wescape development will be within the 16 km "red zone".[142] Eskom appears to have challenged the decision.[143] It is not clear what

[142] See https://www.groundup.org.za/article/wescape-800000-people-koebergs-nuclear-red-zone/ "Another major regulatory loop that Wescape's developers will have to jump through is permission to build a city of 800,000 residents within the 16km zone around Koeberg power station, an area where development is limited due to the need to evacuate the area if there is a nuclear emergency" Note the reference to the EIA in this article.

[143] https://www.fin24.com/Economy/Eskom/eskom-slams-cape-town-leaders-on-wescape-decision-20160622

has happened in the interim in regard to this litigation and updated information in this regard should have been indicated in the Final EIA Report[144].

148. Even if this development is not going ahead, there should have been a far more detailed appraisal of population growth and potential growth in future near the site (as well as any other relevant official town planning decisions which will densify the area around the Duynefontein site) for a decision maker to decide to authorise a nuclear power plant in the area. The EIA Regulations clearly state that any information that has the potential for influencing the decision maker must be brought to his or her attention.[145]

149. In *Seafront for all and Another vs MEC, Environmental and Development Planning, Western Cape Provincial Government and Others* ("***Seafront***")[146] the Western Cape High Court considered the issue of a failure to take into consideration changed circumstances. In this case the MEC's decision was based primarily on information contained in the final scoping report some 4½ years before the MEC took her decision. It was held that "the information in the final scoping report ought to have been augmented by a comprehensive current environmental impact assessment. In failing to call for such updated assessment, the MEC took her decision on the basis

[144] In July 2014 Eskom initiated court proceedings against Bredell, asking that his decision to approve an amendment to the Cape Town Spatial Development Framework to permit residential development, and incorporate Wescape into the urban edge, be set aside.Eskom avers that Bredell and the city council failed to consider all the comments and objections from various stakeholders which consider the safety of the future population of Wescape in the event of an emergency at the Koeberg nuclear power station. The development would be located within the restricted zone of 16 km around Koeberg. Ashleigh Furlong *Eskom takes City to court over Wescape development* 22 June 2016 https://www.fin24.com/Economy/Eskom/eskom-slams-cape-town-leaders-on-wescape-decision-20160622. Eskom says Bredell or the City Council failed to consider the safety of the future population of Wescape in the event of an emergency at the Koeberg nuclear power station.
[145] 2010 EIA regulation 17(f)
[146] (2010) JOL 25602 (WCC)

of irrelevant considerations (information which was out of date and no longer correct), and failed to have regard to relevant considerations".

150. The failure in this regard must have been material, having particular regard to the relationship between such failure and the environmental context. Quoting the ***Fuel Retailers*** case of the Constitutional Court, the Western Cape High Court held that:

> "the Constitution recognizes the inter-relationship between the environment and development; indeed it recognizes the need for the protection of the environment while at the same time it recognises the need for social and economic development. It contemplates the integration of environmental protection and socio-economic development. It envisages that the environmental considerations will be balanced with the socio economic considerations through the ideal of sustainable development".[147]

151. The High Court held in the ***Seafront*** case that "in relying on outdated and erroneous information, the MEC was precluded from properly performing the required balancing exercise required under NEMA. In the absence of information regarding the current socio-economic environment in Seapoint, she could not decide whether the proposed re-development of the site would, in fact, serve a socio economic need, and she was unable to balance the socio-economic consequences of the development against the negative environmental consequences. Accordingly, the record of decision was set aside on this ground".

152. In the case of the nuclear power station, these concerns are aggravated by the fact that the EIA Reports fail to consider the social and economic impact of a catastrophic release of radiation from the proposed power station, and the cumulative impact of such an event. Therefore, a decision to authorise the construction of a nuclear power station based on this report would be open to legal

[147] At para 45.

challenge on the basis that relevant considerations were not placed before the decision maker.

## *E.9 International Law Obligations in respect of EIA*[148]

**Introduction**

153. It is submitted that the EIA and decision on authorisation failed to comply with certain international environmental obligations, and as a consequence the authorisation is fatally flawed and falls to be set aside.

154. This section of the appeal is set out in the following manner:

154.1. factual background;

154.2. international environmental law and its application when applying for an environmental authorisation in South Africa; and

154.3. the grounds of appeal.

**Factual Background**

**International Foot Print wherein the Nuclear Power Station is located**

155. The location of the 4000 MWe (4 GWe) Nuclear Facility (comprising of two or three nuclear reactors) is on the consolidated farm referred to as Duynefontyn no 1552 (the "location"). The Farm lies north of Melkbosstrand on the West Coast of

[148] Acknowledgement: This section of the appeal was drafted by Lucian Limacher (LRC), with input and advice from Cullinan & Associates.

South Africa, it falls within the Southern Benguela Eco-region, the Southwester Cape Inshore Zone[149] and it shares its border with the Atlantic Ocean.[150]

156. This region is dominated by the cold Benguela Current Large Marine Ecosystem[151] ("BCLME"), in which high biological productivity is supported by the upwelling of cool, nutrient-rich waters.[152] The high productivity characterising the west coast region is driven primarily by high densities of phytoplankton and zooplankton.[153]

157. As a result of this nutrient-rich water, the BCLME contributes to one of the most productive large marine ecosystems in the world, which supports large commercial fisheries for many valuable fish and invertebrate species in South Africa, Namibia and Angola. It must be stated, however, that while the South African West Coast supports highly productive fisheries, these are focused offshore. Nearshore fish productivity remains high but diversity is low.

158. The Benguela Current (which includes the BCLME) flows in an upward trajectory from Cape Town, South Africa along the West Coast to Namibia and then to the bottom of Angola. The Benguela Current then joins the South Equatorial Current in a westerly direction away from Africa. The South Equatorial Current then flows

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[149] See Environmental Impact Assessment For the Proposed Nuclear Power Station (Nuclear 1) and Associated Infrastructure – Marin Ecology Impact Assessment February 2016 - https://projects.gibb.co.za/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=3474&language=en-US&PortalId=3&TabId=452 page 5

[150] Accessible at https://projects.gibb.co.za/Portals/3/projects/200707%20nuclear%201/Appendix%20A%20-%20Locality%20Maps.pdf

[151] The BCLME includes a large area of the West African Atlantic Coast and Ocean. The countries that are linked to it geographically is South Africa, Namibia, Angola, Democratic Republic of Congo, Congo, Gabon and Equatorial Guinea.

[152] See Environmental Impact Assessment For the Proposed Nuclear Power Station (Nuclear 1) and Associated Infrastructure – Marin Ecology Impact Assessment February 2016 - https://projects.gibb.co.za/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=3474&language=en-US&PortalId=3&TabId=452 page 5

[153] See Environmental Impact Assessment For the Proposed Nuclear Power Station (Nuclear 1) and Associated Infrastructure – Marin Ecology Impact Assessment February 2016 - https://projects.gibb.co.za/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=3474&language=en-US&PortalId=3&TabId=452 page 5

into the Brazilian Current near South America. The final stage of this loop is when the Brazilian Current, in an easterly direction, flows back into the Benguela Current towards South Africa.[154]

159. Due to the trajectory of the Benguela Current moving in northerly direction from South Africa any activity stemming from South Africa's west coast could potentially have an impact on the BCLME which includes other African countries.[155] For example, deep or shallow mining could pollute the Atlantic Ocean wherein the spill would move towards Namibia, Angola and potentially Gabon.

160. One such activity that is in the pipeline is the construction of the Nuclear Power Station at Duynefontyn.

**Failure to assess the potential adverse impacts of the construction and operation of a nuclear power station at Duynefontein on the coastal and marine environment of the Western Coast of Africa in general and the BCLME in particular**

161. In terms of the Final Environmental Impact Report ("FEIR") under the section specialist reports, the oceanographic specialist report ("Oceanographic Report") undertook the simulation of two potential tsunami events (distant tsunami and local tsunami). Accordingly, in the Oceanographic Report there was no mention of their being a potential impact in terms of the distant tsunami scenario.[156]

[154] Diagram accessible at https://upload.wikimedia.org/wikipedia/commons/thumb/d/d4/South_Atlantic_Gyre.png/379px-South_Atlantic_Gyre.png
[155] See footnote 3
[156] The distant tsunami scenario only took a single tsunami catastrophic event, namely the Sumatara / Thailand tsunami of 2004, into consideration. This appeal believes that this was insufficient for the competent authority to make a decision that was reasonable. ESKOM NUCLEAR SITES SITE SAFETY REPORTS NUMERICAL MODELLING OF COASTAL PROCESSES DUYNEFONTEIN Report No. 1010/4/101 SEPTEMBER 2009 https://projects.gibb.co.za/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=7383&language=en-US&PortalId=3&TabId=452 page 10 – 40

162. However, in terms of the local tsunami scenario a number of slump regions have been documented where historical slumping has occurred on massive scales in various phases. What is important to note about these slumps is that they can potentially cause a tsunami.[157] The Oceanographic Report stated that the Agulhas Slump was one of the largest identified world-wide with an estimated length of 750km, width of 106km and a volume of 20 000km$^{3.}$ The potential risk could be a *"devastating tsunami"*[158]which could have significant damage to the BCLME. It was also stated that due to the potential risk that might happen from a slump event and the fact that further studies were needed to be undertaken, the report, an inclusive opinion was emanated.

163. In terms of the FEIR under the section specialist reports, the Marine Ecology Impact Assessment Report (the "Marine Report") does take into consideration the potential adverse impact of the construction and operation of the nuclear power station. However, such consideration was looked at within a localised defined meaning. The Marine Report states that, "*The likelihood of a nuclear accident affecting the marine environment is very low, as such an incident would require a breach of the entire cooling system. However, should such an event take place, the impacts are likely to be reflected in mortality focused in the general area of the power station. Highly mobile species, such as fish, exposed to low to intermediate levels of radiation may, however, move great distances. This would pose a threat to the general public if*

[157] This possibility was inferred from past events that were recorded or determined due to historical data.
[158] . ESKOM NUCLEAR SITES SITE SAFETY REPORTS NUMERICAL MODELLING OF COASTAL PROCESSES DUYNEFONTEIN Report No. 1010/4/101 SEPTEMBER 2009 https://projects.gibb.co.za/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=7383&language=en-US&PortalId=3&TabId=452 page 21

*these fish were later caught and consumed."*[159] This Marine Report failed to take into consideration the movement of the Benguela Current and the impact it might have on the BCLME in other jurisdictions along the West Coast of Africa. If there were such an event to take place in the Atlantic Ocean the event would not be localised but rather move with the current in a northerly direction significantly impacting other countries eco-marine systems in the BCLME.[160]

164. In terms of the executive summary of the FEIR, it undertook to list a plethora of public health and safety risk events which could have the potential to cause significant harm.[161] In terms of this list any event and in particular a local tsunmai that could occur would have an adverse potential impact on the marine biodiversity along the West Coast of Africa or the BCLME.

[159] See Environmental Impact Assessment For the Proposed Nuclear Power Station (Nuclear 1) and Associated Infrastructure – Marin Ecology Impact Assessment February 2016 - https://projects.gibb.co.za/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=3474&language=en-US&PortalId=3&TabId=452 pages 27 and 44.

[160] See the impact Fukusima Nuclear Power Plant had on the pacific Ocean https://www.zerohedge.com/news/2016-10-02/fukushima-radiation-has-contaminated-entire-pacific-ocean-and-its-going-get-worse, https://www.triplepundit.com/2016/10/fukushima-radiation-now-covers-pacific-ocean/,

[161] Kindly that significant harm has been discussed in light of a nuclear power plant station. The following was stated in that regards at the Economic Commission for Europe Meeting of the Parties to the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters Compliance Committee Fifty-eighth meeting Budva, 10–13 September 2017 Item 8 of the provisional agenda Communications from members of the public. It states the following - In cases concerning ultra-hazardous activities, such as nuclear power plants, members of the public may be affected or likely to be affected by, or have an interest in, environmental decision-making within the scope of the Convention, even if the risk of an accident is very small. When determining who is concerned by the environmental decision making, the magnitude of the effects if an accident would indeed occur, whether the persons and their living environment within the possible range of the adverse effects could be harmed in case of an accident and the perceptions and worries of persons living within the possible range of the adverse effects should be considered.

**Public Health and Safety Risk**

| Potential Environmental Cost | Acute radioactive exposure | |
|---|---|---|
| Inherent risk | HIGH | |
| Causes of risk | Likelihood of causes | |
| | Thyspunt | Duynefontein |
| Loss of control of fission | Highly unlikely | Highly unlikely |
| Surface rupture | Highly unlikely | Highly unlikely |
| Subsurface instability | Highly unlikely | Highly unlikely |
| Volcanic activity | Highly unlikely | Highly unlikely |
| Unstable soil/geological unit | Highly unlikely | Highly unlikely |
| Flooding | Highly unlikely | Highly unlikely |
| Flood damage to access routes | Highly unlikely | Highly unlikely |
| Soil liquefaction damage to access routes | Highly unlikely | Highly unlikely |
| Mobile dunes damaging access routes and infrastructure | Unlikely but possible | Highly unlikely |
| Meteo-Tsunami | Unlikely but possible | Unlikely but possible |
| Corrosion due to groundwater | Likely | Likely |
| Material seismicity | Highly unlikely | Highly unlikely |
| Likelihood of consequence | Highly unlikely | Highly unlikely |
| Residual risk | Moderate | Moderate |

165. In light of the above, the Oceanographic Report and executive summary of the FIER together with the Marine Report details potential significant harm[162] however such detail did not take into consideration the potential harm to the BCLME or the biodiversity of West Coast of Africa.

**Failure to take into consideration international environmental law and a proper public participation process**

166. In terms of chapter six, planning and legislative context, of the FIER there is no reference or mention of the following international environmental laws that South Africa is bound by:

166.1. Benguela Current Convention, 2013 ("BCC");

[162] FIER executive report - https://projects.gibb.co.za/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=3055&language=en-US&PortalId=3&TabId=452 page 30

166.2. Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African region, 23 March 1981 ("Abidjan Convention"); and

166.3. Customary law - Potential transboundary harm and the importance of undertaking an Environmental Impact Assessment that takes such transboundary harm into consideration and that such affected state be notified and consulted in relation to any potential harm as identified (see Corfu Channel Case (United Kingdom v. Albania), 1949 I.C.J. 4, 247), the Nuclear Weapons Case (Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 241-242, 29, and 186) and Pulp Mills Case (Case Concerning Pulp Mills on the River Uruguay, Argentina v Uruguay, Judgment on the merits, ICGJ 425 (ICJ 2010), 20th April 2010, Corfu Channel Case (United Kingdom v. Albania), 1949 I.C.J. 4, 247), the Nuclear Weapons Case (Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 241-242, 29, and 186) and Pulp Mills Case (Case Concerning Pulp Mills on the River Uruguay, Argentina v Uruguay, Judgment on the merits, ICGJ 425 (ICJ 2010), 20th April 2010).

167. In terms of chapter seven, public participation, of the FIER, and taking into consideration the above there is no mention or reference in the report that it notified and consult with the following international bodies and/or countries:

167.1. The BC Commission and specifically the Governments of Namibia and Angola; and

167.2. The United Nations Environmental Programme in its capacity as the secretariat of the Abidjan Convention.

**International Environmental Law and its application when applying for an Environmental Authorisation in South Africa:**

**Application of International Environmental Law in South Africa**

168. The Constitution in terms of section 232, states that customary international law is law in the Republic unless it is inconsistent with the Constitution or an Act of Parliament.

169. The Constitution further states that in terms of section 233, Application of international law, when interpreting any legislation, every court must prefer any reasonable interpretation of the legislation that is consistent with international law over any alternative interpretation that is inconsistent with international law.[163]

170. In terms of the National Environmental Management Act (NEMA) an International Environmental Instrument is defined to be – *"any international agreement, declaration, resolution, convention or protocol which relates to the management of the environment."*

171. NEMA further states that, under section 2(1) and (4)(n),*"The principles set out in this section apply throughout the republic to the actions of all organs of state that may significantly affect the environment and – (n) Global and international responsibility relating to the environment must be discharged in the national interest."*

[163] See EarthLife Africa Johannesburg v Minister of Environmental Affairs and Others (2017) 2 All SA 519 (GP) states that, "*NEMA must also be interpreted consistently with international law. Section 233 of the Constitution provides that when interpreting any legislation, every court must prefer any reasonable interpretation of the legislation that is consistent with international law over any alternative interpretation that is inconsistent with international law."*

**International Transboundary Environmental Impact Assessment and South Africa's obligations**

*International Environmental Customary Law*

172. Customary international law requires a State:

172.1. to use all means at its disposal to prevent activities within its territory causing significant damage to the environment of another state;[164]

172.2. to conduct an environmental impact assessment ("EIA") where there is a risk that a proposed industrial activity may have a significant adverse impact in a transboundary context;[165] and

172.3. to notify and consult potentially affected States in relation to any potential significant adverse transboundary impacts, before authorizing construction.[166]

*International Conventions*

173. Furthermore, as a consequence of being a party to the Convention for Co-operation in the Protection and Development of the Marine and Coastal environment of the West and Central African Region and its protocol ("the Abidjan Convention") and

[164] See the judgements of the International Court of Justice in the *Corfu Channel Case (*United Kingdom v. Albania), 1949 I.C.J. 4, 247*),* the *Nuclear Weapons* Case (Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion, 1996 I.C.J. 241-242, 29, and 186) and *Pulp Mills Case* (Case Concerning Pulp Mills on the River Uruguay, Argentina v Uruguay, Judgment on the merits, ICGJ 425 (ICJ 2010), 20th April 2010 para 204)).

[165] Pulp Mills case, para 204. The Court observed that the practice of environmental impact assessment (EIA) 'has gained so much acceptance among States that it may now be considered a requirement under general international law to undertake an environmental impact assessment where there is a risk that the proposed industrial activity may have a significant adverse impact in a transboundary context, in particular, on a shared resource.'

[166] Certain Activities Carried out by Nicaragua in the Border Area (Costa Rica v. Nicaragua) and Construction of a Road in Costa Rica along the San Juan River (Nicaragua v. Costa Rica) (Joined Cases 16 December 2015) [2015] ICJ Rep ('*Costa Rica v Nicaragua/Nicaragua v Costa Rica'*).

the Benguela Current Convention ("BCC")[167] South Africa has assumed international law obligations:

173.1. to take all possible steps to prevent, abate and minimize pollution and take the necessary measures to protect the marine ecosystem against any adverse impacts[168];

173.2. to undertake an environmental impact assessment for any proposed activity that is likely to cause adverse impacts on the marine and coastal environment (including substantial pollution[169] of, or significant and harmful changes to, that environment);[170]

173.3. to be guided by the precautionary principle;[171] and

[167] Take note that only the following legislation was considered – National Environmental Management Act, 1998 (Act No. 107 of 1998) National Environmental, Management: Biodiversity Act, 2004 National Environmental Management: Integrated Coastal, Management Act, 2008 The Environment Conservation Act, 1989 (Act No. 73 of 1989), The Sea-Shore Act, 1935 The Development Facilitation Act, 1995 White Paper for Sustainable Coastal Development in South Africa (2000) White Paper for Environmental Management Policy (1997). There is no mention of Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region and Protocol (the Abidjan Convention") or the Benguela Current Convention (the Benguela Convention").

[168] Benguela Current Convention ("BCC"), Article 4(2)(a). The BCC defines "adverse impact" broadly. The definition includes actual or potential detrimental effects on the BCLME resulting from human conduct within an area under the jurisdiction of a party to the BCC.

[169] The Abidjan Convention states that:" "Pollution" means the introduction by man, directly or indirectly, of substances or energy into the marine environment, coastal zones, and related inland waters resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities, including fishing, impairment of quality for use of sea-water and reduction of amenities." Read with Economic Commission for Europe Meeting of the Parties to the Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters Compliance Committee Fifty-eighth meeting Budva, 10–13 September 2017 Item 8 of the provisional agenda https://www.unece.org/fileadmin/DAM/env/pp/compliance/CC-58/ece.mp.pp.c.1.2017.14.e.pdf para 75.

[170] BCC, Article 4(2)(b). See also Abidjan Convention article 13 which states: "ENVIRONMENTAL IMPACT ASSESSMENT As part of their environmental management policies, the Contracting Parties shall develop technical and other guidelines to assist the planning of their development projects in such a way as to minimize their harmful impact on the Convention area. Each Contracting Party shall endeavour to include an assessment of the potential environmental effects in any planning activity entailing projects within its territory, particularly in the coastal areas that may cause substantial pollution of, or significant and harmful changes to, the Convention area."

[171] BCC, Article 4(1)(c).

173.4. to take the best practicable means at its disposal and any other appropriate measures, in accordance with its capabilities, to prevent, reduce, combat and control marine and coastal pollution.[172]

174. If radioactive material is discharged from the proposed power plant into the sea or the atmosphere, it will pollute and cause other adverse impacts to the coastal and marine environment both within the territory of South Africa, the Abidjan Convention Area and the BCLME, which cannot be rectified by the payment of compensation.

**Grounds of Appeal**

175. Taking the above facts into consideration, there is enough evidence to show that there is a potential significant adverse impact that could emanate from the construction and operation of the nuclear power station on the BCLME in its entirety.[173] In light of this international foot print South Africa's international legal commitments had to be undertaken. These commitments were never undertaken and thus appealable. The grounds for appeal are as follows:

176. Although the environmental assessment practitioner ("EAP") undertook an Environmental Impact Assessment, the EAP:

176.1. failed adequately to assess the potential adverse impacts of the construction and operation of a nuclear power station at Duynefontein,

[172] Abidjan Convention, Article 4, which reads: *The Contracting Parties shall, individually or jointly as the case may be, take all appropriate measures in accordance with the provisions of this Convention and its protocols in force to which they are parties to prevent, reduce, combat and control pollution of the Convention area and to ensure sound environmental management of natural resources, using for this purpose the best practicable means at their disposal, and in accordance with their capabilities*. (our emphasis).

[173] Take note that this is due to the Beguela Current flowing in a Northerly direction on the West Coast.

(including any unplanned discharges of radioactive material into the coastal and marine environment) on the coastal and marine environment of the Western Coast of Africa[174] in general and the Benguela Current Large Marine Ecosystem in particular.

176.2. failed adequately to assess the potential adverse impact of a local tsunami impact which required (by their own report) further studies to be undertaken;

176.3. failed adequately to take into consideration the flow of the potential nuclear material, moving with the current on the Western African Coast and BLCME in other countries;

176.4. failed to specifically notify the Governments of Namibia and Angola, the Benguela Current Commission ("BC Commission") and the United Nations Environment Programme ("UNEP") in its capacity as the secretariat of the Abidjan Convention, of the proposed construction of a nuclear power plant at Duynefontein and of the potential adverse effects on the Convention Area and the BCLME; and

176.5. failed to give these interested and affected parties an opportunity to make representations during the EIA process.

177. The decision-maker:

177.1. failed to take into account relevant considerations, namely the potential adverse impacts of the construction and operation of the proposed nuclear

[174] The Abidjan Convention

power plants on other parties to the Abidjan Convention and the Benguela Current Convention ("BCC");

177.2. failed to take into account the fact that if the proposed nuclear power plant discharges radioactive material into the sea or the atmosphere, it will pollute and cause other adverse impacts to the coastal and marine environment within the territory of South Africa, the Abidjan Convention Area and the BCLME, which cannot be rectified by the payment of compensation; and

177.3. failed to take into consideration and to comply with South Africa's obligations under international law in that it granted the environmental authorization without first notifying and consulting potentially affected States, the BC Commission and UNEP about the potential adverse impacts of the construction and operation of a nuclear power station at Duynefontein (both transboundary impacts and impacts on shared ecosystems).

### *E.10 Failure to include all listed activities in a single application*[175]

178. It is a mandatory legal requirement that an applicant must make a single application on a single application form for an environmental authorisation for all the listed activities which will be undertaken as part of a project. Eskom has failed to comply with this requirement. Instead of including every listed activity triggered by the proposed project, the applicant has made separate applications for each of the following aspects of the project:[176]

[175] Acknowledgement: This section of the appeal was drafted by Cullinan & Associates.
[176] FEIAR, page 3-2 to 3-3.

178.1. *"*3 X 400kV/ 765 kV Transmission lines: There are three separate EIA applications for the transmission lines that will convey power into the national grid from each of the three proposed NPS sites (refer to www.eskom.co.za). The details of the routes for these lines are, therefore, not discussed in this report. It should be noted that the environmental impacts associated with new transmission power lines (400 kV and 765 kV) conveying power from the HV yard off the Eskom property are not assessed in this EIA and are therefore subject to separate applications for environmental authorisation."

178.2. *"*Various alternative off-site public roads are under consideration for upgrade as well as new roads to act as access routes at all the different sites. The environmental impacts associated with the proposed upgrades of roads off the sites do not form part of this EIA and will therefore require separate applications for environmental authorisation. The off-site public roads under consideration are discussed in Section 3.14."

178.3. *"*The EIA for the dry storage of Koeberg spent fuel - The Transient Interim Storage Facility (TISF) has commenced and the facility is proposed to comprise of a concrete pad covering an area of approximately 12 800m2 onto which up to 160 dry storage casks can be placed. The project is in the Scoping Phase."

178.4. *"*Upgrades to harbours near the sites to handle abnormal loads for the power stations (if necessary) will not form part of this EIA and will therefore require separate applications for environmental authorisation."

179. The infrastructure listed above would not serve any purpose without the proposed nuclear power station, and conversely, the construction of the nuclear power station would be pointless without the listed infrastructure in place. Accordingly, the listed infrastructure forms an integral part of the nuclear-1 project and the listed activities that they trigger had to be assessed and evaluated as part of this EIA. As can be seen in the drawings and plans forming part of Part 4.A2 of the Final EIA Report, the EIA corridor excludes any linear activities, and the transmission lines (which are significantly greater in size and capacity than the existing transmission lines) simply stop just outside of the EIA corridor, unconnected to the grid.

180. The same argument extends to the listed activities and environmental impacts that arise as a consequence of the development, like off-site accommodation for the people employed to construct and operate the nuclear power station. The law requires the decision to consider the environmental impacts of the construction and functioning of new areas of housing necessitated by the nuclear power station project. This includes a consideration of the social impacts and the diversion of municipal funds to effect the necessary infrastructure upgrades.

181. The appellants submit that the Final EIA Report fails to comply with regulations 15(1) of the 2006 EIA Regulations, and as a consequence all relevant considerations were not before the decision maker. In the circumstances, the decision-maker ought to have refused the application.

### *E.11 Inconsistent exclusion criteria*[177]

182. The EAP excluded Bantamsklip from selection as the preferred site on the basis that detailed studies of the transmission lines were not before the decision-maker. Although studies of the transmission lines to Duynefontein have ostensibly been conducted in a separate process, these studies are not included or assessed in the FEIAR and was accordingly not subject to public participation, and not before the decision-maker who must make the decision based on the information before it.

183. The appellants submit that Duynefontein should have been excluded from contention for the preferred site on the same basis as Bantamsklip.

[177] Acknowledgement: This section of the appeal was drafted by Cullinan & Associates.

## F. CONCLUSION

**Review grounds under the Promotion of Administrative Justice Act**

165. The Constitution entrenches the right to lawful, reasonable and procedurally fair administrative action, including any administrative action taken by any organ of state, which would include determining the various authorisations required for developing infrastructure for Nuclear 1, and the Promotion of Administrative Justice Act ("**PAJA**") gives effect to this right.

166. Under section 6 of the Promotion of Administrative Justice Act a decision can be reviewed if:

> "(a) The administrator who took it-
>
> (i) was not authorised to do so by the empowering provision;
>
> (ii) acted under a delegation of power which was not authorised by the empowering provision; or
>
> (iii) was biased or reasonably suspected of bias;
>
> (b) a mandatory and material procedure or condition prescribed by an empowering provision was not complied with;
>
> (c) the action was procedurally unfair;
>
> (d) the action was materially influenced by an error of law;
>
> (e) the action was taken-
>
> (i) for a reason not authorised by the empowering provision;
>
> (ii) for an ulterior purpose or motive;
>
> (iii) because irrelevant considerations were taken into account or relevant considerations were not considered;

(iv) because of the unauthorised or unwarranted dictates of another person or body;

(v) in bad faith; or

(vi) arbitrarily or capriciously;

(f) the action itself-

(i) contravenes a law or is not authorised by the empowering provision; or

(ii) is not rationally connected to-

(aa) the purpose for which it was taken;

(bb) the purpose of the empowering provision;

(cc) the information before the administrator; or

(dd) the reasons given for it by the administrator;

(g) the action concerned consists of a failure to take a decision;

(h) the exercise of the power or the performance of the function authorised by the empowering provision, in pursuance of which the administrative action was purportedly taken, is so unreasonable that no reasonable person could have so exercised the power or performed the function; or

(i) the action is otherwise unconstitutional or unlawful."

167. Decisions based on materially incorrect and/or irrelevant considerations stand to be set aside on review. So too are decisions based on the failure to take into account relevant information, where a decision-maker acts under delegation or where a decision-maker is materially influenced by an error of law. This is also the case

where a decision is not rationally connected to the information before the decision-maker.

168. The Final EIA Report does not place all relevant information that could materially influence the decision maker before it, and therefore the decision to authorise the construction of a nuclear power station based on this report would be open to legal challenge on the review grounds in PAJA.

169. The Final EIA Report recommends the authorisation of the nuclear plant, basing its recommendations on outdated and incomplete and erroneous information, as well as assumptions that are not justified, or justifiable. Reliance on such information will not allow the decision-maker to perform the required balancing exercise, namely the balancing of the socio-economic consequences of the development against the negative environmental consequences and potential consequences and the absence of all the information required precludes the decision-maker from taking an integrated decision as required.

170. The appeal should be upheld. [178]

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Adrian Pole
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**Date:** 5 March 2018

[178] *Seafront For All, at paragraph 75*

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Greenpeace Africa submission on Nuclear-1 Revised Draft EIA Report – August 2011

# 1. Introduction

South Africa is the largest $CO_2$ emitter on the African continent, and the 12th largest emitter in the world. As such, South Africa has a moral responsibility to act swiftly and decisively on climate change. Electricity is the sector which has the best established technological opportunities to reduce emissions while providing employment and development opportunities for the country. South Africa is extremely well endowed with renewable resources, with the potential for 50% of South Africa's electricity to come from renewable energy by 2030, creating an additional 150,000 new jobs at the same time[1,2].

However, the South African government has announced a large expansion of nuclear power in South Africa. The government's choice for expansion of nuclear power in South Africa is both disappointing and risky, especially in the wake of the Fukushima nuclear disaster in Japan in March 2011, which has caused many countries to reconsider or cancel their nuclear programme. The German government has decided to phase out nuclear energy, and a recent referendum in Italy saw 95% of Italians vote against the use of nuclear. Major questions regarding nuclear safety have been raised and will need to be evaluated.

If South Africa is concerned about energy security then nuclear should be the last option. A nuclear plant takes more than a decade to build, is dependent on a non-renewable resource, creates dangerous radioactive waste, and is extremely costly. In contrast, renewable energy capacity can be built much faster, and without the safety, environmental and financial risks associated with nuclear power. South Africa should learn from past mistakes in its costly nuclear history.[3] Indeed nuclear power delivers too little, too late, and at too high a price for the environment and the people of South Africa.

The Integrated Resource Plan 2010 (IRP2010) is a plan that will determine what South Africa's electricity sector will consist of for the next 20 years, including the effort that the

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[1] Greenpeace Africa. *Advanced Energy [R]evolution. A Sustainable Energy Outlook for South Africa.* May 2011.
http://energyblueprint.info/fileadmin/media/documents/national/2011/E_R__South_Africa_May_2011-LR.pdf

[2] Rutovitz, J. 2010. *South African energy sector jobs to 2030.* Prepared for Greenpeace Africa by the Institute for Sustainable Futures, University of Technology, Sydney. In press.

[3] *The True Cost of Nuclear Power in South Africa*, D. Fig, S. Thomas et al, Greenpeace Africa, August 2011.
http://www.greenpeace.org/africa/Global/africa/publications/The%20true%20cost%20of%20Nuclear%20Power%20in%20SA-Screen.pdf

country will put into energy efficiency and the level that South Africa will depend on coal, nuclear and renewable energy sources. The choices that are made now in the electricity sector will determine what South Africa's energy future will look like and will therefore affect our standard of living, levels of job creation, our environment and our economic future as a nation.

The South African government should reconsider its support for nuclear and focus on clean and sustainable energy sources. Greenpeace Africa believes that the energy mix of the country should be focussed on implementing renewable energy on a large-scale, rather than nuclear energy.

## 2. Key points Greenpeace submission

Greenpeace Africa dismisses this EIA and calls for a negative Record of Decision for the following reasons:

- The DEIR does not consider worst case scenario, nor potential radiological environmental impacts.
- The independence of the National Nuclear Regulator, who is ostensibly responsible for any nuclear safety, radiation or radiological issues, is questioned.
- The specialist studies on Human Health Risks and Emergency Response must be recommissioned, as it is based on unscientific statements.
- The SAHRA has recommended that Thyspunt is not a suitable site for development, but this has been proposed as the preferred site.
- The DEIR has not adequately assessed the project alternatives and the no-go option.
- The DEIR has a gaping hole in terms of alternatives for nuclear energy for electricity production.
- A comprehensive assessment of potentially significant impacts cannot be made in the absence of the exact specifications of the intended project (i.e. reactor design choice).
- It is clear that without the choice of design no proper health risk impact assessment can be made.

- The DEIR fails to assess the impacts of a worst case scenario such as a nuclear accident.

| | |
|---|---|
| EIA | Environmental Impact Assessment |
| NEMA | National Environmental Management Act |
| NNR | National Nuclear Regulator |
| NNRA | National Nuclear Regulator Act |
| DEIR | Draft Environmental Impact Assessment Report |

# 3. EIA process

## *3.1 Legal context*

- Promotion of Administrative Justice Act 3 of 2000:

S 6(2): "A court or tribunal has the power to judicially review an administrative action if ...

(b) a mandatory and material procedure or condition prescribed by an empowering provision was not complied with; ...

(e) the action was taken –

(iii) because irrelevant considerations were taken into account and relevant ones were not considered

- The Constitution of the Republic of South Africa Act 108 of 1996:

S 24: Everyone has the right –

(a) to an environment that is not harmful to their health of well-being; and

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –

(i) prevent pollution and ecological degradation;

(ii) promote conservation; and

(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

S 195(1): Public administration must be governed by the democratic values and principles enshrined in the Constitution, including the following principles:

Efficient, economic and effective use of resources must be promoted.

- National Environmental Management Act (NEMA) and the Environmental Impact Assessment (EIA) Regulations:

Relevant provisions of these statutes will be referenced where applicable in the submission.

## *3.2 Exclusion of radiological impacts from EIA process*

(from Chapter 1)

"The National Nuclear Regulator Act, 1999 (Act No. 47 of 1999) (NNRA) provides for the protection of persons, property and the environment against nuclear damage and mandates the NNR to exercise regulatory control related to safety. (...) However, in terms of the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) ("the Constitution") and the NEMA, the DEA has a responsibility for decision-making regarding the potential impacts of the power station on the environment, even though these impacts are likely to include those relating to certain aspects of the radiological hazards associated with the facility.

In recognition of the dual but distinct responsibility with respect to the assessment of radiation issues, a co-operative agreement (Appendix B4) concluded between the DEA and the NNR was gazetted on 18 July 2008. One of the main purposes of this agreement is to "prevent unnecessary and unavoidable duplication of effort" between the NNR and DEA. The NNR authorisation process applies specifically to issues of nuclear and radiation safety related to the siting, design, construction, operation and decommissioning of nuclear installations.

Furthermore, the Director General of the DEA issued a statement in January 2009 (Appendix B4) to further clarify the purpose of the agreement. The statement indicates that nuclear safety, radiation and radiology "are better placed within the regulatory process of the NNRA and that consideration of the same issues in an EIA process will result in unnecessary and avoidable duplication."

Thus, whilst "Site Safety Reports" prepared as part of the authorisation process for nuclear licensing have been included as appendices in this draft EIA Report (Appendices E24, E26 and E27), radiological issues will not be assessed in detail[7] in the Draft EIR and the DEA will not consider radiological impacts in decision-making.

> *Footnote [7] The Emergency Response (Appendix E26) and Site Access Control Report (Appendix E27) and Human Health Risk Assessment (Appendix E24), which have been prepared on a high level,, are appended to this EIR for information only. Further details on these reports will be prepared as part of the NNR nuclear licensing process , as their findings will be evaluated by the NNR."*

EIA Regulation 31(2)(l) states that an environmental assessment report must include "an assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of an impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can be mitigated."[4] "Significant impact" is defined in the Regulations as "an

[4] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2(l).

impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment."[5]

By failing to assess radiological impacts in detail and removing radiological impacts from the DEA (Department of Environmental Affairs) decision-making, the Revised DEIR fails to comply with EIA regulations. The Revised DEIR does not consider a worst-case scenario, nor potential radiological environmental impacts under normal operation or in case of incidents.

The Fukushima nuclear accident in March 2011 and its aftermath prove that the impact of a worst case scenario should be classified as "significant impact" under the EIA Regulations. The Fukushima accident has been classified as a 'level 7' major accident on the IAEA International Nuclear and Radiological Event Scale (INES).[6] Level 7 is the most serious level on INES and is used to describe an event comprised of "A major release of radioactive material with widespread health and environmental effects requiring implementation of planned and extended countermeasures". Omission of a worst case scenario from the Revised DEIR is a serious flaw and breach of EIA regulations.

Also smaller nuclear incidents can result in a "significant impact", as can be concluded from the incident in the ASCO nuclear power plant in Spain in 2007.[7] Even routine operation results in a "significant impact", for example through the production of long-lived highly radioactive waste, which by its 'duration' and 'intensity' may 'have a notable effect on one or more aspects of the environment', and hence its radiological impacts to the environment should have been included in the Revised DEIR. See section 7.1 for potential environmental impacts of radioactive waste.

The European Commission explicitly requires the effects of 'which could result from accidents, abnormal vents or exposure of the Project to natural or man-made disasters' to be described and quantified.[8] By placing nuclear safety, radiation and radiology solely

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[5] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 1.
[6] IAEA Fukushima Nuclear Accident Update (12 April 2011, 04:45 UTC);
http://www.iaea.org/newscenter/news/2011/fukushima120411.html
[7] After initial downplaying of the incident, it has been reclassified as an 'INES 2' incident on the IAEA International Nuclear and Radiological Event Scale, as a significant amount of radioactivity was released into the environment as hot particles. The ASCO incident is described in a letter from Greenpeace Spain to Mr. Andris Pielbags, EU Energy Commissioner. 22 April 2008.
www.**greenpeace**.org/raw/content/.../**letter**-from-**greenpeace**-spain-t.pdf
[8] Guidance on EIA; EIS Review. Environmental Resources Management. June 2001.
http://ec.europa.eu/environment/eia/eia-guidelines/g-review-full-text.pdf

under NNR licensing, the possibilities for public consultation on these issues are significantly reduced.

In addition, one can question the independence of the National Nuclear Regulator, as it is responsible to the Minister of the Department of Energy (formerly Department of Minerals and Energy). The Minister of Energy and the Department of Energy have a clear interest in promoting the use of nuclear power, and expanding South Africa's nuclear industry. During the Minister's budget speech in May 2011, she expressed a strong commitment to incorporating nuclear energy in South Africa's energy mix,[9] and a few days later even trumpeted the development of a nuclear export market for the rest of Africa.[10] This is in breach of Article 8 of the Convention on Nuclear Safety, of which South Africa is a signatory:

> Convention on Nuclear Safety, ARTICLE 8. REGULATORY BODY
>
> Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.
>
> Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.

## *3.3 Specialists reports*

The specialist studies on the Human Health Risk Assessment, Site Control and Emergency Response have been included in the Revised DEIR 'for information only'. These studies will influence the DEA decision-making, even though DEA will officially not consider radiological impacts.

Including the specialist studies gives the impression that Human Health Risks, Site Control and Emergency Response have been properly studied. However, in particular the Human Health Risk Assessment and the Emergency Response reports are of extremely poor quality. The reports are based on general assumptions regarding reactor specifications and possible impacts, and no actual risk assessment has been done (as this is impossible without the choice of design being known).

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[9] *Nuclear still part of energy mix: Peters*, Fin24, 26 May 2011. http://www.fin24.com/Economy/Nuclear-still-part-of-energy-mix-Peters-20110526

[10] *Africa must supply its own nuclear fuel – Peters*, BusinessLIVE, 30 May 2011. http://www.businesslive.co.za/incoming/2011/05/30/africa-must-supply-its-own-nuclear-fuel---peters

The Human Health Risk Assessment report only considers Category A and B events, explicitly excluding so-called 'Beyond Design Basis Accidents' (Category C), which are supposed to be considered in the Emergency Response report.[11] However, the Emergency Response report explicitly excludes "A comprehensive safety analysis of sources of potential exposure to evaluate radiation doses that could be received by the public as well as potential effects on the environment"[12].

The Human Health Risk Assessment report assumes that the probability of occurrence of Category B events (Design Basis Accidents) is very small, but does not argue why this is the case. Such a statement is unfounded; the frequency of DBA events cannot be assessed as long as the reactor design is unknown. Still, despite these unknowns, the specialist already knows that 'it will be demonstrated in the submission to the NNR that the dose to the critical group during such event would be within the dose limit of 50 mSv and ALARA'[13], and therefore the potential impact is assessed as of low significance. Greenpeace believes it is unacceptable to include such unscientific, seemingly clairvoyant statements in specialist reports, and recommends that the specialist studies on Human Health Risk and Emergency Response be re-commissioned.

[11] Human Health Risk Impact Report, October 2010. Pg 11.
[12] Emergency Response Impact Report, March 2011. Pg 4.
[13] Human Health Risk Impact Report, October 2010. Pg 23.

## *3.4 The Weighting/Ranking of Impacts*

In assessing the impacts of the Nuclear Power Station, Arcus GIBB used a subjective process to rank the impact categories (both environmental and technical). This involved a 'specialists' workshop that through a process of elimination determined which impact categories have more relative importance than others. Using this method, Arcus Gibb stated that key "decision factors" were then used in site selection. There is clearly a flaw in this method as the preferred site, Thyspunt has exceptional archaeological, paleontological, and wilderness value[14] and thus should not be developed. Indeed, the Heritage Impact Assessment concluded that Thyspunt has exceptional archaeological, paleontological, and wilderness value and presents excessive difficulties for mitigation[15]. The South African Heritage Resource Agency has unequivocally recommended that Thyspunt is not a suitable site for development.[16]

The Heritage Assessment repeatedly emphasizes the impossibility of constructing Nuclear-1 without extensive, irreversible impacts on heritage sites at Thyspunt.[17] Yet the EIA largely ignores this, recommending that Thyspunt be the preferred site. Despite the Heritage Assessment's unambiguous warnings that mitigation at Thyspunt is highly infeasible,[18] the Revised DEIR has included a "Heritage Mitigation Study" proposing a trial excavation in the Thyspunt site. The Heritage Assessment states that the archaeological preference is to preserve conservation *in-situ*, yet the EIA suggests a parallel system of construction of the nuclear station and excavation instead.[19]

As the projects stands currently, it may not go forward before Eskom has carried out its own proposed trial excavation to explore unknown aspects of the Thyspunt site to determine if there is an area where the development footprint will result in fewer impacts. However, the suitability of Thyspunt as a site for Nuclear-1 will not change whether something is found in the trial excavation or not because the value of Thyspunt lies in both its cultural heritage and high biodiversity – even if the NPS is built in an area of relatively fewer archaeological sites, it will still destroy the landscape and wilderness qualities of the area.[20] Thus, any approval of the project will be an unlawful

[14] Revised DEIR, APP E20, Heritage Impact Assessment 4.3
[15] Revised DEIR, APP E20, Heritage Impact Assessment 4.3; 5.1.3; 5.2.2 (c)
[16] Revised DEIR, APP E20, Heritage Mitigation Study, Introduction 1
[17] Revised DEIR, APP E20, Heritage Impact Assessment 3.1.1; 3.2.9; 3.2.10; 5.1.3
[18] Revised DEIR, APP E20, Heritage Impact Assessment 4.3; 5.1.3; 5.2.2 (c)
[19] Revised DEIR, APP E20, Heritage Impact Assessment 5.1.2; Heritage Mitigation Study 1.1.1
[20] *See* Revised DEIR, APP 20, Heritage Impact Assessment 3.2.9, 3.2.10.

administrative decision in violation of the National Heritage Resources Act s 5, NEMA s 2(4)(a)(iii).

# 4. Lack of appropriate alternatives

A requirement in the Environmental Impact Assessment Regulations (2010)[21] stipulates that a description of any identified alternatives to the proposed activity must be included in the EIA.[22] This includes the advantages and disadvantages that the proposed activity or alternatives will have on the environment and on the community that may be affected by the activity. "Alternatives" as defined in the Regulations are a "different means of meeting the general purpose and requirements of the activity, which may include alternatives to ... the type of activity to be undertaken ... and the option of not implementing the activity."[23] NEMA section 24 also requires every application for an environmental authorisation to include an investigation of alternatives to the activity, including the option of not implementing the activity.[24]

The regulations further define 'alternatives' in relation to a proposed activity to include:

- The property on which or location where it is proposed to undertake the activity;
- The type of activity to be undertaken;
- The design or layout of the activity;
- The technology to be used in the activity;
- The operational aspects of the activity; and
- The option of not implementing the activity.

**The Revised DEIR has not adequately assessed project alternatives and the no-go option.** The DEIR simply lists some energy sources in a table,[25] without any

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[21] National Environmental Management Act, 1998 (Act No. 107 Of 1998), Environmental Impact Assessment Regulations 2010
[22] S31 (2)g
23 EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 1, s 1, subsec 1.
24 NEMA s 24(4)(b)(i).
25 Revised DEIR, Chapter 5, Project Alternatives, 5.3.1 Nuclear Generation Alternatives.

analysis of their impacts or the significance of those impacts, and cites the lack of baseload capacity as justification for not evaluating other energy sources.

Marignac (2010)[26] on a visit to South Africa stated that "*baseload centralised generation, be it coal or nuclear, belongs in the past. Combined renewables, like solar, wind and biomass, together with active demand-side management, and the flexibility provided by communications technologies, are already demonstrating their ability to provide broad, safe and reliable electricity. When taking all indirect, long term and environmental costs into account, they are the most cost-effective options. And their economies are continually improving, in contrast to the escalating costs and negative learning curves of most nuclear programmes. Moreover, they are far less risky than nuclear energy, with its inherent and unsolved problems of safety, proliferation and long-lived radioactive waste.*[27]

The Revised DEIR has a gaping hole in terms of alternatives to nuclear energy for electricity, and should include a true comparison of the various alternatives to produce electricity. There are numerous reports and research documents that illustrate this point. The Greenpeace Africa Advanced Energy [R]evolution[28] is a detailed and practical blueprint for cutting carbon emissions, replacing fossil fuels and nuclear power with renewable energy, and growing the economy. It is one of the most comprehensive plans to resolve the country's need for energy security and a sustainable energy future, ever. The Greenpeace Africa report shows that renewable energy is mature, ready for implementation, and can be deployed on a large scale.

The combination of using renewable energy and promoting energy efficiency programmes to reduce electricity usage are not investigated in the DEIR. Energy efficiency offers some of the simplest, easiest and most cost effective measures for reducing both greenhouse gas emissions and costs to end-users.

The DEIR gives a set of cost data from EPRI (Economic Policy Research Institute) but fails to calculate the production cost or to mention that EPRI report finds that wind on good sites is more affordable than nuclear. Furthermore, the DEIR compares wind to nuclear. This is a false analogy as the RE power plant cost data is out-dated and ignores the fact that to compare with nuclear plant that would go online in 2022, a

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[26] Yves Marignac is director of WISE-Paris, a France based independent consultancy office on energy policy

[27] Yves Marignac, 2010. *SA could lead energy revolution*, Business Day, 13 December 2010. http://www.businessday.co.za/articles/Content.aspx?id=129313

[28] http://www.greenpeace.org/africa/en/News/news/The-Advanced-Energy-Revolution-Report/

comparison would have to be made with wind turbines or PV panels that are ordered in 2020 or 2021, or CSP plant ordered in 2019.

With regard to the no-go option, the DEIR simply states that the no-go alternative is not a feasible or realistic alternative,[29] despite the fact that the government included a no-nuclear scenario in the IRP2 that is cost-effective and provides security of supply.[30] This assertion begs the question of how informed the Environmental Assessment Practitioners were on the project. The DEIR does not examine or support a no-go option even though there was clearly a lack of investigation into alternatives and a lack of understanding of the true impacts of the whole project without an appropriate design for the Nuclear power station.

These assertions about project alternatives and the no-go option thus violate substantive requirements to assess them under NEMA and the EIA Regulations and are also inaccurate. The finalised Integrated Resource Plan (IRP2) included no-nuclear scenarios that are cost-effective and provide security of supply.[31] Thus, the IRP2 shows that baseload is not an issue in pursuing a nuclear-free energy plan. In addition, the IRP2 stated that after taking into account the fact that new energy technology costs would decrease over time and that nuclear would be 40% more expensive that originally projected, the cost-optimal output from the model did not include nuclear at all.[32] Thus, not only is a no-nuclear scenario feasible and secure, it is actually the most cost-effective option.

The applicant has not only failed to properly assess project alternatives and a no-go option, but has inaccurately concluded that alternatives and a no-go option are simply not viable. Any decision taken on the basis of such information will be unlawful. Greenpeace Africa thus believes that on the basis of alternatives a positive Record of Decision should not be provided.

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29 Revised DEIR, Chapter 9, Impact Analysis, 9.33.12.
30 Integrated Resource Plan for Electricty 2010–2030, GNR 400 GG 34263 of 6 May 2011, at 38–45
31 Integrated Resource Plan for Electricity 2010–2030, GNR 400 GG 34263 of 6 May 2011, at p. 18, 6.9.1, 6.9.4 ("If new renewable generation capacities should fail to reach their forecast performance in terms of full-load hours, this will increase total costs. It will, however, not affect other dimensions like security of supply, since solar PV is completely backed up with conventional, dispatchable generation and wind power is backed up to a large extent."); *id.* at p. 39, B.30.
32 *See* Integrated Resource Plan for Electricity 2010–2030, GNR 400 GG 34263 of 6 May 2011, at 38–39, paras. B.23, B.25, B.27, B.30.

# 5. Lack of design choice

## *5.1 Envelope*

> (from Executive Summary):
>
> Detailed descriptions of the proposed nuclear plant are not available, as a preferred supplier has not been selected.
>
> The approach used in this EIA process has been to specify enveloping environmental and other relevant requirements, to which the power station design and placement on site must comply. The enveloping criteria have been developed to ensure that they represent the most conservative parameters associated with the various plant alternatives within the PWR technologies.
>
> (from Chapter 3):
>
> It must be emphasized that Eskom has not decided on a preferred supplier for Nuclear-1 and that any suppliers and plant types named in this report are meant only for reference purposes to provide an indication of a typical power station conforming to Eskom's requirements. Thus, detailed descriptions of the proposed plant are not available. The approach in this EIA process has therefore been to assess a generic nuclear power station design for the EIA process to specify enveloping environmental and other relevant requirements to which the power station design and placement on site must comply.
>
> (from Chapter 9):
>
> At the time of compiling the EIR, Eskom and the South African Government had not yet decided on a vendor for the supply of nuclear power station equipment. Thus, an "envelope" of data was used. This envelope includes the highest possible values for various aspects for a range of different nuclear technology vendors. It is assumed that the design specifications of the proposed plant by the approved vendor will conform to the "envelope". If any of chosen vendor's power station characteristics fall outside of the specified envelope, it may have to be re-assessed from an environmental point of view (depending on the degree of variance).

According to EIA Regulation 31(2)(l), an environmental assessment report must include "an assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of an impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can be mitigated."

A comprehensive assessment of potentially significant impacts can however not be made in the absence of the exact specifications of the intended project. The Revised DEIR is based on a so-called 'envelope' of data, which is **assumed to** cover the chosen nuclear power station, once known. Despite this unconventional approach, the Revised DEIR fails to argue why this assumption would be valid. It is impossible to make general

assumptions about something as complex as a nuclear reactor design. According to international practice, a reactor design needs to be identified prior to a decision on the EIA. An EIA needs to be based on one or more specific reactor designs with specific parameters. For example, European regulations require the project developer to provide at least 'a description of the project comprising information on the site, design and size of the project'.[33]

Even within the category of Generation III reactors (the preferred option) the reactor designs differ significantly, with different power capacities, safety systems, fuel characteristics, cooling parameters, etc.[34] These differences, once evaluated, can result in a wide range of possible environmental impacts, which will not be covered by a generic assessment based on an 'envelope' of parameters (see paragraphs 5.2 – 5.6, 6.2, 6.3, 7.1 and 9).

## *5.2 Generation III*

Eskom favours a nuclear power station of 'standard Generation III design'. The Revised DEIR bases proposed emergency measures as well as mitigation measures on this standard reactor design with an 'envelope' of 'the most conservative parameters associated with the various plant alternatives'.

However, there is no such thing as a 'standard Generation III design'.[35] Some designs rely on active safety systems, while others incorporate passive safety systems. Each design has a different power output, varying between 1000 – 1700 MW. Fuel burnup in different designs varies from 50 – 70 MWd/kg. Reactor core dimensions differ, which will influence potential accident scenarios. New materials are being used, that have not been sufficiently evaluated under the extreme conditions in a nuclear reactor. New safety features are sometimes incorporated, but their performance cannot be accurately simulated.[36]

Most of the Generation III designs only exist on paper, and no construction or operational experience is available. Generation III plants that are currently under

[33] Article 5.2. Council Directive of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment, 85/337/EEC. Reference: Official Journal NO. L 175 , 05/07/1985 P. 0040 – 0048. http://ec.europa.eu/environment/eia/full-legal-text/85337.htm

[34] See e.g. *New Reactor Designs*, US Energy Information Administration, 2006 www.usnuclearenergy.org/pdf_library/new_**reactor_designs**.pdf

[35] *Best Estimate Tools and Challenges of the New Reactor Designs,* Tomislav Bajs, April 2011. www.pnra.org/...5/Bajs_BE%20Tools%20for%20New**ReactorDesigns**.pdf

[36] *Review of Generation III Reactors,* Dr. Helmut Hirsch, April 2009. www.calla.cz/data/energetika/seminare/jrr/hirsch.pdf

construction have been plagued with regulatory issues raised in design approval processes,[37] construction problems, construction delays and cost overruns.[38] Therefore it is essential that any evaluation of potential impacts of these new designs is based on exact specifications identifying all relevant parameters, rather than a generic description.

### *5.3 Fuel*

The Revised DEIR fails to provide essential specifications of the reactor fuel to be incorporated in the reactor core. Even though an enrichment factor of 4.95% is given, no limitations regarding the fuel burn-up are provided. It is also not specified how long fuel elements will stay in the reactor. The source term and temperatures of the fuel at the time of removal from the reactor is unknown due to lack of design choice. The exact volume of the fuel elements is not included in the envelope. The Revised DEIR also does not specify whether so-called Mixed Oxide fuel (uranium oxide mixed with plutonium oxide) will be used in the reactor, while this would have significant implications for potential radiological releases and impacts, as well as for the long term storage of the waste.[39]

All the fuel parameters are essential in assessing the potential environmental impacts of this project. In case of a nuclear incident or accident, the fuel parameters determine the source term and hence the risks of releases of e.g. volatile fractions, temperatures at which certain elements can be released, melting temperature of the fuel, etc. To evaluate potential impacts of long term storage of spent nuclear fuel, the fuel parameters are essential in assessing fractions that can most easily escape (Early Release Fraction),[40] see chapter 7.1.

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[37] *Westinghouse pauses at end of UK reactor generic design approval process,* NEI Magazine, 15 July 2011. http://www.neimagazine.com/story.asp?sectioncode=132&storyCode=2060158
http://www.hse.gov.uk/newreactors/2011-gda-issues-ap1000.htm
http://www.hse.gov.uk/newreactors/2011-gda-issues-epr.htm

[38] *EDF Delays New Reactor at Flamanville to 2016 after Fukushima Stress Tests,* Tara Patel, Bloomberg, 20 July 2011. http://www.bloomberg.com/news/2011-07-20/edf-delays-flamanville-to-2016-on-fukushima-deadly-accidents.html ; *New Problems in Olkiluoto*, Jehki Härkönen, Greenpeace Finland, 21 July 2011. http://www.greenpeace.org/international/en/publications/New-Problems-in-Olkiluoto/

[39] *Public Health Risks of Substituting Mixed-Oxide For Uranium Fuel in Pressurized-Water Reactors,* E.S. Lyman, Science & Global Security, 2000, Volume 9, pp.1–47. www.nci.org/PDF/lyman-**mox**-sgs.pdf

[40] *The Hazards of Generation III Reactor Fuel Wastes*, M. Resnikoff, J. Travers, E. Alexandrova, May 2010. http://www.greenpeace.org/canada/en/campaigns/end-the-nuclear-threat/Resources/Reports/The-Hazards-of-Generation-III-Reactor-Fuel-Wastes/ ; and
http://www.greenpeace.org/international/en/press/releases/new-nuclear-reactor-s-waste-is/

## *5.3 Radiological impacts on health and environment*

Even though a specialist study is included in the Revised DEIR, looking at the Human Health Risk Impacts, this study is very superficial and does not make a quantitative risk assessment, because the reactor technology has not been selected. No source term can be determined, as 'radionuclides and discharge quantities may differ between various technologies'[41] and hence different reactor technologies come with different source terms. A quantitative health risk impact assessment will therefore only be done once Eskom submits its license application to the NNR.

The Human Health Risk Impact report looks at one possible source term 'encompassing all reactor designs and technologies under consideration as an upper limit of radiological discharges'. This however ignores potential radionuclide compositions, as different source terms will have different ratios of e.g. volatile and non-volatile components, long-lived and short-lived components. This simply cannot be simulated with one set of source term data.

The Human Health Risk Impact report is based on the assumption that a license to the site will only be issued by the NNR if full compliance with regulatory requirements is demonstrated. This is in contradiction with the ALARA principle, which states that every reasonable effort should be done to keep exposures to radiation As Low As Reasonably Achievable.

The Human Health Risk Impact report states that the 'envelope' approach is in line with standard international practice, following the approach for Early Site Permit (ESP) applications to the US Nuclear Regulatory Commission. However, ESPs are submitted at a very early stage in the planning process, and prior to Environmental Impact Assessments. The practice with ESPs is in no way applicable or comparable to the practice with Environmental Impact Assessments; under the US National Environmental Policy Act, nuclear power plant developers will separately have to submit an Environmental Impact Statement, specifying reactor design and parameters.[42]

In the Human Health Risk Impact report, there is no assessment at all whether the possible impacts stay within the dose limits set by the NNR, nor does the Revised DEIR propose any mitigation measures to ensure rigorous application of the ALARA principle as required by the NNRA. It is clear that without a choice of design, no proper health risk impact assessment can be made.

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[41] Human Health Risk Impact Report, October 2010. Pg 14.
[42] http://www.epa.gov/compliance/resources/policies/nepa/#nuclear-power-plants

By excluding radiological impacts from the EIA process, and not having made the design choice prior to the Revised DEIR, health and environmental risk impacts can simply not be assessed, and it is impossible for the Environmental Authority to make a proper decision regarding the true environmental impacts of this proposed project.

### *5.5 Site layouts/sizes*

> From Executive Summary:
>
> It is estimated that the total footprint required for Nuclear-1 (4 000 MW) is 200 to 280 hectares.
>
> Finalisation of the site layouts, should the power station be authorised, will require detailed investigations, in conjunction with the relevant qualified and experienced specialists, once the preferred site and power plant type is confirmed.
>
> Based on the sizes of the areas that are environmentally suitable for a nuclear power station on the alternative sites (between 172 ha and 293 ha), and the proposed size of the Nuclear-1 footprint (200 to 280 ha), it will not be possible to construct additional power stations, beyond Nuclear-1, at any one of the alternative sites.

The site layout of the power station footprint is highly dependent on the type of reactor that is going to be built. The Revised DEIR states that detailed investigations will be required for finalisation of the site layout once the reactor type is confirmed. Hence, without the choice of design, a proper assessment of the impacts of the station footprint cannot be made. It is unacceptable and unlawful that these impacts will only be evaluated outside the EIA process and will not be open to public consultation.

The area sizes suitable for a nuclear power station on the three proposed sites are between 172 and 293 ha (DEIR Executive Summary), while the proposed size of Nuclear-1 is between 250 and 280 ha (DEIR Chapter 3) or between 200 and 280 ha (DEIR Executive Summary). Hence even the smallest proposed size would not fit on the suitable area of the smallest of the proposed sites.

## 6. Emergency preparedness

### *6.1 Worst case scenario*

The Revised DEIR fails to assess the impacts of a worst case scenario, such as a nuclear accident, claiming this would fall under the NNR licensing process. However,

NNR authorisation establishes safety standards under normal operating conditions;[43] it does not meet the requirements of NEMA 24(4)(a) to measure environmental impacts.

The DEIR claims that the likelihood of a serious nuclear accident in a modern reactor design is very small[44]. However, the likelihood of an accident in the Fukushima nuclear power plant was estimated to be negligible. Still, a nuclear disaster occurred after the earthquake and tsunami on 11 March 2011, causing a large area around the Fukushima nuclear power station to be seriously radioactively contaminated, and hundreds of thousands of people are being exposed to significant levels of radiation. The impacts of the Fukushima accident are widespread and long-term, and have significant economic and social impacts.

Even though these kind of accidents have a low probability, their probability is not negligible and the impacts are highly significant, hence they should be taken into account in the EIA process. They cannot be simply waved away by stating:

> Since the commercial use of nuclear energy to generate electricity began, it has arguably proved to be one of the world's safest energy generation technologies, with the exception of accidents such as Chernobyl and Three Mile Island.[45]

This was clearly written prior to the Fukushima nuclear accident. The world is reassessing the nuclear risks and impacts of nuclear accidents, as the Fukushima disaster casts serious doubts on current nuclear safety levels. Therefore, all nuclear expansion plans, including this EIA process, should be put on hold awaiting the outcomes of the industry's reassessment. As a basic minimum, the Revised DEIR should be adapted to incorporate lessons learned from Fukushima.

The Revised DEIR claims that the possibility of significant accidental releases of radionuclides can be excluded. This claim is completely implausible because there are several physically plausible sequences of events which can lead to releases of radioactivity from a PWR reactor exceeding those associated with the Chernobyl

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43 *See* National Nuclear Regulator Act Regulations, No. R. 388 (2006) s 3–5; National Nuclear Regulator Act 47 of 1999, ch 1 (definition of "action").

44 Human Health Risk Impact Report, October 2010. Pg 23.

45 Revised DEIR, chapter 3, pg 35.

nuclear accident.[46] These situations can include a material failure, an operator error, an external event, a malicious act, or any combination thereof. The DEIR specification identifies the potential flood hazard on all three sites.[47]

The Revised DEIR claims:

> A key focus of accident prevention has long been the use of multiple precautionary defences against the consequences of failures. This approach of 'defence in depth' is aimed at preventing equipment failures and human errors and mitigating their consequences, should any of these happen. (...) Furthermore, should components or materials fail, or should human errors lead to consequences that may have adverse effects on human health and the environment, several layers of backup systems and other controls are automatically introduced to stop the propagation of the IE [initiating event] or to mitigate its consequences.[48]

The nuclear industry relies on so-called 'probabilistic safety assessments', giving the impression that the probability of a serious accident caused by a sequence of events is extremely low.

The Fukushima accident painfully demonstrates the shortcomings of this approach. The nuclear operator in Japan was not prepared for a tsunami height of more than ten metres. There were no emergency plans for emergency cooling systems failing in multiple reactors at the same time, or for explosions causing reactor control rooms to become inaccessible due to high radiation. There were no emergency plans dealing with the thousands of tonnes of contaminated water that are needed to continue to cool the reactors and spent nuclear fuel pools.

A tsunami is not the only thing that can cause a serious accident. Most reactors are vulnerable as the hot nuclear fuel in the reactors and waste pools need to be cooled long after shutdown, for many months. This is core to the emergency systems in all reactors: continuous cooling needs to be guaranteed in order to prevent hydrogen explosions and fuel meltdown. Unfortunately, failures do occur in cooling systems and backup cooling systems, also in the absence of natural disasters. In 2006 external loss of power almost caused a serious accident in the Forsmark nuclear power plant in Sweden, because two out of the four emergency diesel generators would not connect,

[46] John Large 2007: Assessments of the Radiological Consequences of Releases from Existing and Proposed French EPR/PWR Nuclear Power Plants. Large And Associates. For sequence of events see pg.13. http://www.largeassociates.com/3150%20Flamanville/r3150-final-1.pdf
[47] Revised DEIR, Executive Summary, pg 10.
[48] Human Health Risk Impact Report, October 2010. Pg 24.

and the others only connected after 20 minutes.[49] A former director of Forsmark commented that: "it was pure luck there wasn't a meltdown".[50]

Nuclear accidents can be caused by a wide range of causes, such as design flaws, construction flaws, ageing materials, human errors, and external events. And the worst accidents occur when there is a combination of these factors that is impossible to predict. The failing safety assessments by the nuclear industry prove that nuclear technology is inherently unsafe.

## *6.2 Proposed emergency zones*

**From Chapter 3 DEIR:**

At this stage, the exact delineation of the Emergency Planning Zones (EPZs) is unknown and the sizes of the EPZ have been assumed, based on current international practice for Generation III reactors. The extent of the emergency planning zones will be set by the NNR licensing process.

(...) Given that the technology of nuclear reactors has changed significantly since the commissioning of Koeberg, it is likely that the EPZ will be reduced in comparison to Koeberg Nuclear Power Station's EPZs. The emergency planning zones for Koeberg are characterised by 5 km and 16 km radii around the power station. (...)

It is likely that the corresponding EPZs for the new nuclear power station will be reduced to 800 m and 3 km respectively. (...) The reduced EPZs are based on European Utility Requirements (EUR) standards, which prescribe that modern nuclear power plants should have no or only minimal need for emergency interventions (e.g. evacuation) beyond 800 m from the reactor. The EUR standards also provide a set of criteria that a reactor must meet in order to demonstrate that it can be built to comply with such emergency planning requirements.

The EUR standards were initiated by a group of power utilities from six European countries in 1992. (...) The NNR has indicated to Eskom, as well as in presentations to Parliament (NNR 2010), that it is revisiting its current regulatory requirements, guidelines and processes and updating them accordingly (...). The NNR (2010) states that one major outcome of these new designs is that the emergency planning zones, specifically the Urgent Planning Zone, would in all likelihood be reduced from 16 km in the case of the Koeberg Nuclear Power Station, to a much smaller radius that could fall within the property owned by the power station operator, thereby minimising the issue of the control on urban developments that could potentially threaten the viability of nuclear sites.

**From the Emergency Response Impact report:**

[49] www.analys.se/lankar/Engelsk/.../Bkgr1-07%20**Forsmark**%20Eng.pdf
[50] www.no2nuclearpower.org.uk/reports/Nuclear_Safety.pdf

> This safety philosophy requires enhanced safety features of LWRs and which result in less restrictive requirements for emergency planning. Eskom has developed a document [NSIP-01344] on a framework for demonstrating that a proposed nuclear installation can be built in South Africa without the need for off-site short-term emergency interventions like sheltering, evacuation or iodine prophylaxis, in line with the European Utility Requirements [EUR] for Light Water Reactor (LWR) Nuclear Power Plants. These documents prescribe that modern nuclear power plants should have no or only minimal need for emergency interventions (e.g., evacuation) beyond 800 m from the reactor, and provide a set of criteria that a reactor must meet in order to demonstrate that it can be built without such emergency planning requirements. The EUR requirements can be summarised as follows:
>
> o Minimal emergency protection action beyond 800 m from the reactor during early releases from the reactor containment;
>
> o No delayed action such as temporary transfer of people at any time beyond approximately 3 km from the reactor;
>
> o No long term action involving permanent (longer than 1 year) resettlement of the public at any distance beyond 800 m from the reactor;
>
> o Restriction on the consumption of foodstuff and crops should be limited in terms of timescale and ground area in order to limit the economic impact.

The Revised DEIR relies on a reduction of emergency zones from 5 km and 16 km, to 800 metre and 3 km for the Exclusion Zone and Long Term Protective Action Planning Zone respectively.[51] The extent of the emergency planning zones will be set by the NNR licensing process. It was confirmed in one of the EIA hearings that the DEIR will have to be re-done if the NNR decides on emergency zones larger than 800 m and 3 km.[52]

The Revised DEIR states that the proposed emergency zones are based on current international practice. However, no government or nuclear regulator in the world has adopted emergency zones as small as the proposed 800 m and 3 km, nor is there any evidence that such a significant reduction in emergency zones would be justified. On the contrary, the Fukushima accident has shown that the current practice of emergency zones would not cover the extent of the areas where special measures were implemented in the aftermath of the accident.

Following the Fukushima accident in Japan a 30 km zone has been evacuated, but also villages up to 45 km from the site were found to be highly contaminated, resulting in late

[51] Revised DEIR, Chapter 3, pg. 1.

[52] Final Minutes of the St Francis Bay Public Meeting, 31 May 2011. "If any of the assumptions in the consistent data set or regarding the 800 m and 3 km exclusion zones are incorrect, this EIA would have to be started again." http://projects.gibb.co.za

evacuation of specific areas.[53] Agricultural impacts are enormous, as food at distances of more than 60 km contains levels of radioactive caesium and iodine several times higher than the maximum allowable limit.[54] Recently beef from farms as far as 75 km from the site was found to contain caesium levels more than four times the set limit, caused by cows being fed contaminated straw.[55] Schoolyards also need to be cleaned up as children are being exposed to radiation levels more than 20 times the internationally set limit for members of the public.[56]

Theoretical studies confirm the potential of serious radiological impacts in case of a serious accident. A study commissioned from the prominent UK nuclear expert John Large by Greenpeace, estimated that a severe accident in the French PWR design EPR (European Pressurised Reactor) in France would cause 40-400 early deaths, 6,000-30,000 latent deaths from cancer and necessitate the evacuation of a land area of 5,000-20,000 square kilometres.[57]

It is clear from the Revised DEIR that the main motivation for reducing the emergency zones lies in economical arguments:

- "to a much smaller radius that could fall within the property owned by the power station operator, thereby minimising the issue of the control on urban developments that could potentially threaten the viability of nuclear sites."

- "This safety philosophy requires enhanced safety features of LWRs and which result in less restrictive requirements for emergency planning."

- "Restriction on the consumption of foodstuff and crops should be limited in terms of timescale and ground area in order to limit the economic impact."

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[53] *Fukushima reactions to radioactive 'hot spot' evacuation recommendation mixed,* Mainichi Daily News, 17 June 2011. http://mdn.mainichi.jp

[54] See e.g. *Radiation above standards found in Shizuoka tea,* Asahi, 11 June 2011. http://www.asahi.com/english/TKY201106100410.html ;
*Greenpeace Identifies High Contamination Levels in Vegetables,* Greenpeace International, 6 April 2011. http://www.greenpeace.org/africa/en/News/news/Greenpeace-Identifies-High-Contamination-Levels-in-Vegetables/

[55] *Radioactive cesium detected in straw fed to beef cattle*, Daily Yomiuri Online, 15 July 2011. http://www.yomiuri.co.jp/dy/national/T110715005727.htm

[56] *Fukushima city to remove topsoil from schoolyards,* NHK World, 10 May 2011. http://www3.nhk.or.jp/daily/english/10_24.html

[57] John Large 2007: Assessments of the Radiological Consequences of Releases from Existing and Proposed French EPR/PWR Nuclear Power Plants. Large And Associates. http://www.largeassociates.com/3150%20Flamanville/r3150-final-1.pdf

There is no theoretical or empirical evidence to support a reduction of the emergency zones. The presumption that "modern nuclear power plants should have no or only minimal need for emergency interventions (e.g. evacuation) beyond 800 m from the reactor" has not been proven. In fact, recent experience with the Fukushima nuclear power plant shows that the industry has not been able to predict or prevent a serious accident, despite its assurances that nothing could happen.

Serious flaws in Generation III reactor design have been identified, confirming the vulnerabilities that exist even in 'modern nuclear power plants'. A recent report by the Austrian nuclear expert Dr. Helmut Hirsch shows that the architects of the French EPR failed to systematically design against a sustained loss of power to cooling systems.[58] The entire design is built on the assumption that either grid power or primary diesel generators can be restored within 24 hours, while in Fukushima the blackout lasted for 11 days. If faced with a sustained loss of power, the operators of an EPR would have:

- no ability to cool water in reactor below 100$^{o}$C and achieve stable shutdown;
- no power to pump water into reactor coolant system. This would be critical if the reactor cooling system starts leaking or water level drops because of lack of cooling, and cooling via the steam generators fails;
- no operable boron injection system (boron is needed to keep the nuclear chain reaction from restarting);
- no power to cool spent fuel pool (in the basic design and the US EPR); and
- no hydrogen recombiners or igniters in fuel building to prevent explosions.

The proposed emergency zones are based on European Utility Requirements (EUR) standards, which were initiated by a group of European power utilities. They have not been adopted by any official authority, and hence cannot be regarded as international standards or international practice.

[58] *Selected Aspects of the EPR Design in the Light of the Fukushima Accident,* Dr. Helmut Hirsch, 3 June 2011. http://www.greenpeace.org/france/PageFiles/266521/EPR_Report_Greenpeace.fr.pdf

# 7. Radioactive waste

## *7.1 Waste*

> A nuclear power station of standard Generation III design is favoured by Eskom due to the operational simplicity and rugged design, availability, reduced possibility of core melt accidents, minimal effect on the environment, optimal fuel use and minimal waste output.[59]
>
> The Vaalputs Nuclear Waste Site has the capacity to handle the additional low-level and intermediate-level radioactive waste that will be produced by Nuclear-1 and is regarded as a safe and well-managed site. High-level radioactive waste will be stored on site (as has been the practice at the KNPS) until an authorised facility for the disposal of high-level waste is available in South Africa. This holds no significant risks, provided that the spent fuel waste is contained within a protected area according to management practices approved by the NNR.[60]
>
> (...) the National Radioactive Waste Disposal Institute Act, (Act No. 53 of 2008) was promulgated in January 2009 and came into effect in December 2009. The purpose of this Act is to ensure that the capability and capacity of the institutions to manage radiological w aste is addressed. This Act provides for the establishment of a National Radioactive Waste Disposal Institute in order to manage radioactive waste on a national basis (a function historically performed by Necsa). Although the Act has come into effect, it w ill still be some time before the Agency is formally constituted.[61]
>
> Internationally, this waste is currently being stored (usually above ground), awaiting the development of geological repositories. While the arrangements for storage have proved to be satisfactory and have been operated without problems, it is generally agreed that these arrangements are interim and do not represent a final solution.
>
> These requirements should be supplemented from the experiences of several national programs that are within a decade of operating a geological repository for high-level waste and spent fuel, notably Finland, Sweden and the USA.
>
> The potential environmental impacts identified and assessed include all potential radioactive wastes expected to be generated by the proposed Nuclear-1 Nuclear Power Station. The assessment results indicate that with the implementation of appropriate mitigation measures all potential impacts are low. [62]

EIA Regulation 31(2)(l) states that an environmental assessment report must include "an assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability

[59] Revised DEIR, Executive Summary, pg 3.
[60] Revised DEIR, Executive Summary, pg 17.
[61] Specialist report "Management of Radioactive Waste", September 2010. Pg 25.
[62] Specialist report "Management of Radioactive Waste", September 2010. Pg 87.

of an impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can be mitigated."[63] "Significant impact" is defined in the Regulations as "an impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment."[64]

Radioactive waste is certainly a "significant impact" under a common sense reading of the definition, and it has been identified as such by numerous public participants,[65] the DEA,[66] and the applicant itself.[67] The Revised DEIR fails to adequately assess the impacts of radioactive waste generated in the proposed nuclear power plant. The DEIR does not adequately analyse the nature, extent, duration, and probability of waste impacts and the degree to which they may cause irreversible damage.

The DEIR refers to the National Radioactive Waste Disposal Institute Act (NRWDIA) for the long term storage of radioactive waste. This is completely insufficient and in breach with EIA requirements. The EIA Regulations clearly list the "construction of facilities or infrastructure for (...) the storage and disposal of nuclear fuels" as an activity requiring an EIA[68] and thus also within the ambit of NEMA. The NRWDIA does not present a strategy on how to deal with highly radioactive waste on the long term.[69] The Act merely lists a range of options, each of them requiring further research and development before a decision on waste disposal can be made. Not including concrete plans for the storage and disposal of highly radioactive waste is a serious flaw in this Revised DEIR. The fact that there is no established way to manage a given environmental impact cannot be a justification for its exclusion.

The 'several national programmes that are within a decade of operating a geological repository' referred to in the specialist report, are haunted by serious open questions that will need to be answered prior to any of the proposed options becoming operational.[70]

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[63] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2(l).
[64] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 1.
[65] Revised DEIR App D8 Combined IRR Volumes Final at 157–186.
[66] Letter from Ms. Joanne Yawitch, Deputy Director General of Environmental Quality and Protection, DEA, to Mr. Tim Liversage, Arcus Gibb (Nov. 19, 2008) (laying out conditions under which the scoping report was to be accepted, which included assessment of nuclear waste).
67 Revised DEIR, Chapter 9, Impact Analysis 9.29 and APP E29.
68 EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Listing Notice 2, Appendix 1.
[69] National Radioactive Waste Disposal Institute Act, (Act No. 53 of 2008). December 2009.
[70] Rock Solid? A scientific review of geological disposal of high-level radioactive waste. Dr Helen Wallace (GeneWatch UK). http://www.greenpeace.org/eu-unit/Global/eu-unit/reports-briefings/2010/9/rock-solid-a-scientific-review.pdf

Furthermore, a proper assessment of the potential impacts of radioactive waste cannot be made without detailed knowledge of the reactor design. The potential impacts of the waste will vary depending on the properties and composition of the waste which will depend on the type of fuel (enrichment, MOX), the reactor core design, and the fuel burn-up. "A nuclear power station of standard Generation III design is favoured by Eskom due to -- minimal waste output" = high burn-up. The EIA must include an assessment of the specific risks with high-burn-up fuel, but should also investigate alternatives, i.e. low burn-up fuel.

In addition, the Revised DEIR does not take into account the potential impacts of long term (>70 years) storage of spent nuclear fuel in on-site fuel pools. Storage of spent nuclear fuel in pools poses significant safety risks, as was recently recognised by Jacques Besnainou from the French nuclear company AREVA in North America:

> "One of the things we're discovering in Fukushima is leaving used fuel in ... a spent fuel pool may not be a very wise decision"[71]

Spent nuclear fuel rods require continuous cooling. If the cooling system would fail, spent nuclear fuel rods can overheat, and fuel elements can be damaged, releasing radioactive gases and potentially resulting in melting of the fuel.[72] When spent nuclear fuel pools become too full, these risks increase as the total amount of waste will be hotter and more radioactive.[73]

## *7.2 Dry storage*

> It is expected that standard wet storage will be implemented at the proposed Nuclear-1 Nuclear Power Station, supplemented with dry storage as appropriate.[74]

The Revised DEIR does not properly assess possible alternatives. In the case of evaluating the potential impacts of spent nuclear fuel storage, the DEIR should properly assess the option of storing the spent nuclear fuel in dry storage casks instead of pools. The option of dry storage is common practice in countries like Germany and the US.

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[71] *Areva sees US nuclear waste recycling planning by '15*, Reuters, 6 June 2011. http://af.reuters.com/article/energyOilNews/idAFN0626744520110606

[72] See Union of Concerned Scientists, Nuclear Power, Safer Storage of Spent Nuclear Fuel, at http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/safer-storage-of-spent-fuel.html (last accessed 8 July 2011).

[73] Robert Alvarez, *Spent Nuclear Fuel Pools in the U.S: Reducing the Deadly Risks of Storage, Institute for Policy Studies* (May 2011), available at http://www.ipsdc.org/reports/spent_nuclear_fuel_pools_in_the_us_reducing_the_deadly_risks_of_storage [last accessed 21 July 2011].

[74] Specialist report "Management of Radioactive Waste", September 2010. Pg. 47.

Even though the option is listed in the specialist report, the impacts are not weighed against the storage of spent fuel in pools. This is a serious omission, as the dry storage option is potentially much less risky than wet storage in pools, hence minimising environmental impacts.

### *7.3 Decommissioning*

Table 3-1: Estimated timeframes for Nuclear-1's lifecycle[75]

| | Start | Complete |
|---|---|---|
| Preconstruction | Pending authorisation | 2013 |
| Construction | 2013 - 2014 | 2020 - 22 |
| Operation | 2020 - 2022 | 50 – 60 years |
| Decommissioning | | Undetermined |

The decommissioning plan for Nuclear-1 is likely to be similar to the plan for Koeberg Nuclear Power Station.[76]

The Revised DEIR does not define a detailed decommissioning strategy for Nuclear-1, nor does it evaluate potential environmental impacts thereof. There is no mention of a decommissioning fund in Chapter 3 or the specialist Economic Report, while future cost of decommissioning could have significant social and economic impacts on future generations.

## 8. Water

### *8.1 Groundwater contamination*

Potential impacts identified at all three coastal sites included flooding by groundwater, depletion of local aquifers, degradation of wetlands, contamination of groundwater, degradation of infrastructure by corrosion and contamination of the shore zone. The potential degradation of wetlands is assessed in the specialist wetland assessment.

The assessment concluded that all three sites are environmentally acceptable, with the majority of the impacts being rated as low before and after mitigation. Radioactive contamination was, however, identified as being of high significance before mitigation, reducing to medium after mitigation (use of nuclear reactor designs meeting the NNR's requirements for normal operational dose emissions and containment of accident emissions).[77]

[75] Revised DEIR, Chapter 3, Pg 9.
[76] Revised DEIR, Chapter 3, Pg 43.
[77] Revised DEIR, Executive Summary, Pg 10.

Radioactive contamination of groundwater and wetlands is identified as being of potentially high impact especially in the wetland areas of Thyspunt. However, the Human Health Risk Impact report does not assess the potential health risks caused by groundwater contamination. Also potentially damaging impacts of radioactive contamination to flora and fauna in the area have not been included in the Revised DEIR.

## *8.2 Cooling water*

> Consideration of two cooling water disposal alternatives at Thyspunt: near-shore and off-shore. The assessment concluded that the near shore outfall is acceptable at Thyspunt from the point of view of marine organisms (e.g. chokka squid).[78]
>
> Outlet structures for cooling water and chemical effluent must be offshore. All releases need to occur at the appropriate distances as described by the relevant specialists. Provided that the specific mitigation measures identified in the marine biology report are adhered to, offshore effluent release is therefore the recommended alternative.[79]
>
> It is concluded that offshore deep outlets are required at the Bantamsklip and Duynefontein sites. This is particularly important at Bantamsklip in order to mitigate impacts on abalone. It is further concluded that a shallow (5 m deep) nearshore release point for cooling water is environmentally acceptable at Thyspunt, as it would not result in significant impacts on chokka squid.[80]

It is clear from the Marine Ecology Impact Assessment report that the off-shore release of cooling water will result in fewer environmental impacts than the near-shore option on all three locations. Despite this, the Revised DEIR allows for the less preferred near-shore release of cooling water in shallow waters (5 m deep) stating it is 'environmentally acceptable'. However, it is not Eskom or Arcus Gibb who should judge what is environmentally acceptable, that is for the DEA and the DEA alone to decide. Furthermore, a less damaging option is identified in the DEIR, while no arguments are provided as to why this option would not be favourable. We urge the DEA to ensure that, in case this project does indeed go ahead despite the numerous flaws, the least impacting option will be implemented.

[78] Revised DEIR, Executive Summary, pg 5.
[79] Revised DEIR, Executive Summary, pg 8.
[80] Revised DEIR, Chapter 10, pg 10-2.

# 9. Economic impacts

## *9.1 Economics*

The impacts on the economic environment were considered in the Economic Impact Assessment report contained in Appendix E17. The economic impact assessment does not really look at the impact of the project, nor does it look at the impact of electricity prices and economic losses on the country, but rather focuses on the economic cost effectiveness of the three alternative sites (that includes the capital and operational costs of the service provide). The Economic Impacts covered in this report are thus insufficient as they do not explore the full extent of the macro-economic impacts of building a Nuclear Power Station.

This section only covers a superficial economic impact on the provinces in which the NPS is being placed, confuses the cost data and ignores the huge impact on the country as a whole. At a broader macroeconomic level the report assessed the impacts of the three sites on their relevant provincial economies and did not assess the impacts at a national level. This was also the case in assessing the impacts of a nuclear disaster. The report states that "the likelihood of such an event would be negligible" and only assessed the impacts on the areas close to the three sites. This is an indication of the lack of understanding of the economic impacts such a disaster will have to the country. Kazumasa Iwata, President of the Japan Center for Economic Research, has estimated the costs of the Fukushima Daiichi accident to be ¥ 5.7−20 trillion (US$ 71 – 250 billion). According to a 2006 report by the International Atomic Energy Association, though difficult to measure, the total costs of the Chernobyl disaster were in the hundreds of billions of dollars, Belarus having estimated losses of US$ 235 billion over 30 years.[81]

In terms of the cost of electricity, the Economic Impact Assessment assumes electricity sales revenue of R230/MWh vs EPRI, which are an estimated production cost of about R740/MWh (over R1,200 with the overnight cost used in economics report). There is no explanation as to how this gap will be plugged. It is important to note that Eskom is a publicly owned utility and thus Eskom's losses are losses to the taxpayer – as was the case in the PBMR.

[81] http://www.globalsubsidies.org/subsidy-watch/analysis/fukushima-disaster-puts-focus-hidden-subsidies-nuclear-power

The economic assessment also confuses cost data. The cost comparison states that a 3.3GW nuclear plant would cost R90-R110 bln while the site comparison uses R170 bln. This has the effect of making nuclear look more competitive with other options in the comparison while inflating the macroeconomic impact. The graph below illustrates

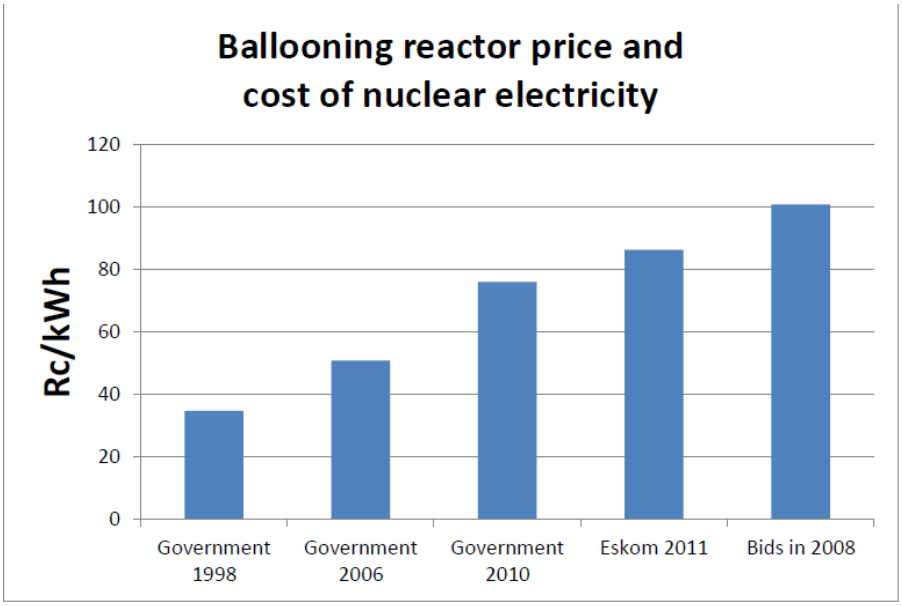


**Figure 1: prepared using information from the True Cost of Nuclear [Source: Greenpeace Africa, 2011]**

that the price in 2008 bids for nuclear power have an electricity cost of about 100c/kWh or more than double the current tariff.

An economic impact assessment must review the impacts of nuclear energy to the country as a whole and thus a true economic assessment must include:

a. the impact on the price of electricity of the expenditure of R120bn on a NPS and how this will affect consumers, particularly the poor;

b. the impact on household income and the taxpayer;

c. the economic impact of a catastrophic incident on adjacent communities;

d. the economic impact on all phases of the NPS's life including decommissioning which could be of the same order as commissioning;

e. an indication of the costs and benefits to assess the socio-economic impacts of the project;

f. the economic impacts of a major or serious accident; and

g. waste storage costs (current and cumulative).

In addition, the economic impacts of the construction of a nuclear reactor would vary depending on the specific design and its corresponding features[82]. In turn, the lack of a final design results in a failure to properly assess and analyse the full potential economic impacts and place sufficient relevant information before the decision maker. It is further submitted that because all potential economic impacts need to be assessed, the impacts of the cost of insurance against significant potential impacts must also be assessed and analysed in the economic report. This is especially so because the cost of insurance against such accidents may be very large and are excluded from household insurance.

Further to the above, the fact that a site has not been chosen again means that it will be impossible to assess and analyse the full potential economic impacts. This report thus lacks crucial information to make an informed decision on the economic impacts of a nuclear Power Station.

# 10. Social impacts

The Social Impact Assessment[83] identified and evaluated the possible impacts of Nuclear-1 during the construction and operation phase of the proposed project that included issues such as small business development, employment opportunities, noise and dust pollution, etc. The report touched on the possible social impacts that are linked to a nuclear disaster, but only as related to people's perceptions rather than the potential social impacts of a nuclear disaster.

[82] Safety features, fuel type, burn up rate, fuel storage options, waste facilities and disposal methods, emergency zones, core catcher, containment hulls, source term, cost overruns, labour, expertise and material required, etc.

[83] *Impacts on the social environment are dealt with in the Social Impact Assessment specialist report contained in Appendix E18*

## *10.1 National*

The Social Impact Assessment (SIA) also focused on the impacts in the three proposed areas. However, the social impact of a nuclear disaster should be done at a national level. There are two very key impacts that are not covered in the SIA – the increase in electricity prices and the economic fallout from a disaster. As noted earlier [section on economic impacts], a nuclear fallout can cripple the economy of a country.

## *10.2 Future generations*

Building a nuclear power station could take 10 years or more to completion. In general the life-cycle of nuclear plants are 40-50 years. The waste that is produced will have to be managed for hundreds of years. This is a burden that is being placed on future generations – socially, environmentally and economically. Section 24 of the South African Constitution sets the foundation for the protection of environmental rights. It stipulates "Everyone has the right to an environment that is not harmful to their health or well-being." Furthermore, it recognises the rights of future generations in the context of sustainable development by stating "and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

The SIA concludes that a "no-development" alternative would impact on the positive impact of the nuclear power station on macro-economic performance indicators. This assessment did not take into account the debt that South Africa would have to incur to build a nuclear power station in South Africa. According to a study by Citibank the costs of constructing a new nuclear power plant range between 2,500 to 3,500 euros (3,420 US dollars) per kilowatt.[84] The construction of a large reactor would cost between R40 billion to R80 billion.

In reality however, it is difficult to estimate the cost of a nuclear reactor as the full costs are only established at the end of the project at which time the amount spent is way above the estimate. A case in point would be the PBMR where the initial project estimate in 2002 was R1013m but by 2010 when the project was shut down it had cost almost R10 billion and nothing to show for it. Similar delays can be seen with the first ever EPR nuclear reactor - currently under construction by French nuclear company

[84] Nuclear Does Not Make Economic Sense Say Studies', http://ipsnews.net/news.asp?idnews=50308

Areva in Finland.[85] Areva recently doubled its claim for economic damages from the Finnish project from 1 billion to 1.9 billion euros , and Areva's total cost for the project is approaching double the contracted price of 3 billion euros .

As NEMA places such a high premium on minimisation of impacts and investigation of mitigation, a worst-case scenario analysis is clearly relevant information, as it will bring to light the full extent of potential impacts and all possible safety measures.[86] Any approval made without such information will be one in which relevant factors were not considered.

The SIA has failed to assess the socio-economic impacts of a worst-case scenario, the long term effects of waste and the socio-economic impacts of project alternatives.

[85] Greenpeace briefing, released 21 July 2011: New problems in Olkiluoto http://www.greenpeace.org/international/en/publications/New-Problems-in-Olkiluoto/

[86] See *supra* Section (b)(ii) at p. 13–15 & n. 30.

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Your Ref: Nuclear 1 DEA Ref. No.:12/12/20/944
Our Ref:

05 August 2011

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**RE: Eskom Environmental Impact Assessment (DEA Ref. No.:12/12/20/944) for a Proposed Nuclear Power Station and Associated Infrastructure - Revised Draft Environmental Impact Assessment Report:**

We act for Earthlife Africa, Johannesburg. We enclose here our client's submission to the Revised Draft Environmental Impact Report ("Revised Draft EIAR") for the proposed Nuclear-1 Power Station (NPS). This submission is supported by:

Alternative Information and Development Centre,
GreenpeaceAfrica,
Christopher Wylde
Hermanus Ratepayers Association
Save Bantamsklip Campaign
Zwartkops Conservancy
South Durban Community Environmental Alliance
Pelindaba Working Group
CANE Northern Regions: Gauteng, NW Province, Mpumulanga, NP and Free State.
St Francis Bay Residents Association
Friends of St Francis Nature Areas (FOSTER)
Gamtkwa KhoiSan Council
First Indigenous Nation - Eastern Cape (FINEC)
Women's Energy and Climate Change Forum
Timberwatch
Mrs Cheron Kraak
Earthlife Africa Cape Town
Dr Caeleen McNaughton-Pascoe
Supertubes Surfing Foundation
St Francis Kromme Trust
Renee Royal,
Dr. A.E. Marshall

David Fig, and Earthlife Africa eThekwini.

A further list of supporting organisations, if any, will be forwarded to you in the course of the next few days.

***This submission will evaluate the Revised DEIR against the legal requirements for such reports***. ***It is submitted that the Revised Draft EIR fails to place relevant considerations before the decision maker as is required by the Promotion of Administrative Justice Act No 3 of 2000 (PAJA) and violates several substantive provisions of the National Environmental Management Act No 107 of 1998 (NEMA) and the regulations passed thereunder (EIA Regulations).***

**1. Legal Context**

1.1 Promotion of Administrative Justice Act 3 of 2000:

S 6(2): "A court or tribunal has the power to judicially review an administrative action if . . .
(b) a mandatory and material procedure or condition prescribed by an empowering provision was not complied with; . . .
(e) the action was taken –
(iii) because irrelevant considerations were taken into account and relevant ones were not considered

1.2 The Constitution of the Republic of South Africa Act 108 of 1996:

S 24: Everyone has the right –
(a) to an environment that is not harmful to their health of well-being; and
(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
(i) prevent pollution and ecological degradation;
(ii) promote conservation; and
(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

S 195(1): Public administration must be governed by the democratic values and principles enshrined in the Constitution, including the following principles:
(b) Efficient, economic and effective use of resources must be promoted.

1.3 National Environmental Management Act (NEMA) and the Environmental Impact Assessment (EIA) Regulations:

Relevant provisions of these statutes will be referenced where applicable in the submission.

**2. Failure to assess socio-economic impacts of the proposed project violates NEMA and the EIA Regulations, read together with PAJA 6(2)(b).**

The preamble and principles laid out in section 2 of NEMA recognises that sustainable development requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations. It further states that ecologically sustainable development must be secured while at the same time promoting justifiable economic and social development.

Section 23 of NEMA is more specific in that it requires the actual and potential impacts on the environment, socio-economic conditions, and cultural heritage to be taken into account in environmental management. Regulations 31(2)(d) of the EIA Regulations state that the manner in which the … social, economic and cultural aspects of the environment may be affected by the proposed activity must be taken into account.

Added to this section 2(4)(b) of NEMA states that environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option. The best practicable environmental option is defined in section 1 of NEMA as the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.

Regulation 17 of the EIA Regulations states that guidelines must be taken into account where they have relevance to the proposed activity. For this purpose guidelines for the Western Cape have been drafted that determine how economists are to be involved in the EIA process.[1] The guidelines are very clear on what should be contained in an economic report. The guidelines state that the basic function of economic specialist input is to assist in the determination of whether a project will enhance the net social welfare. This involves considering the efficiency, equity and sustainability of the project. Input from an economic specialist is especially required if there is a chance that economic impacts are likely to influence the decision of whether or not a project is desirable. The guidelines further state that macro-economic risks need to be taken into account. In fact they clearly state that where the size of the project is such that it could influence relative prices then further analysis is required to identify and assess potential risks. The guidelines go on to state that the report also needs to take into account the vulnerability of the groups impacted on. Part of the assessment should include a consideration of who benefits and who loses from the impacts associated with the project.

It is submitted that the legal context set out above mandates that the EIAR consider the economic impacts that the construction of the NPS will have on broader South Africa, rather than a focused report detailing the economic impacts on the local communities as was submitted by the EAP. Accordingly, the previous submission by Earthlife Africa[2] detailed the concerns with the Draft EIAR as follows:

a. the impact on the price of electricity of the expenditure of R120bn on a NPS and how this will affect consumers, particularly the poor;
b. the impact on household income and the taxpayer;
c. the economic impact of a catastrophic incident on adjacent communities;
d. the economic impact on all phases of the NPS's life including decommissioning which could be of the same order as commissioning;
e. an indication of the costs and benefits to assess the socio-economic impacts of the project;
f. the economic impacts of a major or serious accident;
g. waste storage costs (current and cumulative).

It is submitted that the failure to assess these impacts results in the infringement of the environmental rights set out in both the Constitution and NEMA. Our client is concerned that the costs involved in the construction and operation of the NPS will be passed on to electricity consumers, the majority of whom are from disadvantaged backgrounds, and that these costs will be intergenerational (which is problematic given that future generations will not have benefitted from the generation of electricity from the NPS).[3] Both the Constitution and NEMA make specific mention of the right to have the environment protected for the benefit of both present and future generations and that development should be sustainable. It is submitted that the assessment of the above socio economic impacts as well as the assessment of cumulative economic impacts[4] is required in order to ensure that these constitutional imperatives are complied with.

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[1] Van Zyl, H.W., de Wit, M.P. & Leiman, A. 2005. *Guideline for involving economists in EIA processes: Edition 1.* CSIR Report No ENV-S-C 2005 053 G. Republic of South Africa, Provincial Government of Western Cape, Department of Environmental Affairs & Development Planning, Cape Town. These guidelines are relevant to the extent that the NPS will be built in the Western Cape.

[2] Submission by Earthlife Africa to the Director of the Department of Environmental Affairs on the Draft Environmental Impact Assessment Report. Dated 29 June 2010.

[3] NEMA s 1 (definition of "sustainable development").

[4] EIA Regulations 2010, regulation 22(i)(i).

In spite of the legal framework which clearly mandates that these (macro-economic) impacts must be assessed, and in spite of the concerns having been voiced by various I&APs including Earthlife, these impacts have not been considered in the EIAR. Not only have these concerns been ignored in the revised drafts, but they were ignored in spite of the fact that the scoping report was accepted by DEAT subject to the condition that the economic study was required to address the cost implications of the proposed NPS in relation to other electricity generating activities[5] and in spite of the fact that the Plan of Study reiterated this by including the following criteria for the economic impact analysis:

> *"Impacts on poor (low income households), other households, fiscal impacts, balance of payment impacts and social impacts, cost implications of the proposed NPS in relation to other electricity generation activities as indicated in the long term mitigation strategy document".*[6]

The economic report itself acknowledges that *the NPS is such a large capital investment (equivalent to that of six times the capital investment in Gautrain) that the economic ripple effects will go far beyond its direct boundaries*.[7] However, the response to Earthlife's comments shifts the responsibility of assessing the impact of increased electricity prices to the National Energy Regulator of South Africa ("NERSA"), and avoids the legislative requirement of assessing alternative forms of electricity generation, by stating that it is the purpose of the Integrated Resource Plan[8] ("IRP") to decide the relative contribution of various generation options to South Africa's overall electricity mix. What this response fails to acknowledge is that neither NERSA's electricity price increase process, nor the IRP constitute an equivalent mechanism for assessing the economic impacts of the project in the manner which the law suggests. Further, neither of these processes consider all the economic impacts that must be considered in the EIA, nor do they consider potential or cumulative economic impacts. It is submitted that it is a mistake to conflate these (NERSA and IRP) processes with the environmental impact assessment process and it is further submitted that doing so circumvents the requirements of NEMA.

In addition to the concerns canvassed in earlier submissions, it is submitted that it is not possible for the applicant to come into compliance with the EIA requirements for assessing the economic impacts of the project at this stage because of lack of certainty as to the specific type of plant, its design and safety mitigation features. Different types of nuclear power plants, and their safety mitigation features will generate different consequences in a major accident which will in turn result in different economic impacts. The monetary value of such economic impacts will also be different for different sites, based on issues such as population densities and the nature of the surrounding economy. Factors which may determine the range of impacts include:

a. fuel storage options including alternatives,
b. waste facilities and disposal methods,
c. number of containment hulls,
d. whether a core catcher is necessary (such technology is dependent on the type of design),
e. the emergency zones that need to be determined,
f. the source term,
g. possible cost overruns,
h. labour, expertise and material required etc.
i. the nature of the adjacent economy, and population densities eg types of agriculture undertaken
j. the extent of emergency zones

It is submitted that the cost of insurance against such impacts should be included as part of the economic impact assessment, given that it may be significant. Insurance against the consequences of nuclear accidents is usually excluded from household insurance. It is understood that the actual level of financial security and the manner in which it must be provided must be determined under the provisions of the National

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[5] Letter from DEAT to Arcus Gibb dated 19/11/2008.

[6] Page 27, Plan of Study.

[7] Page 40, Economic Report, Revised DEIR APP E17 Economic Report.

[8] Government Gazette, No 34263, Vol 551, 6 May 2011.

Nuclear Regulator Act No 47 of 1999. However, it is submitted the actual determination of the financial security is not equivalent to the assessment of the economic impact thereof. The failure to assess this impact constitutes a failure to properly comply with statutory requirements.

A final socio economic concern is the fact that the report fails to consider the impact on land use planning in the greater Cape Town metropolitan area of locating a further nuclear plant at Duynefontein, which is to the north of Cape Town. The city has a rapidly increasing demand for housing and is landlocked by mountains and ocean, placing pressure for development on the zone to the north of the city where Koeberg is situated. A further nuclear plant at this site will in all likelihood limit development in the area for a further 100 years. The socio economic impact of such a development, which may be significant has not been considered in the EIA.

As a result it is submitted that the report does not place all relevant socio economic information that could materially influence the decision maker before it and therefore a decision to authorise the construction of a nuclear power station based on this report would be open to legal challenge.[9]

**3. Failure to assess worst-case scenario impacts violates NEMA and the EIA Regulations, read together with PAJA 6(2)(b).**

EIA Regulation 31(2)(l) states that an environmental assessment report must include "an assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of an impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can be mitigated."[10] "Significant impact" is defined in the Regulations as "an impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment."[11] Under this definition, "significant impact" includes a catastrophic, worst-case scenario impact.

In addition, NEMA's repeated focus on minimisation, prevention, and mitigation of environmental degradation[12] mandates an assessment of the impacts of a severe accident because such an assessment will lead to better prevention and mitigation measures. The need to carefully consider catastrophe scenarios is particularly apparent in light of the recent Fukushima nuclear disaster. The plant, operated by Tokyo Electric Power Co. (TEPCO), was protected by a seawall 5.7 meters high but unprepared for the 14 meter waves that actually hit the plant after the earthquake. TEPCO's disaster projection scenarios for the plant had not considered the possibility of higher waves.[13]

The Revised DEIR fails to assess worst-case impacts. With regard to natural disasters, the EIR merely states the obvious, that an earthquake or flood may have a major negative impact on a nuclear power plant, rather than assessing the impacts that the nuclear power plant would have on the surrounding environment in the event of an earthquake or flood.[14] The emergency response report explicitly states, "The approach of this specialist report is different to the other specialist reports, in the sense that *it has not identified and assessed impacts*."[15] With regard to health impacts, the EIR merely estimates the *probability* of accidents caused by

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[9] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000.

[10] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2(l).

[11] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 1.

[12] NEMA s 2(4)(a)(i)–(iii), (vii), s 23(2)(a)–(b), s 24(1), (4)(b)(ii), (4A).

[13] *TEPCO details tsunami damage: Waves that hit Fukushima plant exceeded firm's worst-case projections*, Yomiuri Shimbun (Apr. 11, 2011), available at http://www.yomiuri.co.jp/dy/national/T110410003477.htm.

[14] Revised DEIR APP E4 Seismic Risk Assessment 4.1.1(a), (f); 4.1.2(a), (f); 4.1.3(a), (f); Revised DEIR APP E16 Oceanographic Assessment at 3.1.3, 3.2.3, 3.3.3, 4.1.5, 4.2.7.

[15] Revised DEIR, Chapter 9, Environmental Impact Analysis, Emergency Response, at 9.23 (emphasis added).

external forces ("Category C events") without assessing the *impacts* of such accidents, contrary to Regulation 31.

The response to this issue when raised at the Final Draft Environmental Impact Report stage was that severe accidents "fall firmly within the ambit of the NNR licensing process." [16] Such reliance, however, is misplaced as an NNR license cannot function as the equivalent of an environmental authorisation under NEMA 24L. NNR authorisation establishes safety standards under normal operating conditions;[17] it does not meet the requirements of NEMA 24(4)(a) to measure environmental *impacts*.

It is further submitted that not only does the Revised DEIR bypass the statutory requirement to assess all identified potentially significant impacts, which includes a worst-case analysis, it is actually impossible for the applicant to assess the impacts of a catastrophe in the absence of a final design. Eskom purports to base its assessments on a generic nuclear power station design,[18] using an "envelope" of data that includes the "highest possible values for various aspects for a range of different nuclear technology vendors,"[19] including Generation III reactors. But different systems will have different accident consequences. As stated above, in other words, a nuclear meltdown is not just a nuclear meltdown – rather, the specific effects of an accident will vary widely depending on factors such as the type of fuel used, the burnup rate of the fuel, and the safety mechanisms installed, all of which depend on the final design of the plant. Basing an assessment on "highest possible values" is not sufficient because the difference in impacts is not merely a matter of degree but also of quality and composition. Moreover, it is currently not possible to make generalisations about Generation III reactors as they are just beginning to enter the market and do not yet have a proven track record.[20]

**4. Failure to assess all potential impacts of nuclear waste violates NEMA and the EIA Regulations, read together with PAJA 6(2)(b).**

EIA Regulation 31(2)(l) states that the report must include "an assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of an impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can be mitigated."[21] "Significant impact" is defined in the Regulations as "an impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment."[22] Radioactive waste is certainly a "significant impact" under a common sense reading of the definition, and it has been identified as such by numerous public participants,[23] the DEA,[24] and the applicant itself.[25]

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[16] Revised DEIR, APP IRR 45a Long Submission ELA Final, at 16.

[17] *See* National Nuclear Regulator Act Regulations, No. R. 388 (2006) s 3–5; National Nuclear Regulator Act 47 of 1999, ch 1 (definition of "action").

[18] *Id.*

[19] Revised DEIR, Chapter 9, Impact Analysis, Assumptions 9.2.2.

[20] *See* Advanced Nuclear Power Reactors, World Nuclear Association (June 2011), at http://www.world-nuclear.org/info/inf08.html [last accessed 28 July 2011] (discussing various types of Generation III reactors, only one of which is currently operating while others are still undergoing development, design certification, or construction).

[21] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2(l).

[22] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 1.

[23] Revised DEIR App D8 Combined IRR Volumes Final at 157–186.

[24] Letter from Ms. Joanne Yawitch, Deputy Director General of Environmental Quality and Protection, DEA, to Mr. Tim Liversage, Arcus Gibb (Nov. 19, 2008) (laying out conditions under which the scoping report was to be accepted, which included assessment of nuclear waste).

[25] Revised DEIR, Chapter 9, Impact Analysis 9.29 and APP E29.

The applicant has failed to adequately assess the impacts of generating radioactive waste. First, the EIR does not assess the cumulative impacts of generating radioactive waste, in violation of EIA Regulation 31(2)(l). The impacts of the waste to be generated by Nuclear-1 must be analysed in light of the waste already generated by Koeberg Nuclear Power Station and in addition to other existing environmental stresses in the proposed sites.

Second, the EIR does not adequately analyse the nature, extent, duration, and probability of waste impacts and the degree to which they may cause irreversible damage. The EIR merely classifies each identified potential impact (such as water contamination) as "low," "medium," or "high," without any explanation as to the content of those labels and how it arrived at those conclusions. Such an "impact assessment" is meaningless and results in an incomplete EIR.

Third, the EIR does not assess the economic consequences of long-term waste disposal and storage. Economic impacts are probably the most far-reaching potential impacts of waste management, as the consequences of waste extend to future generations and radioactive emissions can continue to thousands of years,[26] and the costs of constructing high level waste facilities are exorbitant. The proposed Yucca Mountain high level waste repository in the U.S. was estimated in 2006 to cost $23 billion, a 342% increase over the original estimate in 1984 (accounting for inflation).[27] The costs of permanent high level waste disposal is an extremely significant impact of nuclear waste; failure to mention such huge-scale impacts violates EIA Regulation 31(2)'s requirement that an EIR contain all information necessary for the authority to make a decision and PAJA's requirement that all relevant information be presented to the decisionmaker.

Fourth, and most alarmingly, the EIR has failed to identify the overheating of spent fuel rods as a potential impact of storing high level nuclear waste. The EIR proposes to store high level waste temporarily in spent fuel pools on-site.[28] These spent fuel pools pose grave safety risks because in the event of an accident, the rods could overheat, releasing radioactive gases and potentially causing a meltdown.[29] Overcrowding in spent fuel pools also poses risks as the pools become hotter and more radioactive.[30] The risk of overheating pools is particularly salient and urgent in light of the Fukushima nuclear disaster, in which a spent fuel pool overheated at Reactor No. 4 after cooling systems were knocked out by the earthquake and tsunami.[31] Indeed, the head of Areva's North American unit, Jacques Besnainou, stated, "One of the things we're discovering in Fukushima is leaving used fuel in . . . a spent fuel pool may not be a very wise decision."[32] Overcrowding is also a present danger, as the spent fuel rods at Koeberg have been re-racked to extend their

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[26] *See* Revised DEIR, APP E29 Waste Assessment 5.2.2;

[27] *See* Marvin Resnikoff et. al., *The Hazards of Generation III Reactor Fuel Wastes: Implications for Transportation and Long Term Management of Canada's Used Nuclear Fuel*, GREENPEACE CANADA 35 (May 2010), *available at* http://www.greenpeace.org/canada/Global/canada/report/2010/5/nuclear/GP_REACTOR_FUEL_REPORT_MAY2010.pdf.

[28] Revised DEIR APP E29 Waste Assessment 5.5.2.

[29] *See* Union of Concerned Scientists, Nuclear Power, Safer Storage of Spent Nuclear Fuel, at http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/safer-storage-of-spent-fuel.html (last accessed 8 July 2011).

[30] Robert Alvarez, *Spent Nuclear Fuel Pools in the U.S: Reducing the Deadly Risks of Storage, Institute for Policy Studies* (May 2011), available at http://www.ips-dc.org/reports/spent_nuclear_fuel_pools_in_the_us_reducing_the_deadly_risks_of_storage [last accessed 21 July 2011].

[31] *E.g.*, Hiroko Tabuchi et al, "Spent Fuel Hampers Efforts at Japanese Nuclear Plant," N.Y. Times (March 23, 2011) at A14.

[32] *Update 2 –Areva Sees U.S. Nuclear Waste Recycling Planning by '15*, REUTERS AFRICA (June 6, 2011).

operating capacity.[33]

The response to this issue when raised at the Final Draft Environmental Impact Report stage was, "The impacts of handling and storage of radioactive waste is a matter that is firmly within the ambit of the NNR and the newly established National Radioactive Waste Disposal Institute."[34] However, the EIA Regulations clearly list the "construction of facilities or infrastructure for . . . the **storage and disposal of nuclear fuels**" as an activity requiring an EIA[35] and thus also within the ambit of NEMA. The response goes on merely to repeat that no solution has been found for long-term storage of high level waste and that it will be stored indefinitely onsite, unresponsive to any of the issues above.

It is further submitted that just as it is impossible for the applicant to assess socio-economic and worst-case impacts in the absence of a final design,[36] it is also impossible to assess waste impacts in the absence of one. The impacts of radioactive waste will vary depending on the composition of the waste, which depends on the type of fuel used and burnup rate, which in turn depend on the reactor design. The cursory categorisation of potential waste impacts (such as contamination of water) as "low," "medium," or "high," without any explanation as to how it may affect the environment, public health, and agriculture, is unlawful but also unsurprising given that the composition of the waste is unknown.

**5. Failure to adequately assess project alternatives and a no-go option violates NEMA and the EIA Regulations, read together with PAJA 6(2)(b), and places false information in front of the decisionmaker in violation of PAJA 6(2)(e)(iii).**

Regulation 31 of the EIA Regulations requires an assessment and comparison of potential alternatives to the proposed activity.[37] "Alternatives" is defined in the Regulations as "different means of meeting the general purpose and requirements of the activity, which may include alternatives to . . . the type of activity to be undertaken . . . and the option of not implementing the activity."[38] NEMA s 24 also requires every application for an environmental authorisation to include an investigation of alternatives to the activity, including the option of not implementing the activity.[39] The duty of the applicant is to submit "all information necessary for the competent authority to consider the application and reach a decision,"[40] and the duty of the decisionmaker is to then choose the "best practicable environmental option,"[41] the one that "provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term."[42]

Guidelines from the U.S. Nuclear Regulatory Commission (NRC) prove helpful in interpreting what it means to assess alternatives and the option of not implementing the activity (no-go option). NRC guidance calls for investigating alternatives to meet the energy demand that do not require building new capacity, such as purchasing from another utility or initiating energy conservation measures that would avoid the need for the plant.[43] It also calls for consideration of several other energy sources, including wind, geothermal,

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[33] Nuclear Waste, NECSA, at http://www.necsa.co.za/Necsa/Nuclear-Technology/Nuclear-Waste-442.aspx [last accessed 21 July 2011].

[34] Revised DEIR, APP IRR 45a Long Submission ELA Final, at 8.

[35] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Listing Notice 2, Appendix 1.

[36] See discussion *supra* p. 4.

[37] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2(g), (i).

[38] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 1, s 1, subsec 1.

[39] NEMA s 24(4)(b)(i).

[40] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2.

[41] NEMA s 2(4)(b).

[42] NEMA s 1 (definition of "best practicable environmental option").

[43] *See* Environmental Protection Agency, Office of Enforcement and Compliance, EPA Publication 315-X-08-001, § 309 Reviewers Guidance for New Nuclear Power Plant Environmental Impact Statements (Sept. 2008)

hydropower, and solar, even if they are considered non-competitive options.[44]

The Revised DEIR has not adequately assessed project alternatives and the no-go option. The EIR simply lists some energy sources in a table,[45] without any analysis of their impacts or the significance of those impacts, and cites the lack of base load capacity as justification for not evaluating other energy sources. Missing from Eskom's analysis is an investigation of ways to meet energy demand without generating new capacity or ways to generate the shortfall from other sources. In other words a true comparison of the various alternatives. With regard to the no-go option, the EIR simply states that the no-go alternative is not a feasible or realistic alternative,[46] despite the fact that the government included a no-nuclear scenario in the IRP2 that is cost-effective and provides security of supply.[47]

The report's conclusions about project alternatives and the no-go option not only violate substantive requirements to assess them under NEMA and the EIA Regulations but are also inaccurate. The finalised Integrated Resource Plan (IRP2) included no-nuclear scenarios that are cost-effective and provide security of supply.[48] Thus, the IRP2 shows that base load is not an issue in pursuing a nuclear-free energy plan. In addition, the IRP2 stated that after taking into account the fact that new energy technology costs would decrease over time and that nuclear would be 40% more expensive that originally projected, the cost-optimal output from the model did not include nuclear at all.[49] Thus, not only is a no-nuclear scenario feasible and secure, it is actually the most cost-effective option.

The applicant has not only failed to assess project alternatives and a no-go option, but has inaccurately concluded that alternatives and a no-go option are simply not viable. In addition to violating substantive provisions of NEMA and the EIA Regulations, the applicant here has put irrelevant information in front of the decisionmaker in violation of PAJA 6(2)(e)(iii), and any decision taken on the basis of such information will be unlawful.

Further, the report suggests that Eskom has usurped the role of the decisionmaker, deciding for itself which option is best and that the no-go option is not a viable one. Removing options from consideration also precludes the decisionmaker from choosing the best practicable environmental option as required by NEMA. When this issue was raised at the Final Draft Environmental Impact Report stage, applicant asserted that the IRP2, which chose to commit to 9600MW of nuclear, obviates any need to investigate alternative forms of power generation and the no-go option in the EIR because it has already established the optimal energy mix.[50] However, such rigid adherence to policy in making an administrative decision fetters the decisiomaker's discretion in violation of PAJA. While policies in keeping with the empowering legislation may be used to assist decisionmaking, they may not inevitably determine the outcome of the decision, lest they "preclude the person exercising the discretion from bringing his mind to bear in a real sense on the particular circumstances of each and every individual case coming up for decision."[51]

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at 14.1.1, 14.1.2, available at http://epa.gov/compliance/resources/policies/nepa/309-reviewers-guidance-for-new-nuclear-power-plant-EISs-pg.pdf (last accessed 18 June 2011).

[44] *Id.*

[45] Revised DEIR, Chapter 5, Project Alternatives, 5.3.1 Nuclear Generation Alternatives.

[46] Revised DEIR, Chapter 9, Impact Analysis, 9.33.12.

[47] Integrated Resource Plan for Electricty 2010–2030, GNR 400 GG 34263 of 6 May 2011, at 38–45.

[48] Integrated Resource Plan for Electricity 2010–2030, GNR 400 GG 34263 of 6 May 2011, at p. 18, 6.9.1, 6.9.4 ("If new renewable generation capacities should fail to reach their forecast performance in terms of full-load hours, this will increase total costs. It will, however, not affect other dimensions like security of supply, since solar PV is completely backed up with conventional, dispatchable generation and wind power is backed up to a large extent."); *id.* at p. 39, B.30.

[49] *See* Integrated Resource Plan for Electricity 2010–2030, GNR 400 GG 34263 of 6 May 2011, at 38–39, paras. B.23, B.25, B.27, B.30.

[50] Revised DEIR, APP IRR 45a Long Submission ELA Final, at 19–20.

[51] *Richardson v Administrator, Transvaal* 1957 (1) SA 521 (T) at 530.

The IRP2 includes feasible no-nuclear scenarios[52] that are cost effective and provide security of supply, showing that the decision to pursue nuclear energy is not an inevitability but a policy decision. The applicant, however, falsely asserts that the no-go option is not viable and attempts to hide behind policy (the IRP2) to bypass the statutory requirements of NEMA.

**6. General failure to place relevant considerations in front of the decisionmaker violates PAJA 6(2)(e)(iii).**

Failures to assess socio-economic impacts, worst-case scenario impacts, waste impacts, a no-go option, and project alternatives, in addition to violating substantive provisions of NEMA and the EIA Regulations, also amount to withholding relevant information from the decisionmaker in violation of PAJA 6(2)(e)(iii).

Because of NEMA's repeated emphasis on the integrated nature of environmental management, the socio-economic impacts of the NPS (most notably the impact on electricity prices and the economic fallout from a disaster) is relevant information that must be brought before a decisionmaker. Because NEMA places such a high premium on minimisation of impacts and investigation of mitigation, a worst-case scenario analysis is also clearly relevant information, as it will bring to light the full extent of potential impacts and all possible safety measures.[53] Because of NEMA's life cycle and intergenerational provisions, waste impacts are also relevant. Assessment of project alternatives and a no-go option are relevant because NEMA and the EIA Regulations have specified them as such.[54] Any approval made without such information will be one in which relevant factors were not considered.

**7. Approving the NPS in the absence of a long-term solution to the problem of high level nuclear waste is unlawful.**

This EIR acknowledges that no long term solution currently exists for the disposal of high level nuclear waste.[55] Storage of high level waste in spent fuel pools, which the applicant proposes to do, is only an interim solution[56] and one whose safety has been questioned in the aftermath of the Fukushima disaster. The Waste Assessment makes no projection of the costs of this interim storage or any mention of research and development that will be invested in finding a solution.

Approving such a project will violate NEMA's life cycle[57] and intergenerational provisions.[58] Without knowing the project's full life cycle consequences or the costs of long-term waste storage, the decisionmaker will be unable to determine whether the applicant is able to bear responsibility for the project throughout its life cycle (because it is unknown) and whether the project will pose an undue burden on future generations.

Approval will also violate international standards, which state that no "undue burden" be placed on future generations[59] and every country should have a national policy and strategy in place for the management of radioactive waste.[60] While the Revised DEIR refers to the National Radioactive Management Policy and

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[52] Integrated Resource Plan for Electricty 2010–2030, GNR 400 GG 34263 of 6 May 2011, at 38–45.

[53] *See supra* Section (b)(ii) at p. 13–15 & n. 30.

[54] NEMA s 24(b)(ii); EIA Regulation 31(g), 1 (definition of "alternatives").

[55] Revised DEIR, Chapter 9, Impact Analysis, 9.29.6; Revised DEIR APP E29 Waste Assessment, 2.2.10.

[56] National Radioactive Waste Management Policy and Strategy (2005) at 13.1.

[57] NEMA s 2(4)(e).

[58] NEMA s 1 (definition of "sustainable development").

[59] International Atomic Energy Agency, *Policies and Strategies for Radioactive Waste Management*, Chapter 4, Principles for Establishing a Policy and Strategy, at 8 (2009).

[60] International Atomic Energy Agency, *Policies and Strategies for Radioactive Waste Management*, Chapter 1, Introduction, at 3 (2009).

Strategy of 2005 and the National Radioactive Waste Disposal Institute Act of 2008, such policies do not meet international best practice as they do not identify the ultimate disposal end point for high level waste.[61] The National Radioactive Management Policy and Strategy does not identify an ultimate disposal end point, merely stating that "Government shall ensure that investigations are conducted within set timeframes to consider the various options for safe management of used fuel and high level radioactive wastes in South Africa."[62] The National Radioactive Waste Disposal Institute Act also does not provide a long-term solution; its purpose is limited to establishing an agency to manage radioactive waste,[63] which the Revised DEIR acknowledges has not yet been formally constituted.[64]

**8. Approving the NPS in the absence of a final project design is unlawful.**

Eskom has chosen to conduct an EIA before settling on a plant type and admits that "detailed descriptions of the proposed plant are not available."[65] Thus, it has decided to assess a generic nuclear power station design for the EIA process,[66] using an "envelope" of data that includes the "highest possible values for various aspects for a range of different nuclear technology vendors,"[67] including Generation III reactors.

While the EIA regulations do not explicitly require a project design as part of the application,[68] one is necessary in order to meaningfully fulfill its requirements. Without one, it is impossible to specifically and accurately assess the impacts the development will have on the surrounding environment. Absence of a final design precludes a proper impact assessment of not only socio-economic, worst-case, and waste impacts but of all impacts. Mitigation and safety measures, in turn, are also vague and based on inadequate information. Further, a meaningful choice cannot be made between the three proposed sites on the basis of such scanty information.

The pointlessness of conducting an EIA without first deciding on a project design is evident from the superficial treatment given to potential impacts and mitigation measures throughout the Revised DEIR.[69] Even where proposed measures are more detailed, such as the emergency planning zones (EPZs),[70] without

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[61] International Atomic Energy Agency, *Policies and Strategies for Radioactive Waste Management*, Chapter 11, Strategy Formulation and Implementation, at 41 (2009) ("If long term storage is considered within the strategy, the ultimate intended disposal end point should nevertheless be indicated.").

[62] Radioactive Waste Management Policy and Strategy for the Republic of South Africa, Department of Minerals and Energy, at 13.1 (2005).

[63] National Radioactive Waste Disposal Institute Act 53 of 2008.

[64] Revised DEIR, Chapter 9, Impact Analysis, 9.29.6.

[65] Revised DEIR, Chapter 3, Project Description 3.5.

[66] *Id.*

[67] Revised DEIR, Chapter 9, Impact Analysis, Assumptions 9.2.2.

[68] Compare UK regulations, which require environmental statements to contain "a description of the development comprising information on the site, ***design***, and size of the development." Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999, Regulation 2(1) (definition of "environmental statement") & Schedule 4, Part II (1) (emphasis added).

[69] *See, e.g.*, Revised DEIR, Chapter 9, Impact Analysis, Impacts on Flora and Ecosystem Functioning, Duynefontein, 9.10.1(a) ("the primary dunes ***may*** be impacted, ***depending on what coastal setback is created***") (emphasis added); Revised DEIR, APP E29, Waste Assessment, 8.2, 8.3, 8.4, Table 8-1 (superficial assessment of the impacts of radioactive waste, without any explanation as to how it came to its conclusions); Revised DEIR, Chapter 9, Impact Analysis, Impacts of Nuclear and non-nuclear waste, Mitigation 9.29.7 ("high level waste management system must be designed to safely manage and hold all high level waste and spent fuel"); Revised DEIR, Chapter 9, Impact Analysis, Impacts on Terrestrial Vertebrate Fauna, Mitigation, 9.13.5 ("reduce number of roads and tracks and place them carefully").

[70] Eskom has proposed emergency planning zones of 800m and 3km, based on little more than an assertion that

a final design it is unclear how such measures were determined and whether they are justifiable. An EIR of such scanty analysis amounts to a failure to assess impacts and investigate mitigation measures as required by the EIA Regulations and NEMA.

In addition, such an inadequate EIR will constitute a grand failure to place relevant factors in front of the decisionmaker. If the regulator does not get specific, meaningful analysis on the potential impacts of the NPS in each proposed site, he or she will be unable to choose the right site or proper levels of mitigation. Any authorisation based on this EIR will be an unlawful one, as none of the factors identified as relevant under NEMA and the EIA Regulations have been properly assessed. Insofar as the lack of a project design precludes adequate assessment of impacts and mitigation measures, conducting an EIA before choosing a design is premature.

**9. The Thyspunt site is not a viable one for the Nuclear-1 project.**

The Revised DEIR identifies Thyspunt as the preferred site for Nuclear-1,[71] despite the fact that the Heritage Impact Assessment concluded that Thyspunt has exceptional archaeologic, palaeontologic, and wilderness value[72] and presents excessive difficulties for mitigation[73] and that the South African Heritage Resource Agency has uncategorically recommended that Thyspunt is not a suitable site for development.[74] Dr. Binnerman, an archaeological expert states that, "The archaeology of the coastal zone (5 km inland from the coast) is well-known and has been investigated in some detail by the author in the past. Heritage practitioners also conducted surveys along the adjacent coast for the proposed ESKOM Nuclear Power Station at Thyspunt. These studies indicate that the coastal zone from the Klasies River in the west to the Krom River in the east is one of the richest and most important archaeological cultural landscapes in South Africa."[75]

The Heritage Assessment repeatedly emphasizes the impossibility of constructing Nuclear-1 without extensive, irreversable impacts on heritage at Thyspunt.[76] Yet the EIA largely ignores this, recommending that Thyspunt be the preferred site. Despite the Heritage Assessment's unequivocal warnings that mitigation at Thyspunt is highly infeasible,[77] the Revised DEIR has included a "Heritage Mitigation Study" proposing a trial excavation in the Thyspunt site. The Heritage Assessment states that the archaeological preference is to preserve conservation *in-situ*, yet the EIA suggests a parallel system of construction of the nuclear station and excavation instead.[78]

As the projects stands currently, it may not go forward before Eskom has carried out its own proposed trial excavation to explore unknown aspects of the Thyspunt site to determine if there is an area where the development footprint will result in fewer impacts. However, the suitability of Thyspunt as a site for Nuclear-1 will not change whether something is found in the trial excavation or not because the value of Thyspunt lies in

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Generation III nuclear reactors possess enhanced safety features despite the fact that they are just beginning to enter the market and do not yet have a proven track record. *See* Revised DEIR Chapter 9, Impact Analysis, Limitations 9.2.1 & Emergency Response 9.23.

[71] Revised DEIR, Executive Summary.

[72] Revised DEIR, APP E20, Heritage Impact Assessment 4.3.

[73] Revised DEIR, APP E20, Heritage Impact Assessment 4.3; 5.1.3; 5.2.2 (c).

[74] Revised DEIR, APP E20, Heritage Mitigation Study, Introduction 1.

[75] Dr. Johan Binnerman, An Archaeological Desktop Study for the Constructio of the Proposed Tsitsikamma Community Wind Energy Facility, Kouga Local Municipality, Humansdorp District, Eastern Cape Province (March 2011).

[76] Revised DEIR, APP E20, Heritage Impact Assessment 3.1.1; 3.2.9; 3.2.10; 5.1.3.

[77] Revised DEIR, APP E20, Heritage Impact Assessment 4.3; 5.1.3; 5.2.2 (c).

[78] Revised DEIR, APP E20, Heritage Impact Assessment 5.1.2; Heritage Mitigation Study 1.1.1.

both its cultural heritage and high biodiversity – even if the NPS is built in an area of relatively fewer archaeological sites, it will still destroy the landscape and wilderness qualities of the area.[79] Further, cultural heritage as understood under the NHRA is not limited to artifacts and other physical vestiges of human society; rather, it is a holistic concept, encompassing all the relationships that existed within a certain geographical area.[80] As the HIA states, "The landscape, together with the archaeological sites it contains may be viewed as a single holistic entity, which retains the spatial patterning of human use of the landscape in a largely intact natural coastal environment that has not changed significantly since prehistoric times."[81] Thus, any approval of the project will be an unlawful administrative decision in violation of the National Heritage Resources Act s 5, NEMA s 2(4)(a)(iii) and PAJA s 6(2)(e)(iii) & (h).

A project approval at Thyspunt would also violate international law. Given that the Thyspunt site qualifies as a "cultural landscape" under the UNESCO World Heritage Convention, the state now has an obligation, under Article 4 of the treaty, to ensure "the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage referred to in Articles 1 and 2 . . . . to the utmost of its own resources and, where appropriate, with any international assistance and co-operation, in particular, financial, artistic, scientific and technical, which it may be able to obtain." Article 5 also require each State party to "take the appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection, conservation, presentation and rehabilitation of this heritage."

In addition to violating several statutes, pursuing the Thyspunt site also presents practical difficulties. The rich palaeontological and archaeological record at Thyspunt would require a large-scale scientific dig over the period of decades, far longer than during the proposed construction of the nuclear power station. A similar scope would be Klassies Rivers Mouth, which has been under continuous archaeological examination since 1960.[82]

**Conclusion**

It is submitted that the failure to properly assess the impacts referred to above creates a real risk that if the project is authorized it will infringing the environmental rights of both present and future generations. Further, the revised draft environmental impact assessment report does not place all relevant information that could materially influence the decision maker before it, and therefore a decision to authorise the construction of a nuclear power station based on this report would be open to legal challenge.[83]

Yours faithfully,
**LEGAL RESOURCES CENTRE**
**PER:**

**Angela ANDREWS**

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[79] *See* Revised DEIR, APP 20, Heritage Impact Assessment 3.2.9, 3.2.10.

[80] *See* National Heritage Resources Act s 1 (definition of "living heritage"), s 3(2).

[81] Revised DEIR, APP 20, Heritage Impact Assessment 2.3.2(c).

[82] See Archaeology Case Studies, Klasies River Caves, Association of Southern African Professional Archaeologists, at http://www.asapa.org.za/index.php/archeaology/case_studies/about_archaeology_klasies_river_caves/ [last accessed 27 July 2011].

[83] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000.

**Annexure C**

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Your Ref: Nuclear 1 DEA Ref. No.:12/12/20/944
Our Ref:

05 2015

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**RE: Revised Eskom Environmental Impact Assessment (DEA Ref. No.:12/12/20/944) for a Proposed Nuclear Power Station and Associated Infrastructure - Revised Draft Environmental Impact Assessment Report:**

We act for Earthlife Africa, Johannesburg. We enclose here our client's submission to the Revised Draft Environmental Impact Report ("Revised Draft EIAR") for the proposed Nuclear-1 Power Station (NPS). This submission is supported by:

Alternative Information and Development Centre,
GreenpeaceAfrica,
Christopher Wylde
Hermanus Ratepayers Association
Save Bantamsklip Campaign
Zwartkops Conservancy
South Durban Community Environmental Alliance
Pelindaba Working Group
CANE Northern Regions: Gauteng, NW Province, Mpumulanga, NP and Free State.
St Francis Bay Residents Association
Friends of St Francis Nature Areas (FOSTER)
Gamtkwa KhoiSan Council
First Indigenous Nation - Eastern Cape (FINEC)
Women's Energy and Climate Change Forum
Timberwatch
Mrs Cheron Kraak
Earthlife Africa Cape Town
Dr Caeleen McNaughton-Pascoe
Supertubes Surfing Foundation
St Francis Kromme Trust
Renee Royal,
Dr. A.E. Marshall

David Fig, and Earthlife Africa eThekwini.

A further list of supporting organisations, if any, will be forwarded to you in the course of the next few days.

***We refer to our submission to the Revised DEIR dated August 2013.***
***Many of the issues raised in this submission have not been addressed in the final EIR to our clients satisfaction. We request that this submission in its entirety is placed before the decision maker.***

***This submission will evaluate the final EIR against the legal requirements for such reports***. ***It is submitted that the Revised Draft EIR fails to place relevant considerations before the decision maker as is required by the Promotion of Administrative Justice Act No 3 of 2000 (PAJA) and violates several substantive provisions of the National Environmental Management Act No 107 of 1998 (NEMA) and the regulations passed thereunder (EIA Regulations).***

**1. Legal Context**

1.1 Promotion of Administrative Justice Act 3 of 2000:

S 6(2): "A court or tribunal has the power to judicially review an administrative action if . . .
(b) a mandatory and material procedure or condition prescribed by an empowering provision was not complied with; . . .
(e) the action was taken –
(iii) because irrelevant considerations were taken into account and relevant ones were not considered

1.2 The Constitution of the Republic of South Africa Act 108 of 1996:

S 24: Everyone has the right –
(a) to an environment that is not harmful to their health of well-being; and
(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
(i) prevent pollution and ecological degradation;
(ii) promote conservation; and
(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

S 195(1): Public administration must be governed by the democratic values and principles enshrined in the Constitution, including the following principles:
(b) Efficient, economic and effective use of resources must be promoted.

1.3 National Environmental Management Act (NEMA) and the Environmental Impact Assessment (EIA) Regulations:

Relevant provisions of these statutes will be referenced where applicable in the submission.

**2. Failure to assess socio-economic impacts of the proposed project violates NEMA and the EIA Regulations, read together with PAJA 6(2)(b).**

The final EIR does not address the concerns raised by Earthlife Africa under this heading and incorrectly quotes from our submission. The salient points of our submission are therefore repeated.

**Possible future benefits of the project**

The final EIR wrongly records our submissions. It states[1] "Your concern is that these costs are inter generational and you claim that future generations will not have benefitted from the generation of electricity from Nuclear 1…" No such statement was made in our submission. Reference was merely made to Western Cape Guidelines for economic expert reports in environmental impact assessments which require some reference to benefits in EIA's.

**Cumulative impacts**
Our submission stated that cumulative impacts of the project must be assessed. This is a requirement of the applicable regulations, (regulation 32 (k)(i) of GNR of 21 April 2006. Our reference to the applicable regulations being 2010 regulations was incorrect, and an oversight.

**Summary of issues not addressed**
The following issues raised in our submission were not addressed and remain key concerns. They are updated, summarized, and repeated for completeness. We request that the full letter is placed before the decision maker.

**Failure to assess socio-economic impacts of the proposed project violates NEMA and the EIA Regulations, read together with PAJA 6(2)(b).**

The final EIR does not assess these impacts. Instead it refers to a report on the costs of nuclear power. A statement of the estimated costs of the nuclear power plants does not equate to a socio economic impact assessment.

The legislative requirements in this regard are as follows. The EIR requires an assessment of each identified potentially significant impact, including cumulative impacts, extent and duration of impact, probability of impact, degree to which it can be reversed and mitigated (regulation (regulation 32 (k)(i) of GNR of 21 April 2006.)
Socio economic impacts are recognized as requiring assessment by virtue of the following provisions of NEMA. The preamble and principles laid out in section 2 of NEMA recognizes that sustainable development requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations. Section 23 of NEMA requires the actual and potential impacts on the environment, socio-economic conditions, and cultural heritage to be taken into account in environmental management. Regulations 32(1)(d) of the 2006 EIA require a description of the environment that may be affected by the activiey and the maner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity.

Added to this section 2(4)(b) of NEMA states that environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option. The best practicable environmental option is defined in section 1 of NEMA as the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.

Guidelines which have been promulgated have relevance to the proposed activity, and should be considered. IN 2005 Western Cape published guidelines hat determine how economists are to be involved in the EIA process.[2] The guidelines are very clear on what should be contained in an economic report. The guidelines state that the basic function of economic specialist input is to assist in the determination of whether a project will enhance the net social welfare. This involves considering the efficiency, equity and sustainability of the

[1] Letter to the Legal Resources Centre from Gibb

[2] Van Zyl, H.W., de Wit, M.P. & Leiman, A. 2005. *Guideline for involving economists in EIA processes: Edition 1.* CSIR Report No ENV-S-C 2005 053 G. Republic of South Africa, Provincial Government of Western Cape, Department of Environmental Affairs & Development Planning, Cape Town. These guidelines are relevant to the extent that the NPS will be built in the Western Cape.

project. Input from an economic specialist is especially required if there is a chance that economic impacts are likely to influence the decision of whether or not a project is desirable. The guidelines further state that macro-economic risks need to be taken into account. In fact they clearly state that where the size of the project is such that it could influence relative prices then further analysis is required to identify and assess potential risks. The guidelines go on to state that the report also needs to take into account the vulnerability of the groups impacted on. Part of the assessment should include a consideration of who benefits and who loses from the impacts associated with the project.

It is submitted that the legal context set out above mandates that the EIAR consider the economic impacts that the construction of the NPS will have on broader South Africa, rather than a focused report detailing the economic impacts on the local communities as was submitted by the EAP. Accordingly, the previous submission by Earthlife Africa[3] detailed the concerns with the Draft EIAR as follows:

a. the impact on the price of electricity of the expenditure of R120bn on a NPS and how this will affect consumers, particularly the poor;
b. the impact on household income and the taxpayer;
c. the economic impact of a catastrophic incident on adjacent communities;
d. the economic impact on all phases of the NPS's life including decommissioning which could be of the same order as commissioning;
e. an indication of the costs and benefits to assess the socio-economic impacts of the project;
f. the economic impacts of a major or serious accident;
g. waste storage costs (current and cumulative).

It is submitted that the failure to assess these impacts results in the infringement of the environmental rights set out in both the Constitution and NEMA. Our client is concerned that the costs involved in the construction and operation of the NPS will be passed on to electricity consumers, the majority of whom are from disadvantaged backgrounds, and that these costs will be intergenerational (which is problematic given that future generations will not have benefitted from the generation of electricity from the NPS).[4] Both the Constitution and NEMA make specific mention of the right to have the environment protected for the benefit of both present and future generations and that development should be sustainable. It is submitted that the assessment of the above socio economic impacts as well as the assessment of cumulative economic impacts[5] is required in order to ensure that these constitutional imperatives are complied with.

In spite of the legal framework which clearly mandates that these (macro-economic) impacts must be assessed, and in spite of the concerns having been voiced by various I&APs including Earthlife, these impacts have not been considered in the EIAR. Not only have these concerns been ignored in the revised drafts, but they were ignored in spite of the fact that the scoping report was accepted by DEAT subject to the condition that the economic study was required to address the cost implications of the proposed NPS in relation to other electricity generating activities[6] and in spite of the fact that the Plan of Study reiterated this by including the following criteria for the economic impact analysis:

> *"Impacts on poor (low income households), other households, fiscal impacts, balance of payment impacts and social impacts, cost implications of the proposed NPS in relation to other electricity generation activities as indicated in the long term mitigation strategy document".*[7]

The economic report itself acknowledges that *the NPS is such a large capital investment (equivalent to that of six times the capital investment in Gautrain) that the economic ripple effects will go far beyond its direct*

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[3] Submission by Earthlife Africa to the Director of the Department of Environmental Affairs on the Draft Environmental Impact Assessment Report. Dated 29 June 2010.

[4] NEMA s 1 (definition of "sustainable development").

[5] EIA Regulations 2010, regulation 22(i)(i).

[6] Letter from DEAT to Arcus Gibb dated 19/11/2008.

[7] Page 27, Plan of Study.

*boundaries*.[8] However, the response to Earthlife's comments shifts the responsibility of assessing the impact of increased electricity prices to the National Energy Regulator of South Africa ("NERSA"), and avoids the legislative requirement of assessing alternative forms of electricity generation, by stating that it is the purpose of the Integrated Resource Plan[9] ("IRP") to decide the relative contribution of various generation options to South Africa's overall electricity mix. What this response fails to acknowledge is that neither NERSA's electricity price increase process, nor the IRP constitute an equivalent mechanism for assessing the economic impacts of the project in the manner which the law suggests. Further, neither of these processes consider all the economic impacts that must be considered in the EIA, nor do they consider potential or cumulative economic impacts. It is submitted that it is a mistake to conflate these (NERSA and IRP) processes with the environmental impact assessment process and it is further submitted that doing so circumvents the requirements of NEMA.

In addition to the concerns canvassed in earlier submissions, it is submitted that it is not possible for the applicant to come into compliance with the EIA requirements for assessing the economic impacts of the project at this stage because of lack of certainty as to the specific type of plant, its design and safety mitigation features. Different types of nuclear power plants, and their safety mitigation features will generate different consequences in a major accident which will in turn result in different economic impacts. The monetary value of such economic impacts will also be different for different sites, based on issues such as population densities and the nature of the surrounding economy. Factors which may determine the range of impacts include:

a. fuel storage options including alternatives,
b. waste facilities and disposal methods,
c. number of containment hulls,
d. whether a core catcher is necessary (such technology is dependent on the type of design),
e. the emergency zones that need to be determined,
f. the source term,
g. possible cost overruns,
h. labour, expertise and material required etc.
i. the nature of the adjacent economy, and population densities eg types of agriculture undertaken
j. the extent of emergency zones

It is submitted that the cost of insurance against such impacts should be included as part of the economic impact assessment, given that it may be significant. Insurance against the consequences of nuclear accidents is usually excluded from household insurance. It is understood that the actual level of financial security and the manner in which it must be provided must be determined under the provisions of the National Nuclear Regulator Act No 47 of 1999. However, it is submitted the actual determination of the financial security is not equivalent to the assessment of the economic impact thereof. The failure to assess this impact constitutes a failure to properly comply with statutory requirements.

**Land use planning**

A final socio economic concern is the fact that the report fails to consider the impact on land use planning in the greater Cape Town metropolitan area of locating a further nuclear plant at Duynefontein, which is to the north of Cape Town. The city has a rapidly increasing demand for housing and is landlocked by mountains and ocean, placing pressure for development on the zone to the north of the city where Koeberg is situated. A further nuclear plant at this site will in all likelihood limit development in the area for a further 100 years. The socio economic impact of such a development, which may be significant has not been considered in the EIA.

As a result it is submitted that the report does not place all relevant socio economic information that could materially influence the decision maker before it and therefore a decision to authorise the construction of a

[8] Page 40, Economic Report, Revised DEIR APP E17 Economic Report.

[9] Government Gazette, No 34263, Vol 551, 6 May 2011.

nuclear power station based on this report would be open to legal challenge.[10]

**3. Failure to assess worst-case scenario impacts violates NEMA and the EIA Regulations, read together with PAJA 6(2)(b).**

EIA Regulation 31(2)(l) states that an environmental assessment report must include "an assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of an impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can be mitigated."[11] "Significant impact" is defined in the Regulations as "an impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment."[12] Under this definition, "significant impact" includes a catastrophic, worst-case scenario impact.

In addition, NEMA's repeated focus on minimisation, prevention, and mitigation of environmental degradation[13] mandates an assessment of the impacts of a severe accident because such an assessment will lead to better prevention and mitigation measures. The need to carefully consider catastrophe scenarios is particularly apparent in light of the recent Fukushima nuclear disaster. The plant, operated by Tokyo Electric Power Co. (TEPCO), was protected by a seawall 5.7 meters high but unprepared for the 14 meter waves that actually hit the plant after the earthquake. TEPCO's disaster projection scenarios for the plant had not considered the possibility of higher waves.[14]

The Revised DEIR fails to assess worst-case impacts. With regard to natural disasters, the EIR merely states the obvious, that an earthquake or flood may have a major negative impact on a nuclear power plant, rather than assessing the impacts that the nuclear power plant would have on the surrounding environment in the event of an earthquake or flood.[15] The emergency response report explicitly states, "The approach of this specialist report is different to the other specialist reports, in the sense that *it has not identified and assessed impacts*."[16] With regard to health impacts, the EIR merely estimates the *probability* of accidents caused by external forces ("Category C events") without assessing the *impacts* of such accidents, contrary to Regulation 31.

The response to this issue when raised at the Final Draft Environmental Impact Report stage was that severe accidents "fall firmly within the ambit of the NNR licensing process." [17] Such reliance, however, is misplaced as an NNR license cannot function as the equivalent of an environmental authorisation under NEMA 24L. NNR authorisation establishes safety standards under normal operating conditions;[18] it does not meet the requirements of NEMA 24(4)(a) to measure environmental *impacts*.

It is further submitted that not only does the Revised DEIR bypass the statutory requirement to assess all

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[10] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000.

[11] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2(l).

[12] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 1.

[13] NEMA s 2(4)(a)(i)–(iii), (vii), s 23(2)(a)–(b), s 24(1), (4)(b)(ii), (4A).

[14] *TEPCO details tsunami damage: Waves that hit Fukushima plant exceeded firm's worst-case projections*, Yomiuri Shimbun (Apr. 11, 2011), available at http://www.yomiuri.co.jp/dy/national/T110410003477.htm.

[15] Revised DEIR APP E4 Seismic Risk Assessment 4.1.1(a), (f); 4.1.2(a), (f); 4.1.3(a), (f); Revised DEIR APP E16 Oceanographic Assessment at 3.1.3, 3.2.3, 3.3.3, 4.1.5, 4.2.7.

[16] Revised DEIR, Chapter 9, Environmental Impact Analysis, Emergency Response, at 9.23 (emphasis added).

[17] Revised DEIR, APP IRR 45a Long Submission ELA Final, at 16.

[18] *See* National Nuclear Regulator Act Regulations, No. R. 388 (2006) s 3–5; National Nuclear Regulator Act 47 of 1999, ch 1 (definition of "action").

identified potentially significant impacts, which includes a worst-case analysis, it is actually impossible for the applicant to assess the impacts of a catastrophe in the absence of a final design. Eskom purports to base its assessments on a generic nuclear power station design,[19] using an "envelope" of data that includes the "highest possible values for various aspects for a range of different nuclear technology vendors,"[20] including Generation III reactors. But different systems will have different accident consequences. As stated above, in other words, a nuclear meltdown is not just a nuclear meltdown – rather, the specific effects of an accident will vary widely depending on factors such as the type of fuel used, the burnup rate of the fuel, and the safety mechanisms installed, all of which depend on the final design of the plant. Basing an assessment on "highest possible values" is not sufficient because the difference in impacts is not merely a matter of degree but also of quality and composition. Moreover, it is currently not possible to make generalisations about Generation III reactors as they are just beginning to enter the market and do not yet have a proven track record.[21]

**4. Failure to assess all potential impacts of nuclear waste violates NEMA and the EIA Regulations, read together with PAJA 6(2)(b).**

EIA Regulation 31(2)(l) states that the report must include "an assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of an impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can be mitigated."[22] "Significant impact" is defined in the Regulations as "an impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment."[23] Radioactive waste is certainly a "significant impact" under a common sense reading of the definition, and it has been identified as such by numerous public participants,[24] the DEA,[25] and the applicant itself.[26]

The applicant has failed to adequately assess the impacts of generating radioactive waste. First, the EIR does not assess the cumulative impacts of generating radioactive waste, in violation of EIA Regulation 31(2)(l). The impacts of the waste to be generated by Nuclear-1 must be analysed in light of the waste already generated by Koeberg Nuclear Power Station and in addition to other existing environmental stresses in the proposed sites.

Second, the EIR does not adequately analyse the nature, extent, duration, and probability of waste impacts and the degree to which they may cause irreversible damage. The EIR merely classifies each identified potential impact (such as water contamination) as "low," "medium," or "high," without any explanation as to the content of those labels and how it arrived at those conclusions. Such an "impact assessment" is meaningless and results in an incomplete EIR.

Third, the EIR does not assess the economic consequences of long-term waste disposal and storage.

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[19] *Id.*

[20] Revised DEIR, Chapter 9, Impact Analysis, Assumptions 9.2.2.

[21] *See* Advanced Nuclear Power Reactors, World Nuclear Association (June 2011), at http://www.world-nuclear.org/info/inf08.html [last accessed 28 July 2011] (discussing various types of Generation III reactors, only one of which is currently operating while others are still undergoing development, design certification, or construction).

[22] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2(l).

[23] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 1.

[24] Revised DEIR App D8 Combined IRR Volumes Final at 157–186.

[25] Letter from Ms. Joanne Yawitch, Deputy Director General of Environmental Quality and Protection, DEA, to Mr. Tim Liversage, Arcus Gibb (Nov. 19, 2008) (laying out conditions under which the scoping report was to be accepted, which included assessment of nuclear waste).

[26] Revised DEIR, Chapter 9, Impact Analysis 9.29 and APP E29.

Economic impacts are probably the most far-reaching potential impacts of waste management, as the consequences of waste extend to future generations and radioactive emissions can continue to thousands of years,[27] and the costs of constructing high level waste facilities are exorbitant. The proposed Yucca Mountain high level waste repository in the U.S. was estimated in 2006 to cost $23 billion, a 342% increase over the original estimate in 1984 (accounting for inflation).[28] The costs of permanent high level waste disposal is an extremely significant impact of nuclear waste; failure to mention such huge-scale impacts violates EIA Regulation 31(2)'s requirement that an EIR contain all information necessary for the authority to make a decision and PAJA's requirement that all relevant information be presented to the decisionmaker.

Fourth, and most alarmingly, the EIR has failed to identify the overheating of spent fuel rods as a potential impact of storing high level nuclear waste. The EIR proposes to store high level waste temporarily in spent fuel pools on-site.[29] These spent fuel pools pose grave safety risks because in the event of an accident, the rods could overheat, releasing radioactive gases and potentially causing a meltdown.[30] Overcrowding in spent fuel pools also poses risks as the pools become hotter and more radioactive.[31] The risk of overheating pools is particularly salient and urgent in light of the Fukushima nuclear disaster, in which a spent fuel pool overheated at Reactor No. 4 after cooling systems were knocked out by the earthquake and tsunami.[32] Indeed, the head of Areva's North American unit, Jacques Besnainou, stated, "One of the things we're discovering in Fukushima is leaving used fuel in . . . a spent fuel pool may not be a very wise decision."[33] Overcrowding is also a present danger, as the spent fuel rods at Koeberg have been re-racked to extend their operating capacity.[34]

The response to this issue when raised at the Final Draft Environmental Impact Report stage was, "The impacts of handling and storage of radioactive waste is a matter that is firmly within the ambit of the NNR and the newly established National Radioactive Waste Disposal Institute."[35] However, the EIA Regulations clearly list the "construction of facilities or infrastructure for . . . the **storage and disposal of nuclear fuels**" as an activity requiring an EIA[36] and thus also within the ambit of NEMA. The response goes on merely to repeat that no solution has been found for long-term storage of high level waste and that it will be stored indefinitely onsite, unresponsive to any of the issues above.

It is further submitted that just as it is impossible for the applicant to assess socio-economic and worst-case

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[27] *See* Revised DEIR, APP E29 Waste Assessment 5.2.2;

[28] *See* Marvin Resnikoff et. al., *The Hazards of Generation III Reactor Fuel Wastes: Implications for Transportation and Long Term Management of Canada's Used Nuclear Fuel*, GREENPEACE CANADA 35 (May 2010), *available at* http://www.greenpeace.org/canada/Global/canada/report/2010/5/nuclear/GP_REACTOR_FUEL_REPORT_MAY2010.pdf.

[29] Revised DEIR APP E29 Waste Assessment 5.5.2.

[30] *See* Union of Concerned Scientists, Nuclear Power, Safer Storage of Spent Nuclear Fuel, at http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/safer-storage-of-spent-fuel.html (last accessed 8 July 2011).

[31] Robert Alvarez, *Spent Nuclear Fuel Pools in the U.S: Reducing the Deadly Risks of Storage, Institute for Policy Studies* (May 2011), available at http://www.ips-dc.org/reports/spent_nuclear_fuel_pools_in_the_us_reducing_the_deadly_risks_of_storage [last accessed 21 July 2011].

[32] *E.g.*, Hiroko Tabuchi et al, "Spent Fuel Hampers Efforts at Japanese Nuclear Plant," N.Y. Times (March 23, 2011) at A14.

[33] *Update 2 –Areva Sees U.S. Nuclear Waste Recycling Planning by '15*, REUTERS AFRICA (June 6, 2011).

[34] Nuclear Waste, NECSA, at http://www.necsa.co.za/Necsa/Nuclear-Technology/Nuclear-Waste-442.aspx [last accessed 21 July 2011].

[35] Revised DEIR, APP IRR 45a Long Submission ELA Final, at 8.

[36] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Listing Notice 2, Appendix 1.

impacts in the absence of a final design,[37] it is also impossible to assess waste impacts in the absence of one. The impacts of radioactive waste will vary depending on the composition of the waste, which depends on the type of fuel used and burnup rate, which in turn depend on the reactor design. The cursory categorisation of potential waste impacts (such as contamination of water) as "low," "medium," or "high," without any explanation as to how it may affect the environment, public health, and agriculture, is unlawful but also unsurprising given that the composition of the waste is unknown.

**5. Failure to adequately assess project alternatives and a no-go option violates NEMA and the EIA Regulations, read together with PAJA 6(2)(b), and places false information in front of the decisionmaker in violation of PAJA 6(2)(e)(iii).**

Regulation 31 of the EIA Regulations requires an assessment and comparison of potential alternatives to the proposed activity.[38] "Alternatives" is defined in the Regulations as "different means of meeting the general purpose and requirements of the activity, which may include alternatives to . . . the type of activity to be undertaken . . . and the option of not implementing the activity."[39] NEMA s 24 also requires every application for an environmental authorisation to include an investigation of alternatives to the activity, including the option of not implementing the activity.[40] The duty of the applicant is to submit "all information necessary for the competent authority to consider the application and reach a decision,"[41] and the duty of the decisionmaker is to then choose the "best practicable environmental option,"[42] the one that "provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term."[43]

Guidelines from the U.S. Nuclear Regulatory Commission (NRC) prove helpful in interpreting what it means to assess alternatives and the option of not implementing the activity (no-go option). NRC guidance calls for investigating alternatives to meet the energy demand that do not require building new capacity, such as purchasing from another utility or initiating energy conservation measures that would avoid the need for the plant.[44] It also calls for consideration of several other energy sources, including wind, geothermal, hydropower, and solar, even if they are considered non-competitive options.[45]

The Revised DEIR has not adequately assessed project alternatives and the no-go option. The EIR simply lists some energy sources in a table,[46] without any analysis of their impacts or the significance of those impacts, and cites the lack of base load capacity as justification for not evaluating other energy sources. Missing from Eskom's analysis is an investigation of ways to meet energy demand without generating new capacity or ways to generate the shortfall from other sources. In other words a true comparison of the various alternatives. With regard to the no-go option, the EIR simply states that the no-go alternative is not a feasible

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[37] See discussion *supra* p. 4.

[38] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2(g), (i).

[39] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 1, s 1, subsec 1.

[40] NEMA s 24(4)(b)(i).

[41] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2.

[42] NEMA s 2(4)(b).

[43] NEMA s 1 (definition of "best practicable environmental option").

[44] *See* Environmental Protection Agency, Office of Enforcement and Compliance, EPA Publication 315-X-08-001, § 309 Reviewers Guidance for New Nuclear Power Plant Environmental Impact Statements (Sept. 2008) at 14.1.1, 14.1.2, available at http://epa.gov/compliance/resources/policies/nepa/309-reviewers-guidance-for-new-nuclear-power-plant-EISs-pg.pdf (last accessed 18 June 2011).

[45] *Id.*

[46] Revised DEIR, Chapter 5, Project Alternatives, 5.3.1 Nuclear Generation Alternatives.

or realistic alternative,[47] despite the fact that the government included a no-nuclear scenario in the IRP2 that is cost-effective and provides security of supply.[48]

The report's conclusions about project alternatives and the no-go option not only violate substantive requirements to assess them under NEMA and the EIA Regulations but are also inaccurate. The finalised Integrated Resource Plan (IRP2) included no-nuclear scenarios that are cost-effective and provide security of supply.[49] Thus, the IRP2 shows that base load is not an issue in pursuing a nuclear-free energy plan. In addition, the IRP2 stated that after taking into account the fact that new energy technology costs would decrease over time and that nuclear would be 40% more expensive that originally projected, the cost-optimal output from the model did not include nuclear at all.[50] Thus, not only is a no-nuclear scenario feasible and secure, it is actually the most cost-effective option.

The applicant has not only failed to assess project alternatives and a no-go option, but has inaccurately concluded that alternatives and a no-go option are simply not viable. In addition to violating substantive provisions of NEMA and the EIA Regulations, the applicant here has put irrelevant information in front of the decisionmaker in violation of PAJA 6(2)(e)(iii), and any decision taken on the basis of such information will be unlawful.

Further, the report suggests that Eskom has usurped the role of the decisionmaker, deciding for itself which option is best and that the no-go option is not a viable one. Removing options from consideration also precludes the decisionmaker from choosing the best practicable environmental option as required by NEMA. When this issue was raised at the Final Draft Environmental Impact Report stage, applicant asserted that the IRP2, which chose to commit to 9600MW of nuclear, obviates any need to investigate alternative forms of power generation and the no-go option in the EIR because it has already established the optimal energy mix.[51] However, such rigid adherence to policy in making an administrative decision fetters the decisiomaker's discretion in violation of PAJA. While policies in keeping with the empowering legislation may be used to assist decisionmaking, they may not inevitably determine the outcome of the decision, lest they "preclude the person exercising the discretion from bringing his mind to bear in a real sense on the particular circumstances of each and every individual case coming up for decision."[52]

The IRP2 includes feasible no-nuclear scenarios[53] that are cost effective and provide security of supply, showing that the decision to pursue nuclear energy is not an inevitability but a policy decision. The applicant, however, falsely asserts that the no-go option is not viable and attempts to hide behind policy (the IRP2) to bypass the statutory requirements of NEMA.

**6. General failure to place relevant considerations in front of the decisionmaker violates PAJA 6(2)(e)(iii).**

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[47] Revised DEIR, Chapter 9, Impact Analysis, 9.33.12.

[48] Integrated Resource Plan for Electricty 2010–2030, GNR 400 GG 34263 of 6 May 2011, at 38–45.

[49] Integrated Resource Plan for Electricity 2010–2030, GNR 400 GG 34263 of 6 May 2011, at p. 18, 6.9.1, 6.9.4 ("If new renewable generation capacities should fail to reach their forecast performance in terms of full-load hours, this will increase total costs. It will, however, not affect other dimensions like security of supply, since solar PV is completely backed up with conventional, dispatchable generation and wind power is backed up to a large extent."); *id.* at p. 39, B.30.

[50] *See* Integrated Resource Plan for Electricity 2010–2030, GNR 400 GG 34263 of 6 May 2011, at 38–39, paras. B.23, B.25, B.27, B.30.

[51] Revised DEIR, APP IRR 45a Long Submission ELA Final, at 19–20.

[52] *Richardson v Administrator, Transvaal* 1957 (1) SA 521 (T) at 530.

[53] Integrated Resource Plan for Electricty 2010–2030, GNR 400 GG 34263 of 6 May 2011, at 38–45.

Failures to assess socio-economic impacts, worst-case scenario impacts, waste impacts, a no-go option, and project alternatives, in addition to violating substantive provisions of NEMA and the EIA Regulations, also amount to withholding relevant information from the decisionmaker in violation of PAJA 6(2)(e)(iii).

Because of NEMA's repeated emphasis on the integrated nature of environmental management, the socio-economic impacts of the NPS (most notably the impact on electricity prices and the economic fallout from a disaster) is relevant information that must be brought before a decisionmaker. Because NEMA places such a high premium on minimisation of impacts and investigation of mitigation, a worst-case scenario analysis is also clearly relevant information, as it will bring to light the full extent of potential impacts and all possible safety measures.[54] Because of NEMA's life cycle and intergenerational provisions, waste impacts are also relevant. Assessment of project alternatives and a no-go option are relevant because NEMA and the EIA Regulations have specified them as such.[55] Any approval made without such information will be one in which relevant factors were not considered.

**7. Approving the NPS in the absence of a long-term solution to the problem of high level nuclear waste is unlawful.**

This EIR acknowledges that no long term solution currently exists for the disposal of high level nuclear waste.[56] Storage of high level waste in spent fuel pools, which the applicant proposes to do, is only an interim solution[57] and one whose safety has been questioned in the aftermath of the Fukushima disaster. The Waste Assessment makes no projection of the costs of this interim storage or any mention of research and development that will be invested in finding a solution.

Approving such a project will violate NEMA's life cycle[58] and intergenerational provisions.[59] Without knowing the project's full life cycle consequences or the costs of long-term waste storage, the decisionmaker will be unable to determine whether the applicant is able to bear responsibility for the project throughout its life cycle (because it is unknown) and whether the project will pose an undue burden on future generations.

Approval will also violate international standards, which state that no "undue burden" be placed on future generations[60] and every country should have a national policy and strategy in place for the management of radioactive waste.[61] While the Revised DEIR refers to the National Radioactive Management Policy and Strategy of 2005 and the National Radioactive Waste Disposal Institute Act of 2008, such policies do not meet international best practice as they do not identify the ultimate disposal end point for high level waste.[62] The National Radioactive Management Policy and Strategy does not identify an ultimate disposal end point, merely stating that "Government shall ensure that investigations are conducted within set timeframes to consider the various options for safe management of used fuel and high level radioactive wastes in South Africa."[63] The National Radioactive Waste Disposal Institute Act also does not provide a long-term solution;

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[54] *See supra* Section (b)(ii) at p. 13–15 & n. 30.

[55] NEMA s 24(b)(ii); EIA Regulation 31(g), 1 (definition of "alternatives").

[56] Revised DEIR, Chapter 9, Impact Analysis, 9.29.6; Revised DEIR APP E29 Waste Assessment, 2.2.10.

[57] National Radioactive Waste Management Policy and Strategy (2005) at 13.1.

[58] NEMA s 2(4)(e).

[59] NEMA s 1 (definition of "sustainable development").

[60] International Atomic Energy Agency, *Policies and Strategies for Radioactive Waste Management*, Chapter 4, Principles for Establishing a Policy and Strategy, at 8 (2009).

[61] International Atomic Energy Agency, *Policies and Strategies for Radioactive Waste Management*, Chapter 1, Introduction, at 3 (2009).

[62] International Atomic Energy Agency, *Policies and Strategies for Radioactive Waste Management*, Chapter 11, Strategy Formulation and Implementation, at 41 (2009) ("If long term storage is considered within the strategy, the ultimate intended disposal end point should nevertheless be indicated.").

its purpose is limited to establishing an agency to manage radioactive waste,[64] which the Revised DEIR acknowledges has not yet been formally constituted.[65]

**8. Approving the NPS in the absence of a final project design is unlawful.**

Eskom has chosen to conduct an EIA before settling on a plant type and admits that "detailed descriptions of the proposed plant are not available."[66] Thus, it has decided to assess a generic nuclear power station design for the EIA process,[67] using an "envelope" of data that includes the "highest possible values for various aspects for a range of different nuclear technology vendors,"[68] including Generation III reactors.

While the EIA regulations do not explicitly require a project design as part of the application,[69] one is necessary in order to meaningfully fulfill its requirements. Without one, it is impossible to specifically and accurately assess the impacts the development will have on the surrounding environment. Absence of a final design precludes a proper impact assessment of not only socio-economic, worst-case, and waste impacts but of all impacts. Mitigation and safety measures, in turn, are also vague and based on inadequate information. Further, a meaningful choice cannot be made between the three proposed sites on the basis of such scanty information.

The pointlessness of conducting an EIA without first deciding on a project design is evident from the superficial treatment given to potential impacts and mitigation measures throughout the Revised DEIR.[70] Even where proposed measures are more detailed, such as the emergency planning zones (EPZs),[71] without a final design it is unclear how such measures were determined and whether they are justifiable. An EIR of such scanty analysis amounts to a failure to assess impacts and investigate mitigation measures as required by the EIA Regulations and NEMA.

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[63] Radioactive Waste Management Policy and Strategy for the Republic of South Africa, Department of Minerals and Energy, at 13.1 (2005).

[64] National Radioactive Waste Disposal Institute Act 53 of 2008.

[65] Revised DEIR, Chapter 9, Impact Analysis, 9.29.6.

[66] Revised DEIR, Chapter 3, Project Description 3.5.

[67] *Id.*

[68] Revised DEIR, Chapter 9, Impact Analysis, Assumptions 9.2.2.

[69] Compare UK regulations, which require environmental statements to contain "a description of the development comprising information on the site, ***design***, and size of the development." Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999, Regulation 2(1) (definition of "environmental statement") & Schedule 4, Part II (1) (emphasis added).

[70] *See, e.g.*, Revised DEIR, Chapter 9, Impact Analysis, Impacts on Flora and Ecosystem Functioning, Duynefontein, 9.10.1(a) ("the primary dunes ***may*** be impacted, ***depending on what coastal setback is created***") (emphasis added); Revised DEIR, APP E29, Waste Assessment, 8.2, 8.3, 8.4, Table 8-1 (superficial assessment of the impacts of radioactive waste, without any explanation as to how it came to its conclusions); Revised DEIR, Chapter 9, Impact Analysis, Impacts of Nuclear and non-nuclear waste, Mitigation 9.29.7 ("high level waste management system must be designed to safely manage and hold all high level waste and spent fuel"); Revised DEIR, Chapter 9, Impact Analysis, Impacts on Terrestrial Vertebrate Fauna, Mitigation, 9.13.5 ("reduce number of roads and tracks and place them carefully").

[71] Eskom has proposed emergency planning zones of 800m and 3km, based on little more than an assertion that Generation III nuclear reactors possess enhanced safety features despite the fact that they are just beginning to enter the market and do not yet have a proven track record. *See* Revised DEIR Chapter 9, Impact Analysis, Limitations 9.2.1 & Emergency Response 9.23.

In addition, such an inadequate EIR will constitute a grand failure to place relevant factors in front of the decisionmaker. If the regulator does not get specific, meaningful analysis on the potential impacts of the NPS in each proposed site, he or she will be unable to choose the right site or proper levels of mitigation. Any authorisation based on this EIR will be an unlawful one, as none of the factors identified as relevant under NEMA and the EIA Regulations have been properly assessed. Insofar as the lack of a project design precludes adequate assessment of impacts and mitigation measures, conducting an EIA before choosing a design is premature.

**9. The Thyspunt site is not a viable one for the Nuclear-1 project.**

The Revised DEIR identifies Thyspunt as the preferred site for Nuclear-1,[72] despite the fact that the Heritage Impact Assessment concluded that Thyspunt has exceptional archaeologic, palaeontologic, and wilderness value[73] and presents excessive difficulties for mitigation[74] and that the South African Heritage Resource Agency has uncategorically recommended that Thyspunt is not a suitable site for development.[75] Dr. Binnerman, an archaeological expert states that, "The archaeology of the coastal zone (5 km inland from the coast) is well-known and has been investigated in some detail by the author in the past. Heritage practitioners also conducted surveys along the adjacent coast for the proposed ESKOM Nuclear Power Station at Thyspunt. These studies indicate that the coastal zone from the Klasies River in the west to the Krom River in the east is one of the richest and most important archaeological cultural landscapes in South Africa."[76]

The Heritage Assessment repeatedly emphasizes the impossibility of constructing Nuclear-1 without extensive, irreversable impacts on heritage at Thyspunt.[77] Yet the EIA largely ignores this, recommending that Thyspunt be the preferred site. Despite the Heritage Assessment's unequivocal warnings that mitigation at Thyspunt is highly infeasible,[78] the Revised DEIR has included a "Heritage Mitigation Study" proposing a trial excavation in the Thyspunt site. The Heritage Assessment states that the archaeological preference is to preserve conservation *in-situ*, yet the EIA suggests a parallel system of construction of the nuclear station and excavation instead.[79]

As the projects stands currently, it may not go forward before Eskom has carried out its own proposed trial excavation to explore unknown aspects of the Thyspunt site to determine if there is an area where the development footprint will result in fewer impacts. However, the suitability of Thyspunt as a site for Nuclear-1 will not change whether something is found in the trial excavation or not because the value of Thyspunt lies in both its cultural heritage and high biodiversity – even if the NPS is built in an area of relatively fewer archaeological sites, it will still destroy the landscape and wilderness qualities of the area.[80] Further, cultural heritage as understood under the NHRA is not limited to artifacts and other physical vestiges of human society; rather, it is a holistic concept, encompassing all the relationships that existed within a certain geographical area.[81] As the HIA states, "The landscape, together with the archaeological sites it contains may be viewed as a single holistic entity, which retains the spatial patterning of human use of the landscape

[72] Revised DEIR, Executive Summary.

[73] Revised DEIR, APP E20, Heritage Impact Assessment 4.3.

[74] Revised DEIR, APP E20, Heritage Impact Assessment 4.3; 5.1.3; 5.2.2 (c).

[75] Revised DEIR, APP E20, Heritage Mitigation Study, Introduction 1.

[76] Dr. Johan Binnerman, An Archaeological Desktop Study for the Constructio of the Proposed Tsitsikamma Community Wind Energy Facility, Kouga Local Municipality, Humansdorp District, Eastern Cape Province (March 2011).

[77] Revised DEIR, APP E20, Heritage Impact Assessment 3.1.1; 3.2.9; 3.2.10; 5.1.3.

[78] Revised DEIR, APP E20, Heritage Impact Assessment 4.3; 5.1.3; 5.2.2 (c).

[79] Revised DEIR, APP E20, Heritage Impact Assessment 5.1.2; Heritage Mitigation Study 1.1.1.

[80] *See* Revised DEIR, APP 20, Heritage Impact Assessment 3.2.9, 3.2.10.

[81] *See* National Heritage Resources Act s 1 (definition of "living heritage"), s 3(2).

in a largely intact natural coastal environment that has not changed significantly since prehistoric times."[82] Thus, any approval of the project will be an unlawful administrative decision in violation of the National Heritage Resources Act s 5, NEMA s 2(4)(a)(iii) and PAJA s 6(2)(e)(iii) & (h).
A project approval at Thyspunt would also violate international law. Given that the Thyspunt site qualifies as a "cultural landscape" under the UNESCO World Heritage Convention, the state now has an obligation, under Article 4 of the treaty, to ensure "the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage referred to in Articles 1 and 2 . . . . to the utmost of its own resources and, where appropriate, with any international assistance and co-operation, in particular, financial, artistic, scientific and technical, which it may be able to obtain." Article 5 also require each State party to "take the appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection, conservation, presentation and rehabilitation of this heritage."

In addition to violating several statutes, pursuing the Thyspunt site also presents practical difficulties. The rich palaeontological and archaeological record at Thyspunt would require a large-scale scientific dig over the period of decades, far longer than during the proposed construction of the nuclear power station. A similar scope would be Klassies Rivers Mouth, which has been under continuous archaeological examination since 1960.[83]

**Conclusion**

It is submitted that the failure to properly assess the impacts referred to above creates a real risk that if the project is authorized it will infringing the environmental rights of both present and future generations. Further, the revised draft environmental impact assessment report does not place all relevant information that could materially influence the decision maker before it, and therefore a decision to authorise the construction of a nuclear power station based on this report would be open to legal challenge.[84]

Yours faithfully,
**LEGAL RESOURCES CENTRE**
**PER:**

**Angela ANDREWS**

[82] Revised DEIR, APP 20, Heritage Impact Assessment 2.3.2(c).

[83] See Archaeology Case Studies, Klasies River Caves, Association of Southern African Professional Archaeologists, at http://www.asapa.org.za/index.php/archeaology/case_studies/about_archaeology_klasies_river_caves/ [last accessed 27 July 2011].

[84] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000.

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LRC
Legal Resources Centre

Your Ref: Nuclear 1 DEA Ref. No.:12/12/20/944

Our Ref: AA

9th December 2015

GIBB Public Participation Office,
Nuclear-1 EIA,
P.O. Box 35007
Menlo Park,
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Att: Elizabeth Nortje

By email: nuclear1@gibb.co.za/ nuclear-1@gibb.co.za

**RE:**
**Revised Draft Environmental Impact Assessment Report Version 2 for the Eskom Nuclear Power Station and Associated Infrastructure (Nuclear-1) - DEA Ref. No: 12/12/20/944[1] ("Version 2 of the RDEIA report") for a Proposed Nuclear Power Station and Associated Infrastructure.**

We act for Earthlife Africa, Johannesburg and Greenpeace Africa. We submit our clients' comments on Version 2 of the Revised Draft Environmental Impact Assessment Report (**Version 2 of the RDEIA report**) for the proposed Nuclear-1 Power Station (**NPS**).
We are assisted in making this submission by Dr Mark Chernaik PhD[2], and Professor Stephen Thomas.[3] (See: expert submission by Professor Thomas attached to this submission.)

1. We refer to the submission made by us on behalf of our clients dated 5th August 2011 in response to the publication for comment of Version 1 of the revised RDEIA report. Many of the issues raised in that submission have not been addressed in Version 2 of the RDEIA report. These deficiencies will be

[1] Gibb Pty Ltd August 2015

[2] Staff Scientist, E Law (Environmental Law Alliance World Wide), Eugene, Oregon, USA

[3] Professor of Energy Policy, Public Services International Research Unit (PSIRU), Business School, University of Greenwich 30 Park Row London SE10 9LS UK

addressed in the present submission. They are updated, summarized, and repeated where necessary for completeness. We request that this entire letter is placed before the decision maker.

2. It is submitted that Version 2 of the RDEIA report fails to place material relevant considerations before the decision maker as is required by the Promotion of Administrative Justice Act[4] No (**PAJA**)[5] and violates several substantive provisions of the National Environmental Management Act[6] (**NEMA**) and applicable regulations promulgated thereunder.[7] As such it does not comply with the regulatory requirements for the granting of an authorization under section 24 of NEMA and should such authorization be granted it stands to be reviewed and set aside by the High Court,

The following issues raised in our submission were not addressed and remain key concerns.

**FAILURE TO ASSESS ECONOMIC AND SOCIO-ECONOMIC IMPACTS OF THE PROPOSED PROJECT VIOLATES NEMA AND THE EIA REGULATIONS, READ TOGETHER WITH PAJA 6(2)(B).**

**Possible future benefits of the project**

3. Version 2 of the RDEIA report does not address the concerns raised by Earthlife Africa under this heading and incorrectly quotes from, and responds to our submission. It states[8] "Your concern is that these costs are inter generational and you claim that future generations will not have benefited from the generation of electricity from Nuclear 1…" "In view of the fact that Nuclear 1 is meant to address both growth in electricity demand and to replace existing ageing coal fired power stations. It is difficult to understand your conclusion that future generations would derive no benefit from electricity to be generated by Nuclear 1." What this response fails to recognize is that the costs of disposal of nuclear waste will be borne by future generations for thousands of years. The power stations will only be supplying electricity to the country for the next sixty to a hundred years. Generations after this period will not have received any benefit for the debt they must service.

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[4] 3 of 2000

[5] S 6(2): "A court or tribunal has the power to judicially review an administrative action if . . .

(b) a mandatory and material procedure or condition prescribed by an empowering provision was not complied with; . . .
(e) the action was taken –
(iii) because irrelevant considerations were taken into account and relevant ones were not considered

[6] 107 of 1998

[7] EIA Regulations 2006, GNR 385 GG 28753 of 21 April 2006 ("2006 EIA Regulations")

[8] Letter to the Legal Resources Centre from Gibb dated 5th August 2015, response 4 on page 5

4. Version 2 of the RDEIA report does not assess some of the most important and far reaching economic and socio-economic impacts of the project, despite these having been drawn to the attention of Eskom in our clients' comments on Version 1 of the RDEIA report. These include the economic impact of a worst case scenario radiation release, (see paragraphs 21 onwards, below). Also the impact on electricity price increases due to the cost of the nuclear build program and its impact on vulnerable and disadvantaged communities. Instead it submits a report on the costs of nuclear power, endeavoring to argue that these costs are competitive with other technologies. A statement of the estimated costs of the nuclear power plants does not equate to an economic or socio-economic impact assessment.
5. The assessment of costs submitted is in any event flawed. We annex an expert report by Professor S Thomas which disputes the basis given for these cost estimates. The figures are about 20% of the forecast of the costs estimated by the UK government and about 33% of the costs forecast by the USA government. (See annexure "Critique of Affordability of nuclear power and impact on electricity prices: Professor S Thomas November 2015.") We include an excerpt from this report:

> "First, figures are presented from the (version 2 of the RD)EIR and from the UK and US governments as authoritative when in practice, they are based on little or no experience. The projected cost of nuclear for South Africa is aboutR470/MWh or, at exchange rates of Nov 2 2015, £22/MWh or$34.78/MWh. These figures are about 20% of the figure forecast by the UK government (£100/MWh) and about 33% of that forecast by the US government ($108/MWh). Despite these huge discrepancies, no explanation is given as to how this remarkable cost reduction will be achieved. South Africa will be buying any nuclear power plants it purchases from the same world market as UK and US so it is hard to see how South Africa will be able to buy so much more cheaply than the UK and US, countries with far more experience of nuclear power than South Africa. The cost reduction is all the more remarkable given that costs in UK and US are as low as forecast because the plants planned for UK and USA will receive sovereign loan guarantees by the UK and US governments, both of whom have much higher credit rating than South Africa. This will make the cost of borrowing, a major determinant of nuclear costs, in UK and US much lower than is likely to be possible in South Africa."[9]

And in conclusion:

> "The conclusion drawn in the draft EIA is as follows: 'These figures indicate that coal-fired electricity and nuclear power have comparable costs in South Africa and the USA, but that nuclear is cheaper than coal in the UK and the USA, particularly if modern coal technologies (e.g Carbon

[9] id page 1

Sequestration and Control or Integrated Gasification Combined Cycle) that reduce greenhouse gas emissions are used.' There is therefore no basis for this conclusion and the omission of any reference to the 3-5-fold discrepancy between the US and UK nuclear costs is glaring."[10]

6. Version 2 of the RRDEIA report submits such cost estimates without justification or authority and as such these constitute irrelevant considerations that should be disregarded by the decision maker.[11]

**Legislative context and duty to assess economic impacts.**

7. The argument made in Version 2 of the RDEIA report that "it is not the purpose of the EIA process to deal with the impact of electricity prices and make a recommendation on this issue to the environmental decision maker"[12] is incorrect. The legislative requirements in this regard are as follows:
8. The EIA report requires an assessment of each identified potentially significant impact, including cumulative impacts, extent and duration of impact, probability of impact, degree to which it can be reversed and mitigated.[13]
9. Socio economic impacts are recognized as requiring assessment by virtue of the following provisions of NEMA. The preamble and principles laid out in section 2 of NEMA recognizes that sustainable development requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations. Section 23 of NEMA requires the actual and potential impacts on the environment, socio-economic conditions, and cultural heritage to be taken into account in environmental management. Regulations 32(1)(d) of the 2006 EIA regulations requires a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity.
10. Added to this section 2(4)(b) of NEMA states that environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option. The best practicable environmental option is defined in section 1 of NEMA as the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.
11. Guidelines published in 2005 by the Provincial Government of the Western Cape determine how economists are to be involved in the EIA process, and are

[10] id page 2

[11] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000

[12] Version 2 DEIA report 2 Table 7-22 Common thematic issues and responses page 7-64

[13] 2006 EIA Regulations, regulation 32 (k)(i)

clearly a relevant consideration.[14] They stated that the basic function of economic specialist input is to assist in the determination of whether a project will enhance the net social welfare. This involves considering the efficiency, equity and sustainability of the project. Input from an economic specialist is especially required if there is a chance that economic impacts are likely to influence the decision of whether or not a project is desirable. The guidelines further state that macro-economic risks need to be taken into account. In fact they clearly state that where the **size of the project is such that it could influence relative prices then further analysis is required to identify and assess potential risks[15].** The guidelines go on to state that the report also needs to take into account the vulnerability of the groups impacted on. Part of the assessment should include a consideration of who benefits and who loses from the impacts associated with the project.

12. It is submitted that the legal context set out above requires the EIA report to consider the economic impacts that the construction of the NPS will have on broader South Africa and in particular the following aspects which were listed in our clients' submission to Version 1 of the RRDEIA report.
    a. the impact on the price of electricity of the expenditure of R120bn on a NPS and how this will affect consumers, particularly the poor;
    b. the impact on household income and the taxpayer;
    c. the economic impact of a catastrophic incident on adjacent communities;
    d. the economic impact on all phases of the NPS's life including decommissioning which could be of the same order as commissioning;
    e. an indication of the costs and benefits to assess the socio-economic impacts of the project;
    f. the economic impacts of a major or serious accident on the broader community of Cape Town and environs;
    g. waste storage costs (current and cumulative).
13. It is submitted that the failure to assess these impacts results in the infringement of the environmental rights set out in both the Constitution and NEMA. Our client is concerned that the costs involved in the construction and operation of the NPS will be passed on to electricity consumers, including those from disadvantaged backgrounds, and will be intergenerational for thousands of years, being visited on future generations long after these plants have been decommissioned and who therefore have not had any benefit from them.[16] Both the Constitution and NEMA make specific mention of the right to have the environment protected for the benefit of both present and future generations and that development should be sustainable. It is submitted that the assessment of the above socio-economic impacts as well as the assessment

[14] Van Zyl, H.W., de Wit, M.P. & Leiman, A. 2005. *Guideline for involving economists in EIA processes: Edition 1*. CSIR Report No ENV-S-C 2005 053 G. Republic of South Africa, Provincial Government of Western Cape, Department of Environmental Affairs & Development Planning, Cape Town. These guidelines are relevant to the extent that the NPS will be built in the Western Cape.

[15] id page 35

[16] NEMA s 1 (definition of "sustainable development").

of cumulative economic impacts[17] is required in order to ensure that these constitutional imperatives are complied with.

14. In addition to the concerns canvassed in earlier submissions, we reiterate that it is not possible for the applicant to come into compliance with the EIA requirements for assessing the economic impacts of the project at this stage because of lack of certainty as to the specific type of plant, its design and safety mitigation features. Different types of nuclear power plants, and their safety mitigation features will generate different consequences in a major accident which will in turn result in different economic impacts. The monetary value of such economic impacts will also be different for different sites, based on issues such as population densities and the nature of the surrounding economy. Factors which may determine the range of impacts include:
    a. fuel storage options including alternatives;
    b. waste facilities and disposal methods;
    c. number of containment hulls and their quality;
    d. whether a core catcher is implemented (such technology is dependent on the type of design);
    e. the emergency zones that need to be determined;
    f. the source term;
    g. possible cost overruns;
    h. labour, expertise and material required etc;
    i. the nature of the adjacent economy, and population densities e.g. types of agriculture undertaken;
    j. the extent of emergency zones

**Cumulative impacts**

**15.** Our submission stated that cumulative impacts of the project must be assessed. This is a requirement of the applicable regulations[18], Our reference to the applicable regulations being 2010 regulations was incorrect, and an oversight. Version 2 of the RDEIA report incorrectly states that such cumulative impacts do not need to be assessed

**Land use planning**

16. Our clients submitted in comments on Version 1 of the RDEIA report that the impact on land use planning in the greater Cape Town metropolitan area, of locating further nuclear plants at Duynefontein, which is to the north of Cape Town had not been assessed.
17. In response Version 2 of the RDEIA report states that new designs for reactors would reduce the evacuation zone in all likelihood and "should the emergency planning zones for the Koeberg Nuclear Power station continue to exist, the

[17] 2006 EIA Regulations, regulation 32 (k)(i),

[18] id

EPZ's for nuclear -1 would therefore have no impact on spatial planning or expansion of the city of Cape Town also on the West Coast corridor."[19]

18. This response completely fails to address the impact that the construction of nuclear power stations would have on the development and expansion of Cape Town and surrounding areas such as Atlantis. The report therefore fails to place a relevant consideration before the decision maker, in matters which is of high importance to the City of Cape Town and its residents.

19. The anticipated closure and decommissioning of the Koeberg power station in the course of the next few decades would have meant that areas around Koeberg, which are currently too close to the power station, would become available for development. The Koeberg nuclear power station is thirty years old and due to be decommissioned over the next two decades.[20] Hence in the next two decades land in the vicinity of the Koeberg Power station will become available for development. The application for authorization of a further 4000MW of nuclear power envisages the construction of facilities which could generate 4000MW of nuclear power and which will have a life span of between fourty and sixty years and perhaps longer.[21] Added to this would be the construction and decommissioning time. In total, the planned building of addition nuclear power will constrain development around the northern suburbs of Cape Town, a large metropolis **for another eighty or more years**. This is a very significant socio economic impact as the city has a rapidly increasing demand for housing and is landlocked by mountains and ocean, placing pressure for development on the zone to the north of the city between Cape Town and Dynefotein as well as to the north of Dynefontein. Also Atlantis, which is 23 km north of the Koeberg, has a critical need for investment in job creating industries in order to address the legacy of apartheid planning which put this residential area very far from economic activity. According to the Cape Town City Council website:[22]

> "Job creation and economic development are two of Cape Town's biggest priorities. The unemployment rate in Atlantis is one of the highest in the metropole. [23]

In the experience of our client, Greenpeace, in the case of nuclear plant construction, that construction workers need to be certified for this work, and

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[19] Table 7-22 Common thematic issues and responses – item 17

[20] "It is accepted, however, that the Koeberg design in conjunction with the initiative contained in the station Life of Plant Plans, currently supports an operational life of 40 to 50 years. By 2014, unit 1 will have been in operation for 30 years, with unit 2 reaching the equivalent operational age by 2015." Johannes Kotze, Project Director: Strategic Nuclear Projects at Eskom, http://www.pragmaworld.net/media-centre/news-articles/long-term-asset-management-of-koeberg-nuclear-power-station-to-be-addressed-at-physical-asset-management-conference.php

[21] http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Power-Reactors/Nuclear-Power-Reactors/

[22] http://www.capetown.gov.za/en/MediaReleases/Pages/CityReleasesIndustrialLand.aspx

[23] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000.

only a small fraction are usually sourced locally due to certification requirements.[24]

20. This highly significant impact and relevant consideration that has simply been ignored in Version 2 of the RDEIA report. The report therefore does not place all relevant considerations, (including socio economic information) that could materially influence the decision maker before it. Therefore a decision to authorise the construction of a nuclear power station based on this report would be open to legal challenge.

**FAILURE TO ASSESS WORST-CASE SCENARIO IMPACTS VIOLATES NEMA AND THE EIA REGULATIONS, READ TOGETHER WITH PAJA 6(2)(B).**

21. This issue was pertinently raised in our clients' submissions on Version 1 of the RRDEIA report. Version 2 of the report claims that it has addressed these concerns. However it has not discharged this requirement.

**Failure to assess radiological impacts of a beyond design basis accident**
**Introduction**

22. Version 2 of the RDEIA report presents confusing information. The Executive Summary to the specialist reports states that "catastrophic incidents were not part of the plan of study for the assessment since these incidents are within the jurisdiction of the NNR."[25] However in a report entitled "Table 7-22 Common Thematic Issues and Responses" Item 3 indicates that the Version 2 of the RDEIA report has adopted a different approach, and that it includes a radiological assessment to determine the potential radiation exposure from the proposed nuclear reactor during normal as well as upset condition.[26] The two further expert reports which purport to deal with this issue and have been added to Version 2 of the RDEIA are the "Beyond design basis accidents" report, and the "Radiological assessment report."
23. It therefore appears that parts of Version 2 of the RDEIA report have not been comprehensively revised and edited to take into account new studies and a new approach and the decision maker is therefore being presented with contradictory information.
24. As will be discussed below, these reports in any event fail to provide an assessment of the radiological impacts of a severe (beyond design basis)

[24] This has been their experience on all of the roughly 20 construction projects that they have been involved in. In the case of Olkiluoto in Finland these workers came from Portugal, Poland and Ukraine, not from Finland. In the case of the Temelin in the Czech Republic, these workers came the entire republic, as well as from Ukraine and Russia, but not from Ceske Budejovice, the nearest major town. In Flamanville there were hardly any Bretons among the workers - they came from the entire country of France.

[25] Specialist reports - executive summaries– assumptions and limitations paragraph 1.10

[26] Page 7-34

accident at the proposed facility, a fatal flaw in an impact assessment under section 24 of the NEMA.

**Critique of beyond design basis impacts analysis**

25. Without quantitative description of what a worst-case scenario looks like, including an estimate of the number cancer cases and fatalities among the local population, and a realistic estimate of economic costs[27], decision-makers will be unable to make a rationally informed choice about whether the purported benefits of the project outweigh its risk.
26. Version 2 of the RDEIA report finally concedes that the EIA must include an assessment of the impacts of a worst case scenario. This is after all the impact assessment of a nuclear reactor, recognized as inherently hazardous as far back as the White Paper on Energy, in 1998.[28] However the report has simply not provided an assessment of the radiological impacts of a severe (beyond-design basis) accident.
27. Eskom states that there is lack of certainty about the type of nuclear reactor that the project would ultimately employ. However, despite such lack of certainly, Eskom claims **that it is providing** an assessment of the radiological impacts of a severe (beyond design basis) accident of the proposed nuclear facility. See Page 5-20 of Version 2 of the RDEIA Report:

> "At the time of writing, Eskom had not yet chosen a preferred vendor for the supply and installation of PWR technology. The Department of Energy has taken over the nuclear procurement process from Eskom. Thus, the plant types may not be limited to the abovementioned alternatives. The Department of Energy has not made public which plant types are currently being considered for Nuclear-1. To deal with the potential variations in design Eskom has identified an "envelope" that defines the full range of different plant types, in terms of their footprints and the emissions to air, land and water that they may cause. The envelope represents a "worst case scenario" of potential impacts from a PWR Generation III nuclear power station. The envelope was presented in the form of a "consistent

[27] These costs have been assessed with reference to recent serious accidents by competent institutions - See the European Commission estimates contained in COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT - Accompanying the document - Proposal for a Council Directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations - {COM(2013) 343 final} - {SWD(2013) 200 final} - {SWD(2013) 201 final})
http://eur-lex.europa.eu/resource.html?uri=cellar:f15c5932-a8c5-4f00-b681-dc132ce667cb.0001.02/DOC_1&format=PDF
Another important recent study was that of the French nuclear institute IRSN , which calculated that the total costs of a typical large scale nuclear accident in France would cost around 430 Billion Euro
http://www.irsn.fr/FR/Actualites_presse/Actualites/Documents/EN_Eurosafe-2012_Massive-releases-vs-controlled-releases_Cost_IRSN-Momal.pdf
http://www.reuters.com/article/2013/02/07/us-france-nuclear-disaster-cost-idUSBRE91603X20130207#UFuKLRqw62Wtmyh4.97

[28] 1998, Department of Minerals and Energy ISBN: 0-9584235-8-X

dataset" that was provided to all specialists, to serve as the basis for their assessment (Appendix C). Only the key features of the envelope are indicated in Table 5-56."

28. Version 2 of the RDEIA report identifies the following specialist study as providing a "worst case scenario" of potential impacts from a PWR Generation III nuclear power station - Beyond Design Accident Report (Appendix E33). However this report, despite its title, does not contain an assessment of the radiological impacts of a severe (beyond-design basis) accident of the proposed nuclear facility.
29. The 47-page Beyond Design Accident Report contains only the following:

1 – An introduction

2 – A discussion of the report's scope (see below)

"The reader is introduced to some of the important safety principles upon which NPP design and operation are based and how they relate to accidents that are defined as beyond-design-basis accidents (BDBAs).

"The concept of defence in depth (DiD) and its application in the nuclear industry has been proven to be of cardinal importance as a result of lessons learnt from NPP accidents. DiD is discussed and the associated safety assessment methodologies. Mitigation of a potential severe accident at a NPP relies on the proper implementation of DiD to be demonstrated using various safety analysis methodologies in an integrated manner.

"Three major NPP accidents demonstrated weaknesses in the application of the fundamental nuclear safety principles. Three Mile Island, Chernobyl, and Fukushima Daiichi are discussed. The aim of new GEN III NPP designs is to practically eliminate these BDBAs. An overview of national and international compliance criteria for nuclear facilities (regulatory framework) is provided.

"The role of the International Atomic Energy Agency (IAEA) in the event of an accident is described, including the Agency's role in developing lessons learned and revision of international recommendations for ensuring that the accident is not repeated."

3 – A discussion of principles fundamental to safety in the nuclear industry

4 – A discussion of beyond-design-basis accident and related safety concepts

5 – A discussion of nuclear power plant design to prevent a beyond-design-basis accident

6 –A discussion of beyond-design-basis accidents at Three Mile Island, Chernobyl and Fukushima

7 – A discussion of the International Atomic Energy Agency at its role in the event of an accident

8 –A discussion of the South African Regulatory Framework in respect of nuclear power plant risk

9 –A discussion of examples from other countries to improve nuclear power plant safety

10 – Concluding statements

11 – References

30. Not one page of the Beyond Design Accident Report contains an assessment of the radiological impacts of a severe (beyond-design basis) accident of the proposed nuclear facility. For example, there is no site-specific information about populations that would be exposed to releases of radioactivity in the event of a severe accident, whether the project would be built at Thyspunt, Bantamsklip, or Duynefontein.
31. The report ends with the following statement:

> "A comparison of the GEN III PWR of estimated annual frequencies of a large radioactivity release during a BDBA that could result in radiological exposure of the public and pose a high fatality risk, indicates that these NPP designs should be able to meet the regulatory limits of the NNR. The accident frequencies in Table E-1 (pg. 6) can be compared to the NNR peak individual fatality risk of 5E-06 per year."[29]
>
> "A NPP to be built in South Africa **will** have to submit a safety analysis report that provide the evidence for this provisional conclusion, based on **an analysis of external and internal events for the specific design and specific site where it will be built."**

32. Notably, the title of a document "Beyond Design Accident Report" is not consistent with the actual substance of the document, or what the project

[29] "Significant impact" is defined in the Regulations as "an impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment". The use of the word "or" makes it clear that the legislator intended to include accidents that have a large magnitude irrespective of their probability.

proponent claims it to be, in this case "a "worst case scenario" of potential impacts from a PWR Generation III nuclear power station" (pg. 5-20 of Version 2 of the RDEIA report.)

33. The consultants for Eskom could look to the following report as examples of site-specific assessments of the radiological impacts of a severe (beyond-design basis) accident at individual nuclear facilities: Nuclear Regulatory Commission. (1990). Severe accident risks: an assessment for five US nuclear power plants. *NUREG-1150, Final Report, 1*.[30]
34. It is not the purpose of this submission to suggest that South Africa should follow the methodologies for impact assessments of other jurisdictions. However by way of example, the USA demonstrates a rational approach to the issue of assessing the impacts of a worst case scenario and is included here for information and to guide the decision maker as to whether sufficient information has been placed before it.
35. The U.S. Nuclear Regulatory Commission requires a radiological impact assessment of the worst-case scenario in environmental impact statements for proposed new nuclear power plants in the United States. The document: Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan (NUREG-1555) sets out what information needs to be in the environmental review of a proposed new nuclear power plant.[31] The document contains a chapter titled "Environmental Impacts of Postulated Accidents Involving Radioactive Materials" (NUREG-1555, Chapter 7)[32] which sets out the requirement for assessing the radiological impacts of a severe (beyond-design basis) accident.[33]
36. The U.S. Nuclear Regulatory Commission specifies the methodology for how to assess the radiological impacts of a severe (beyond-design basis) accident[34] A critical step is the use of appropriate 'source terms' – that is, the amount of individual radioisotopes that would be released during a severe accident. For the type of reactor that Eskom is proposing - a light-water Pressurized Water Reactor – the source terms for assessing the radiological impacts of a severe (beyond-design basis) accident is specified in the following additional document of the Nuclear Regulatory Commission: Soffer, L., Burson, S. B., Ferrell, C. M., Lee, R. Y., & Ridgely, J. N. (1995) "Accident source terms for light-water nuclear power plants" (NUREG-1465)[35]

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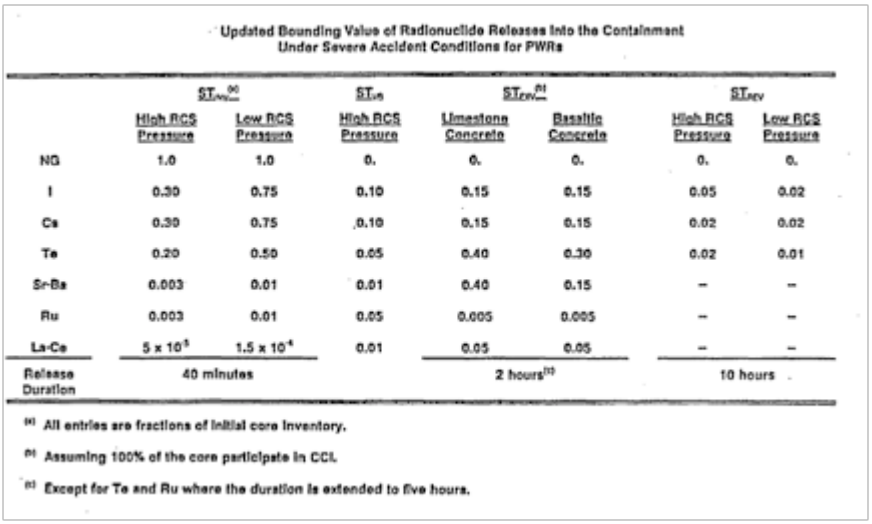
[30] http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1150/

31 http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1555/
32 http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1555/toc/ch7/
33 http://pbadupws.nrc.gov/docs/ML0716/ML071690007.pdf
34 "The environmental consequences of severe accidents are estimated using acceptable methodology (such as the MACCS2 code package; Chanin and Young [1997]. … Chanin, D. L. and M. L. Young. 1997. Code Manual for MACCS2: Volume 1, User's Guide. SAND97-0594, Sandia National Laboratories, Albuquerque, New Mexico (Also published as NUREG/CR-6613 in 1998)."
http://nnsa.energy.gov/sites/default/files/nv_sweis/appendixG/Chanin%20and%20Young%201997.pdf
35 http://www.nucleartourist.com/events/NUREG-1465.pdf

37. The KEY & CRITICAL aspect of this document is that for selection of source terms, one assumes release of certain fractions of the total amount of individual radioisotopes in the reactor core (core inventory) according to the following table in NUREG-1465 and based on the kind of PWR and the kind of containment structure (see below).



Updated Bounding Value of Radionuclide Releases into the Containment Under Severe Accident Conditions for PWRs

| | $ST_{ex}$[a] | | $ST_{in}$ | $ST_{cr}$[b] | | $ST_{erv}$ | |
|---|---|---|---|---|---|---|---|
| | High RCS Pressure | Low RCS Pressure | High RCS Pressure | Limestone Concrete | Basaltic Concrete | High RCS Pressure | Low RCS Pressure |
| NG | 1.0 | 1.0 | 0. | 0. | 0. | 0. | 0. |
| I | 0.30 | 0.75 | 0.10 | 0.15 | 0.15 | 0.05 | 0.02 |
| Cs | 0.30 | 0.75 | 0.10 | 0.15 | 0.15 | 0.02 | 0.02 |
| Te | 0.20 | 0.50 | 0.05 | 0.40 | 0.30 | 0.02 | 0.01 |
| Sr-Ba | 0.003 | 0.01 | 0.01 | 0.40 | 0.15 | – | – |
| Ru | 0.003 | 0.01 | 0.05 | 0.005 | 0.005 | – | – |
| La-Ce | $5 \times 10^{-5}$ | $1.5 \times 10^{-4}$ | 0.01 | 0.05 | 0.05 | – | – |
| Release Duration | 40 minutes | | | 2 hours[c] | | 10 hours | |

[a] All entries are fractions of initial core inventory.

[b] Assuming 100% of the core participate in CCI.

[c] Except for Te and Ru where the duration is extended to five hours.

38. According to information in Version 2 of the revised draft EIR, there is sufficient certainty about the project for Eskom to provide an assessment of the radiological impacts of a severe (beyond-design basis) accident.
39. First, we know that Eskom's first choice of technology is a light-water Pressurized Water Reactor. Page 5 of the Executive Summary states:

> "Pressurised Water Reactor (PWR) technology, which uses water as a coolant and moderator, was chosen by Eskom for Nuclear-1. PWRs are the most commonly used nuclear reactors internationally. Eskom is familiar with this technology from a health and safety, as well as an operational perspective, having used it for the past 30 years at the Koeberg Nuclear Power Station (KNPS)."

40. Second, because we know the size of the plant (4000 MW) and the quality of the enriched uranium that would be used by the plant, Eskom's consultants have a reasonably certain idea of the amounts of radioisotopes (e.g. radioactive isotopes of noble gases, iodine, cesium, tellurium, strontium, etc.) in the "core inventory" for purposes of **using the table above in NUREG-1465 to estimate the amount of individual radioisotopes that would blow out of the facility if there were a severe accident**
41. Another estimate of a potential source term for three of the considered reactor designs (the Hitachi / GE ABWR, the Westinghouse AP1000, and the Areva / EdF EPR) can be found in a recent study from the Institute for Safety and Risk

Studies of the BOKU University in Vienna.[36]

| Reactor design | Release fraction Iodine group, source term 2 | Release fraction Cesium group, source term 2 |
|---|---|---|
| ABWR | 49% | 58% |
| AP1000 | 44.70% | 27.20% |
| EPR | 17.80% | 17.80% |

**FAILURE TO ASSESS ECONOMIC IMPACTS OF A MAJOR BEYOND DESIGN BASIS ACCIDENT -CRITIQUE OF ECONOMIC IMPACT ASSESSMENT**

42. The Version 2 of the RRDEIA report does not assess the economic and socio-economic consequences of a worst case scenario, or even a serious incident, at the proposed nuclear power plant. It indicates instead that such an event is highly unlikely, so unlikely that it renders the question academic. It concludes however the economic impacts would be greatest at the Dynefontein site and states that it would affect the economy of the entire Cape Town Metropolitan region and large parts of the neighbouring municipalities. The extent and nature of the impact of such an abnormal event or range of events is not considered, despite the requirements of Regulation 32(2)(k).[37]
43. We submit that this conclusion is without foundation, and even if unlikely, the assessment is required by this regulation, as it states that an environmental assessment report must include "an assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of an impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can be mitigated."[38] "Significant impact" is defined in the Regulations as "an impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.[39] Under this definition, "significant impact" includes a catastrophic, worst-case scenario impact. In addition, NEMA's repeated focus on minimisation, prevention, and mitigation of environmental degradation[40] mandates an assessment of the impacts of a severe accident because such an assessment will lead to better

36 Sholly, Steven, Nikolaus Müllner, Nikolaus Arnold, Klaus Gufler, Source Terms for Potential NPPs at the Lubiatowo Site, Poland, Vienna (2014) Institut für Sicherheits- und Risikowissenschaften (ISR) BOKU; https://www.greenpeace.de/sites/www.greenpeace.de/files/publications/20140304-irs_report_source_terms_poland.pdf

37 2006 EIA Regulations

38 EIA Regulations 2006regulation 32

39 op cit: regulation 1 "definitions"

40 NEMA s 2(4)(a)(i)–(iii), (vii), s 23(2)(a)–(b), s 24(1), (4)(b)(ii), (4A).

prevention and mitigation measures.

44. Version 2 of the RDEIA report[41] endeavours to assess the probability of a major accident by referring to opinions regarding nuclear safety expressed in Great Britain ten years ago.[42] This UK report believes that the safety, security, health and non-proliferation risks of nuclear power stations are very small, and that there is an effective regulatory framework in place that ensures that these risks are minimized and sensibly managed by industry. The report is clearly referring to the UK regulatory situation. It goes on to caution against comparing "past accidents that happened abroad with anything that might occur at new civil nuclear power stations in the UK." By the same token, we submit that comparing the UK safety and regulatory scheme to that which exists in South Africa is equally fallacious and in fact constitutes an irrelevant consideration, which the decision maker may not consider. (PAJA section 6(2)(e)(iii))
45. As regards comments in the Economic Impact Assessment on the Russian nuclear accident at Chernobyl and its relevance to the assessment of the safety of nuclear power, the report leaves out a highly relevant piece of information. It states in regard to the case of Chernobyl "given the technological and safety differences between the Soviet and Western ( French and US ) systems , the likelihood of a Chernobyl – type incident occurring at Nuclear 1 is negligible." It fails to mention the fact that SA has entered in to a strategic partnership agreement with the Russian Federation for the procurement of a fleet of nuclear reactors, and is therefore very likely to procure nuclear power from Russia.
46. Although the Beyond Design Basis Accidents report refers to the fact that South Africa has carried out an Integrated Nuclear Infrastructure Review (INIR) it does not mention that the South African government has refused to make public this report. A report by the Department of Energy to the Portfolio Committee on Energy on 2nd June 2015 revealed that this assessment was undertaken in order to ascertain South Africa's readiness to roll out the planned 9000MW nuclear procurement. Nineteen issues were evaluated and SA was found to be deficient in a significant number of these categories. Although assurances were given that these deficiencies are being addressed the process is not being undertaken in a transparent manner. The refusal to disclose this report demonstrates a culture of secrecy around nuclear reactor governance in South Africa. It should be noted that a significant part of the blame for the Fukushima Disaster was put on a culture of secrecy in Japan.[43] Other nations

[41] Page 57

[42] White paper on Nuclear Power (Great Britain 2006) see paragraph 4.3.1.1 Economic Impact Assessment FEIR

[43] See **report** http://edition.cnn.com/2012/07/05/world/asia/japan-fukushima-report/
**"**Japanese parliament report: Fukushima nuclear crisis was 'man-made'" By Yoko Wakatsuki and Jethro Mullen, CNN - Updated 0054 GMT (0754 HKT) July 6, 2012, which states as follows:
"The nuclear crisis at the Fukushima Daiichi power plant in Japan was a "man-made disaster" that unfolded as a result of collusion between the facility's operator, regulators and the government, an independent panel said in an unusually frank report Thursday. The report by the Fukushima Nuclear

have openly disclosed the contents of their INIR safety self- assessment reports, for example European Union member states have disclosed their assessment reports on nuclear power safety plans post Fukushima. (Stress Test reports).[44]

47. The possibility of a nuclear accident arises not only as a result of the design of the technology but also the manner in which the technology is managed which varies from society to society, depending on factors such as skill level and corporate culture. We have an admitted lack of skills for nuclear power generation as mentioned in the economic impact assessment report, and are faced with the challenge of finding and retaining such skills.[45]

48. Version 2 of the RDEIA report concedes that an EIA should include a study of the impacts of potential radiation exposure from the plant during normal conditions and upset conditions, but does not assess the economic and socio-economic impact of a major industrial accident at each of the proposed sites and in particular such impacts at Dynefontein. This site is 22 km from the center of Cape Town and there are suburbs located within a few kilometers of the site. It should be emphasized that within 20 to 30 km of the site there are major wine and fruit growing areas.[46] Much of this fruit and wine is exported to Europe. The evacuation area of the Fukushima Disaster was 20 km.[47] Cape Town and the winelands is critically dependent on tourism as the backbone of its economy. The impact of a major radiation release on the tourism, the fruit and wine industry, as well as the general economy of the greater Cape Town area has not even been considered in Version 2 of the RDEIA report, despite an acceptance that a change of approach was appropriate and in the light of the

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Accident Independent Investigation Commission outlines errors and willful negligence at the plant before the earthquake and tsunami that devastated swaths of northeastern Japan on March 11 last year, and a flawed response in the hours, days and weeks that followed. It also offers recommendations and encourages the nation's parliament to "thoroughly debate and deliberate" the suggestions. Commissioned by the national parliament, the panel's report tellingly blames Japanese culture for the fundamental causes of the disaster. As well as detailing the specific failings related to the accident, the report describes a Japan in which nuclear power became "an unstoppable force, immune to scrutiny by civil society. Its regulation was entrusted to the same government bureaucracy responsible for its promotion," the commission said.

[44] EU Stress Tests and Follow-up, 2011-2012, http://www.ensreg.eu/EU-Stress-Tests. Also all reports and the outcome of the European post-Fukushima stress tests are available on the internet (http://ensreg.eu/EU-Stress-Tests). All reports from the operators, the interim and final reports from the national regulators, the reports from the peer-review sessions as well as the national action plans and the revised national action plans were published on the internet for all participating countries

[45] Economic Impact Assessment report – September 2013 - Page 62

[46] Winelands are also considered to be heritage sites. UNESCO world heritage nomination made by WC gov - http://whc.unesco.org/en/tentativelists/6049/

[47] https://www.rt.com/news/japan-fukushima-evacuation-nuclear-673/ "**Japan lifts evacuation order near Fukushima for first time since nuclear disaster. "**The resulting radioactive fallout forced nearly 160,000 people to leave their homes. In April 2011, the government imposed a 20-kilometer no-entry zone around the crippled nuclear power plant in the interest of public health. Around 80,000 Fukushima residents remain in temporary accommodation, local Asahi newspaper reported on Tuesday. The cities, towns, and villages in the vicinity have been reduced to ghost towns."

regulatory requirements for impact assessments. This constitutes a failure to place relevant information before the decision maker.

49. Another issue of concern is the assumption contained in the Beyond Design Basis Accidents that specifically Generation 111 pressurised water reactors will be the selected technology. Reports from the UK indicate that this technology is significantly more expensive than earlier generations of nuclear power stations and any assessment of impacts based on a more favourable safety design will skew the findings of the environmental impact assessment towards a favourable outcome. If at a later stage the procurement determines that Generation 111 is not chosen, what this means is that the environmental impact assessment will have been premature and will not constitute an accurate assessment of probable impacts of the power plant that is finally constructed.
50. A sound basis has therefore not been provided for the conclusion that there is a minimal prospect of a major disaster.

**FAILURE TO ASSESS ALL POTENTIAL IMPACTS OF NUCLEAR WASTE VIOLATES NEMA AND THE EIA REGULATIONS, READ TOGETHER WITH PAJA 6(2)(B).**

51. Radioactive waste is certainly a "significant impact" under a common sense reading of the definition, provided in the 2006 EIA regulations,[48] and it has been identified as such by numerous public participants,[49] the DEA,[50] and the applicant itself.[51]
52. Version 2 of the RDEIA report fails to undertake an environmental impact assessment of waste to be generated by the proposed power station, which is a fatal flaw in the authorisation process. It also specifically does not address the four areas of concern raised in our submission on Version 1 of the RDEIA report.[52] It merely states that nuclear waste will be managed consistently with IAEA guidelines and due to the physical nature of the waste "migration along the atmospheric pathway is highly unlikely."[53]
53. The response provided to our submissions contained in the letter from Gibb[54] is a facile non analysis consisting largely of irrelevant considerations. The concerns we raised are summarized as follows:

[48] 2006 EIA Regulations, regulation 1

[49] Revised DEIR App D8 Combined IRR Volumes Final at 157–186.

[50] Letter from Ms. Joanne Yawitch, Deputy Director General of Environmental Quality and Protection, DEA, to Mr. Tim Liversage, Arcus Gibb (Nov. 19, 2008) (laying out conditions under which the scoping report was to be accepted, which included assessment of nuclear waste).

[51] Revised DEIR, Chapter 9, Impact Analysis 9.29 and APP E29.

[52] Letter Gibb to the Legal Resources Centre dated 5th August 2015

[53] Table 7-22 Common thematic issues and responses item 13 page 7-43 ; Annexure E29 report "Management of Radioactive Waste", p 73

[54] Gibb letter to LRC dated 5th August 2015

a) The failure to adequately assess the cumulative impacts of generating radioactive waste, i.e. the waste to be generated in addition to the waste already generated by Koeberg Nuclear Power Station. Version 2 of the RDEIA report fails to assess the cumulative economic impact of the generation of so much more nuclear waste than just the current Koeberg Nuclear Power Station.
b) The failure to analyse the nature, extent, duration, and probability of waste impacts and the degree to which they may cause irreversible damage. The EIR merely classifies each identified potential impact (such as water contamination) as "low," "medium," or "high," without any explanation as to the content of those labels and how it arrived at those conclusions. Such an "impact assessment" is meaningless and results in an incomplete EIR.
c) The failure to assess the economic consequences of long-term waste disposal and storage: Economic impacts are probably the most far-reaching potential impacts of waste management, as the consequences of waste extend to future generations and radioactive emissions can continue to thousands of years.[55] This concern is dismissed, with reference to the fact that conventional waste also can involve long term environmental issues.[56] The hazardous nature of nuclear waste and its potential for creating catastrophic releases is not to be underestimated and cannot be likened to the other forms of waste glibly referred to in the Gibb response. Reference is also made to the fact that there is radiation emanating from South Africa's gold mine dumps.[57] This facile non analysis should be rejected as containing irrelevant considerations and as being non-compliant with the requirements of scholarly impact assessment envisaged by our legal system.[58]
d) Fourth, and most alarmingly, the EIR has failed to identify the overheating of spent fuel rods as a potential impact of storing high level nuclear waste.

**In response to Version 2 of the RDEIA report we raise the following areas of particular concern.**

**Inadequate Plans for the Interim Storage of Spent Fuel**

54. The response to the LRC submission to Version 1 of the RDEIA report by Gibb[59] states as follows:

[55] *See* Revised DEIR, APP E29 Waste Assessment 5.2.2;

[56] Gibb letter to LRC dated 5th August 2015

[57] id

[58] See also PAJA section 6

[59] Gibb letter to the Legal Resources Centre dated 5th August 2015

> "It is an international practice that the spent fuel from the reactor core is in the spent fuel pool filled with water for periods of up to 15 to 20 years or up to full capacity of the spent fuel racks before it is transferred into the metal or concrete casks. Spent fuel pools are designed to internationally accepted standards to ensure safety of public, workers and environment, and in line with the principle of defence in depth."

55. However the proposed Eskom nuclear-1 build program does not suggest that the storage of spent fuel will be in line with international best practice (see below). The disaster at the Fukushima Dai-ichi Nuclear Power Plant taught us that on-site storage of spent fuel rods poses a separate and perhaps greater risk to public safety, health and the environment than nuclear fuel in the reactor core. Because Japan, like many countries lacks adequate facilities for the long-term storage of nuclear waste, spent fuel rods are stored in pools of water on-site at nuclear power plants. At Fukushima, spent fuel rods were stored in pools of water nearby each of the plant's six reactors. Pools of spent fuel rods pose an especially serious risk to public safety, health and the environment because: 1) they are located OUTSIDE of the thick concrete containment vessel that surrounds the reactor core; and 2) spent fuel rods contain a more toxic mixture of radioisotopes (cesium-137, strontium-90, and iodine-131). Spent fuel rods require continuous cooling just as much as new fuel rods in the reactor core. If spent fuel rods experience loss of cooling and crack open, then there is no containment vessel that might prevent the release of radioisotopes from the spent fuel rods into the environment.
56. According to following information in Version 2 of the RDEIA Report, the proposed Eskom Nuclear Power Station would repeat the choice of the Fukushima Dai-ichi Nuclear Power Plant by engaging in on-site storage of spent fuel rods not within a containment vessel:
57. Page 3-14 of Version 2 of the DEAI Report states:

> "The nuclear fuel consists of uranium that is enriched to 4.95 %. Over time, the fuel becomes less effective as it loses its uranium-235 content and fission product (waste) begins to form. The concentration of fission fragments and heavy elements will increase to the point where it is no longer practical to continue to use the fuel. **Thus after 12 - 24 months the 'spent fuel' is removed from the reactor. When removed from a reactor, the fuel will continue to emit both radiation and heat. Used fuel is unloaded into a storage pond immediately adjacent to the reactor to allow the radiation levels to decrease. In the ponds the water shields the radiation and absorbs the heat. Used fuel is held in such pools for several months to several years**. The spent fuel is then either kept on site or permanently disposed at an off-site nuclear waste repository facility. …

58. Page 3-41 of Version 2 of the DEAI Report states:

"To ensure that the performance of a reactor is optimised, **approximately one-third of the spent fuel is removed every 12 to 18 months** and replaced with new fuel. When the spent fuel is removed from the reactor, it is highly radioactive, which causes a great deal of heat to be produced, and they must, therefore, undergo cooling and be shielded from people. **It is therefore placed in water-filled storage ponds in the nuclear island (Figure 3-18)** or in dry storage. The storage ponds are steel-lined concrete tanks, approximately eight metres deep. The heat and radioactivity decrease over time, and after about 40 years the radioactivity is reduced to about 1/1000th of what it was when the spent fuel was initially removed from the reactor."

59. With respect to interim storage of spent fuel, the design of the proposed Eskom Nuclear Power Station is inconsistent with design requirements of the U.S. Nuclear Regulatory Commission, which specify the following:

10 CFR § 50.150 Aircraft impact assessment.

"(a) Assessment requirements.
(1) Assessment. Each applicant listed in paragraph (a)(3) shall perform a design-specific assessment of the effects on the facility of the impact of a large, commercial aircraft. Using realistic analyses, **the applicant shall identify and incorporate into the design those design features and functional capabilities to show that,** with reduced use of operator actions:

"(i) The reactor core remains cooled, or the containment remains intact; and
"(ii) **Spent fuel cooling or spent fuel pool integrity is maintained.**

"(2) Aircraft impact characteristics. The assessment must be based on the beyond-design-basis impact of a large, commercial aircraft used for long distance flights in the United States, with aviation fuel loading typically used in such flights, and an impact speed and angle of impact considering the ability of both experienced and inexperienced pilots to control large, commercial aircraft at the low altitude representative of a nuclear power plant's low profile.

"(3) Applicability. The requirements of paragraphs (a)(1) and (a)(2) of this section apply to applicants for:

'(i) Construction permits for nuclear power reactors issued under this part after July 13, 2009;

"(ii) Operating licenses for nuclear power reactors issued under this part for which a construction permit was issued after July 13, 2009; ….

"(b) Content of application. **For applicants identified in paragraph (a)(3) of this section, the preliminary or final safety analysis report, as applicable, must include a description of:**

"(1) The design features and functional capabilities identified in paragraph (a)(1) of this section; and"

(2**) How the design features and functional capabilities identified in paragraph (a)(1) of this section meet the assessment requirements in paragraph (a)(1) of this section.**

60. In order for spent fuel cooling or spent fuel pool integrity to be maintained if there were a beyond-design-basis impact of a large, commercial aircraft, then the facility for the interim storage of spent fuel at the proposed Eskom Nuclear Power Station would need to be protected by a thick concrete containment vessel. However, based on information provided in the Version 2 of the DEAI Report, it seems that the facility for the interim storage of spent fuel at the proposed Eskom Nuclear Power Station lacks the necessary safety design features to comply with standards of the U.S. Nuclear Regulatory Commission. In January 2015, the Constitutional Court in Germany cancelled the radioactive waste storage permit of the Brunsbüttel NPP. One of its arguments was that the storage could not withstand the impact of an Airbus A-380 passenger airliner as well as an attack with charged head missiles.[60]

**FAILURE TO ADEQUATELY ASSESS PROJECT ALTERNATIVES AND A NO-GO OPTION VIOLATES NEMA AND THE EIA REGULATIONS, READ TOGETHER WITH PAJA 6(2)(B), AND PLACES INCORRECT INFORMATION IN FRONT OF THE DECISION MAKER IN VIOLATION OF PAJA 6(2)(E)(III).**

**The no-go option**

61. Although the issue of the no-go option was pertinently raised in submissions on Version 1 of the RDEIA report, there has not been a compliant analysis of this aspect in Version 2 of the report. Our clients' concerns have been ignored. Instead the report merely states that such option is not feasible.[61] It is

[60] http://www.ndr.de/nachrichten/schleswig-holstein/AKW-Brunsbuettel-Urteil-bringt-neue-Probleme,brunsbuettel326.html

[61] Executive summary Version 2 DEIA report at page 37 states:

**"No-Go alternative**
Given the urgent power demand based on economic growth in South Africa, the No-Go alternative is not considered to be a feasible and realistic alternative. As indicated in the need and desirability section (Chapter 4 of this EIR), there is a proven need to additional generation

submitted that this is both factually incorrect and a legally incorrect approach to assessing the no-go alternative. We reiterate our earlier submission that the Integrated Resource Plan 2010-2030 (IRP2010) did initially include feasible no-nuclear scenarios.[62] that are cost effective and provide security of supply. This demonstrates that the decision to pursue nuclear energy is not an inevitability, based on lack of feasibility of alternatives, but a policy decision. The applicant, however, falsely asserts that the no-go option is not viable and attempts to hide behind policy (the IRP2010) to bypass the statutory requirements of NEMA.

62. NEMA Section 24(4) (b) (i) requires the consideration of the no-go option. Regulation 29(1)(i)(iii) of the 2006 EIA regulations requires the plan of study for an environmental impact assessment to indicate the proposed method of assessing the environmental issues and alternatives including the option of not proceeding with the activity. NEMA Section 24 also requires every application for an environmental authorisation to include an investigation of alternatives to the activity, including the **option of not implementing the activity**.[63] The duty of the applicant is to submit "all information necessary for the competent authority to consider the application and reach a decision,"[64] and the duty of the decision maker is to then choose the "best practicable environmental option,"[65] the one that "provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term."[66]

63. The methodology for assessing the no-go option would involve the consideration of scientific and technical reports together with up to date policies in order to ascertain the consequences of not implementing the project. This is clear from South African legislation, case law and international best practice. It would involve assessing what the impact of not going ahead with the project would be, and therefore whether the need that the nuclear plant purports to address could be met through some other means, with reference to current policy and technical information. The failure to undertake a proper analysis of the no-go option is fatal legal flaw in the environmental authorisation process.

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capacity in South Africato ensure that there is sufficient electricity available over the next 20 years South Africa, would in all likelihood, have to adapt the IRP to develop more coal-fired power stations if the No-Go alternative for the proposed nuclear power station is adopted, as this is the only alternative proven base load generation option available in South Africa. It would not be economically viable (and difficult to finance these projects as banks are becoming reluctant to finance such projects) to develop more coal-fired power stations in the future, due to carbon taxes that are likely be imposed on countries that continue to emit greenhouse gases."

Also refer to Version 2 DEIA report at paragraph 10.24, and 5-39

[62] Integrated Resource Plan for Electricity 2010–2030, GNR 400 GG 34263 of 6 May 2011, at 38–45.

[63] NEMA s 24(4)(b)(i).

[64] EIA Regulations 2006, regulation 32(2).

[65] NEMA s 2(4)(b).

[66] NEMA s 1 (definition of "best practicable environmental option").

64. The report states as follows.[67]

> "The final observation on the no-go option is that it curtails Eskom's ability to respond to growing electricity demand. It would be foolish to suggest that the no-go option will result in rolling blackouts because it will not necessarily mean that at all. Eskom, or indeed anyone else for that matter, will be extremely hard pressed, however, to find a reliable, alternative manner of generating baseload which is crucial to the sustainability of our national electricity supply, and which does not result in significant greenhouse gas production. Finally, but importantly, the decision not to proceed with the Nuclear Power Station would directly not contribute to the realisation of the IRP2020 requirements."

65. This statement is not an expert evaluation or analysis of the no-go option but an opinion regarding the availability of base load energy which is not borne out by the facts or by recent government pronouncements. Based on the regulatory regime for environmental authorisations under NEMA it is clear that an analysis of the no-go option is required to be based on reports[68] and the environmental practitioner is required compile reports on the basis of expertise and by implication not on the basis of its own opinion.[69] However Version 2 of the RDEIA report contains no such reports. The following judgment indicates the level of detail required in the assessment of the no-go option. Saldanha, J of the High Court of South Africa in *Langebaan Ratepayers and Residents Association v. The Western Cape Provincial Minister for Local Government, Environmental Affairs and Developmental Planning*[70], stated:

> "The adequacy of the alternatives considered must also in my view be considered in the light of the considerations given to the "no-go" option. In the Guidelines on Alternatives (EIA Guidelines and Information Document Series August 2010) with reference to NEMA principles and sections 24(4)(b) and 24(4A) of NEMA it is stated: "The assessment of alternatives must at all times include the "no-go" option as a baseline against which all other alternatives must be measured. The option of not implementing the activity [for which authorization is sought] must always be assessed and to the same level of detail as the other feasible and reasonable alternatives."

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[67] Revised DEIA report 5- 39

[68] See *Sea Front For All and Another v the MEC: Environmental and Development Planning Western Cape Provincial Government and Others* 2011 (3) SA 55 (WCC). paragraph 30; and NEMA section 24(1)

[69] 2006 EIA Regulations, regulation 18(b)

[70] High Court of South Africa (Western Cape Division, Cape Town), Case No. 4917/2013 (19 August 2014) at Para. 88, available at: http://www.saflii.org/za/cases/ZAWCHC/2014/212.pdf

66. The RDEIA report's opinion and conclusion is also not borne out by facts or policies of the South African Government. As stated above, the IRP2010 initially included feasible no-nuclear scenarios[71] that are cost effective and provide security of supply, showing that the decision to pursue nuclear energy is not an inevitability but a policy decision. Since the publication of the IRP 2010 reduced electricity demand has resulted in several government announcements that the need and desirability of nuclear power is a matter which requires further study. (See further submissions below on this issue)
67. Version 2 of the RDEIA report demonstrates an incorrect and inadequate interpretation of what the no-go option entails. Guidance in interpreting the requirements for evaluating how a study of the no-go option should be conducted can be found in several foreign jurisdictions and in international law. For example: European Commission, "Guidance on EIA Scoping" (2001),at Section B.6.2 (available at http://ec.europa.eu/environment/eia/eia-guidelines/g-scoping-full-text.pdf). This guideline became mandatory in the recently amended Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (commonly known as the "EU EIA Directive"). Lawmakers in the European Union undertook a multi-year law reform effort to strengthen the quality of EIAs and address shortcomings in the existing Directive. Among other things, the amended Directive requires project proponents in EU Member States to prepare a "description of the relevant aspects of the current state of the environment (baseline scenario) **and an outline of the likely evolution thereof without implementation of the project** as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge." Directive 2014/52/EU, at Annex IV, sec. 3 (emphasis added). An EIA issued by the United Nations Environment Programme (UNEP) and the Swedish Defence Research Agency (FOI), includes the no-go alternative.[72]
68. Not only does the failure to describe the 'no-go' option, constitute non-compliance with section 24(4) (b) (i) of the NEMA. In addition section 2(4)(b) of NEMA requires that the best practical environmental option be pursued in decision-making. The failure to consider alternatives and in particular the no-go option precludes the decision-maker from selecting the best practical environmental option as only one option is presented. It also precludes the assessment of the significance of the potential impact of alternatives on the environment, socio-economic conditions and cultural heritage, as required by the regulations.[73] As a consequence, the draft EIR does not comply with the requirements of NEMA.
69. Version 2 of the RDEIA report justifies not considering alternatives and the no-go option on the basis that the IRP 2010 process has concluded that nuclear

[71] IRP 2010 38–45.

[72] See: Environmental Impact Assessment, United Nations Support Office for AMISOM (UNSOA), Proposed Expansion of Logistics Base, Mombasa, Kenya, available at: http://postconflict.unep.ch/publications/UNEP_EIA_UNSOA_Mombasa.pdf

[73] 2006 EIA Regulations , regulation 32(2)(d).

technology must form part of the mix of generation technologies. Further that the environmental impact assessment process is a "project specific environmental management tool that does not have the mandate, neither is it equipped to revisit the strategic analysis of power generation alternatives that was completed in the IRP."[74] In other words the scope of the EIA is predetermined by a Department of Energy policy on macro energy planning. This conclusion is at odds with the requirements of the regulatory framework for environmental authorisations under NEMA section 24.

70. There are several other reasons why this reasoning is fallacious:

(i) The IRP 2010 is by now out of date. It states at paragraph 1.1 that it is a "living plan that is expected to be continuously revised and updated as necessitated by changing circumstances. At the very least, it is expected that the IRP should be revised by the [DOE] every two years, resulting in a revision in 2012;

(ii) The IRP 2010 was in any event not a final document. It required review as well as the completion of research into the costing of significant aspects of the nuclear program, neither of which have been completed.[75] An incomplete policy cannot be relied on five years later to exclude compliance with a statutory requirement for assessment of the no-go option;

(iii) The IRP 2010 Update was published for comment on the Department of Energy website in 2013. The DOE acknowledged in the IRP 2010 Update summary that there have been a number of developments in the energy sector in South and Southern Africa since the IRP2010 was published, and that the electricity demand outlook has changed markedly from that expected in 2010. It indicated that the electricity demand in 2030 is now projected to be in the range of 345-416 TWh as opposed to the 454 TWh expected in the policy-adjusted IRP2010, and identifies various other uncertainties, including uncertainty in the cost of nuclear capacity and future fuel costs (specifically coal and gas), as well as in fuel availability. It is stated further in the IRP2010 Update summary that

> "[A]ll these uncertainties suggest that an alternative to a fixed capacity plan (as espoused in the IRP 2010) is a more flexible approach taking into account the different outcomes based on changing assumptions (and scenarios) and looking at the determinants required in making key investment decisions."[76]

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[74] Letter from Gibb to Legal Resources Centre dated 5th August 2015.

[75] IRP 2010 paragraph 7.11 states: "Further research is required on the full costs relating to specific technologies (coal and nuclear) around the costs of decommissioning and managing waste (in the case of nuclear specifically spent fuel)."

[76] http://www.doe-irp.co.za/content/IRP2010_update.pdf - See Summary, p8. The IRP 2010 Update was also informed by data published online at http://www.doe-irp.co.za/content/EpriEskom_2012July24_Rev5.pdf.

(iv) The IRP2010 Update summary indicates further that in the shorter term (next two to three years) there are clear guidelines arising from the scenarios, including that:

> "The nuclear decision can possibly be delayed. The revised demand projections suggest that no new nuclear base-load capacity is required until after 2025 (and for lower demand not until at earliest 2035) **and that there are alternative options, such as regional hydro, that can fulfil the requirement and allow further exploration of the shale gas potential before prematurely committing to a technology that may be redundant if the electricity demand expectations do not materialise**."[77]

(v) The IRP2010 Update summary concludes that:

> "Considering the changes in consumption patterns and technology costs over the past three years it is imperative that the IRP should be updated on a regular basis (possibly even annually), while flexibility in decisions should be the priority to favour decisions of least regret. This would suggest that commitments to long range large-scale investment decisions should be avoided."

(vi) Factors such as the changed exchange rate, and Eskom credit ratings have increased the cost of capital to such an extent that it might not be financially feasible to build the nuclear power program. The IRP 2010 required a costs assessment which has not yet been completed or made public.

(vii) A policy which is in any event incomplete cannot override a legislative requirement.

71. In conclusion it is submitted that the argument that the no-go option is not feasible should be rejected. The fact that Version 2 of the RDEIA report fails to comply with the requirements for authorization in respect of the analysis of the no-go option means that authorization should not be granted.

**Alternatives**

72. As with the no-go option, Version 2 of the Draft EIA report rejects the possibility of alternatives, premising this recommendation on the existence of the IRP 2010 policy and the opinion that base load cannot be met through anything other than coal and nuclear power. We reiterate our submissions above, that the IRP 2010 is both out of date, incomplete and in any event did not, at the outset, preclude the consideration of a non-nuclear option. In other words it did not indicate that there are not feasible alternatives to Nuclear 1.

73. Environmental authorization decisions based on outdated information, such as

[77] id page 8

the IRP 2010 stand to be set aside. See *Sea Front for All and Another v the MEC: Environmental and Development Planning Western Cape Provincial Government and Others.*[78] As stated in this judgment,

> "The integrity of the environmental impact assessment process will be seriously undermined if decision makers are to base their decisions on substantially outdated information."[79]

74. As with our submissions regarding the failure to consider the no-go option, the opinion that base load cannot be met except with coal or nuclear power is materially incorrect and/or incomplete and/or a non expert opinion, and therefor constitutes an irrelevant consideration. It cannot form the basis of a lawful decision on the application for authorization. Decisions based on materially incorrect information, and/or irrelevant considerations[80] stand to be set aside on review.
75. As per the judgment in *Sea Front For All*, [81] the failure to consider reports of alternatives and the no-go option are a fatal flaw as these considerations are a jurisdictional prerequisite for the exercise of the relevant decision making function. Although this case considered the position under the Environment Conservation Act[82] the same provisions apply under the National Environmental Management Act.[83]
76. Version 2 of the RDEIA report recommends the authorization of the nuclear plants, without the consideration of alternatives, basing its recommendations on outdated and incomplete and erroneous information. Reliance on information of this nature will preclude the decision maker from performing the required balancing exercise, namely the balancing of the socio-economic consequences of the development against the negative environmental consequences, and stands to be set aside as unlawful. [84]
77. In circumstances such as the present, where the policy on nuclear energy is under review and is being updated, it is inappropriate to be conducting an environmental impact assessment, as it will obviously be based on out of date information. The result can only be an irregular authorization. Since Eskom's consultants contend that the environmental impact assessment process is a

> "project specific environmental management tool does not have the mandate, neither is it equipped to revisit the strategic analysis of power generation alternatives that was completed in the IRP,"[85]

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[78] Paragraph 39

[79] Paragraph 73

[80] PAJA section 6

[81] Paragraph 39

[82] Act of 73 of 1989

[83] Act 107 of 1998

[84] *Seafront For All* at paragraph 75

[85] Letter from Gibb to Legal Resources Centre dated 5th August 2015.

The application for authorization should be suspended until the requisite information has been generated, by means of the policy and regulatory processes, such as the Integrated Energy Plan and the Integrated Resource Plan (provided for under the National Energy Act,[86] the Electricity Regulations Act,[87]) which the public has been advised are being reviewed.

**Need and Desirability.**

78. Guidance for interpreting this requirement of the 2006 EIA regulation is provided in the national[88] and provincial[89] guidelines 2010 guidelines, that are also referred to in Version 2 of the RDEIA report.[90] The DEA 2010 guidelines state:

> "While NEMA (and its predecessor the Environment Conservation Act, 1989 (Act No. 73 of 1989) does not specifically refer to "need and desirability", the Constitutional Court in the Fuel Retailed case in 2007 already confirmed that "need and desirability" is a relevant consideration and the Constitutional Court at that time equated it to the socio-economic considerations. Since then the EIA Regulations, as highlighted above, has specifically included the requirement that the "need for and desirability of the proposed activity" must be considered. With the EIA Regulations specifically calling for the consideration of how the "geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity"[8], "need and desirability" relates to all of these considerations and not only to socio-economic considerations.[91]
>
> With regard to the issue of "need", it is important to note that this "need" is not the same as the "general purpose and requirements" of the activity. While the "general purpose and requirements" of the activity might to some extent relate to the specific requirements, intentions and reasons that the applicant has for proposing the specific activity, the "need" relates to the interests and needs of the broader public. The consideration of "need and desirability" in EIA decision-making therefore requires the consideration of the strategic context of the development proposal along with the broader societal needs and the

[86] 34 of 2008

[87] 4 of 2006

[88] DEA (2010), Guideline on Need and Desirability, Integrated Environmental Management Guideline Series 9, Department of Environmental Affairs

[89] DEA and DP 2011- EIA Guideline and Information Document Series Guideline On Need And Desirability

[90] Paragraph 4.8

[91] DEA Guideline On Need And Desirability- page 13

public interest."[92]

> "Financial viability must be considered within the context of justifiable economic development, measured against the broader societal short-term and long-term needs. While the financial viability considerations of the private developer might indicate if a development is "do-able", the "need and desirability" will be determined by considering the broader community's needs and interests as reflected in an IDP, SDF and EMF for the area, and as determined by the EIA. While the importance of job creation and economic growth for South Africa cannot be denied, the Constitution calls for *justifiable* economic development. The specific needs of the broader community must therefore be considered together with the opportunity costs and distributional consequences in order to determine whether or not the development will result in the securing of ecological sustainable development and the promotion of justifiable social and economic development - in other words to ensure that the development will be socially, economically and environmentally sustainable."[93]

79. Version 2 of the RDEIA report states that "it is clear that as part of South Africa's development of new electricity generating capacity to meet the needs outlined in the IPR 2010 a component of nuclear energy is essential.[94] Reasons are then given to support this conclusion. The report concludes by presenting the "case for nuclear energy expressed as six basic propositions.[95] These include that nuclear power is proven and is "here to stay" and is supported by key role players.
80. An examination of the strategic context for electricity generation does not however support these conclusions. This context consists of policies and legislation which are currently out of date or have not been enacted (**see paragraph 70 above)**. These include the updated Integrated Resource Plan, section 6 of the National Energy Act[96] and the Integrated Energy Plan. It is submitted that in the absence of an up to date and compliant regulatory framework for energy governance it is not possible for the environmental

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[92] id page 14

[93] id page 11

[94] Version 2 revised DEIA report chapter 4: - Need and desirability report paragraph 4.6

[95] id paragraph 4.9

[96] 34 of 2008. Once section 6 is in force,

- the Minister will be required to develop, and on an annual basis review and publish, the Integrated Energy Plan (IEP) in the *Gazette;*[96]
- the IEP must deal with affordability,[96] and economic viability must be taken into account in its development;[96] and
- the IEP must serve as a guide for energy infrastructure developments, must take into account all viable energy supply options, and must guide the selection of the appropriate technology to meet energy demand.[96]

impact assessment report to assess the need and desirability for the project. Since the evaluation of need and desirability of the project is a mandatory requirement for environmental impact assessments under section 24 of NEMA, this means that the EIA cannot be completed until the energy policy framework is in place that determines whether 4000MW or indeed 9000 MW of electricity derived from nuclear power sources, has been put in place.

81. Once again we reiterate that the application for authorization and its attendant environmental impact assessment process should be postponed until there is regulatory finality on the issue of the purpose and need for the nuclear fleet. This process is conducted by the Department of Minerals and Energy in terms of the National Energy Act and Electricity Regulation Act.
82. It is clear that Version 2 of the RDEIA report is not an independent assessment but a statement of Eskom's views, that since the IRP2010 chose to commit to 9600MW of nuclear, this obviates any need to investigate alternative forms of power because it has already established the optimal energy mix. However, such rigid adherence to policy in making an administrative decision fetters the decision maker's discretion, in violation of basic principles of just administrative action. While policies in keeping with the empowering legislation may be used to assist decision making, they may not inevitably determine the outcome of the decision, lest they "preclude the person exercising the discretion from bringing his mind to bear in a real sense on the particular circumstances of each and every individual case coming up for decision."[97]

**THE THYSPUNT SITE IS NOT A VIABLE ONE FOR THE NUCLEAR-1 PROJECT.**

**Introduction**

83. We reiterate the submissions made on behalf of our clients to Version 1 of the RDEIA report, which responded to the Heritage Impact Assessment that had concluded that Thyspunt has exceptional archaeologic, palaeontologic, and wilderness value[98] and presents excessive difficulties for mitigation.[99] The submission was also based on the fact that the South African Heritage Resource Agency had uncategorically recommended that Thyspunt is not a suitable site for development.[100] These concerns have not been addressed in Version 2 of the RDEIA report and therefore remain.
84. Version 2 of the RDEIA report includes the Environmental Impact Assessment for the Proposed Nuclear power station ('Nuclear 1') and Associated Infrastructure Heritage Impact Assessment for the sites known as Thypunt, Bantamsklip and Duynefontein, 2012 which constitutes the heritage component

[97] *Richardson v Administrator, Transvaal* 1957 (1) SA 521 (T) at 530.

[98] Revised DEIR, APP E20, Heritage Impact Assessment 4.3.

[99] Revised DEIR, APP E20, Heritage Impact Assessment 4.3; 5.1.3; 5.2.2 (c).

[100] Revised DEIR, APP E20, Heritage Mitigation Study, Introduction 1.

of an Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP).[101]

85. The purpose of an EIA is to provide decision makers with adequate and appropriate information about the potential positive and negative impacts of proposed development and associated management actions in order to make an informed decision on whether or not to approve, proceed or finance a proposed development.[102]

86. The requirements of heritage assessments, either as a stand-alone Heritage Impact Assessment (HIA) or as a specialist component of the EIA process are set out in section 38 of the National Resources Heritage Act 22 of 1999, (NHRA).

87. Section 38(3) of the NHRA makes provision for the minimum requirements for heritage assessment:
    a) The identification and mapping of all heritage resources in the area affected;
    b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;
    c) An assessment of the impact of the development on such heritage resources;
    d) An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development ;
    e) The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
    f) If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
    g) Plans for mitigation of any adverse effects during and after the completion of the proposed development"[103]

**Background**

88. An impact assessment report was concluded in October 2010 to fulfil the heritage component of an environmental impact assessment of three proposed sites for a 4000MW nuclear power station and associated infrastructure.[104] The

[101] Environmental Impact Assessment for the Proposed Nuclear Power Station ("Nuclear 1") and Associated Infrastructure: Heritage Impact Assessment October 2010 **("HIA 2010")** pg. 1

[102] Winter, S. & Baumann, N. Guideline for involving heritage specialists in EIA processes: Edition 1. CSIR Report No. ENV-S-C 2005 053 E. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town ("Guidelines") pg. ii

[103] NHRA 25 of 1999

[104] HIA 2010, Executive Summary

HIA 2010 acknowledges that "[a]ll three sites are highly sensitive in heritage terms. Within the ambit of the related disciplines of heritage, they are all undesirable, as the cost to the National Estate is going to be high, unless properly mitigated."[105]

89. The Heritage Impact Assessment September 2012[106], (HIA 2012) is a revision of the Heritage Impact Assessment October 2010[107], (HIA 2010), and was produced in response to the change in scope requested by Eskom.[108] The HIA 2012 submits that:

> "[t]he field survey conducted in 2007 encountered physical restrictions in that vegetation in particularly vegetated dunes was so dense that confident findings about the state of archaeological heritage could not be determined. To resolve this a further phase of work was commissioned by Eskom that involved a systematic pattern of trial excavations in these areas. This programme has now been completed and the findings incorporated within this version".[109]

The scope and location of these trial excavations, in relation to the previous assessment are not specified. It is thus not possible to meaningfully compare the two assessments.

90. The guidelines[110] state as a matter of fact that management of heritage impacts tends to be restricted purely to mitigation measures.[111] Significant heritage resources will be destroyed[112] by the proposed development which means that mitigation measures are an essential component of HIA.

**Mitigation**

91. Archaeological material is a finite resource and cannot be reproduced, thus once it is destroyed or removed it is gone forever, and a fragment of history is irrevocably deleted.[113] For this reason the fundamental principle in heritage

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[105] HIA 2010 pg. 77

[106] Hart, TJG. Environmental Impact Assessment for the Proposed Nuclear power station ('Nuclear 1') and Associated Infrastructure Heritage Impact Assessment for the sites known as Thypunt, Bantamsklip and Duynefontein Pretoria September 2012 **("HIA 2012")**

[107] HIA 2010

[108] HIA 2012 pg. 1

[109] HIA 2010 pg. 1

[110] Winter, S. & Baumann, N. Guideline for involving heritage specialists in EIA processes: Edition 1. CSIR Report No. ENV-S-C 2005 053 E. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town (**"Guidelines"**)

[111] Guidelines pg. 2

[112] Archaeology and Heritage Mitigation Study for a Proposed Nuclear Power Station at Thyspunt, Eastern Cape, South Africa: Status Report and Way Forward, March 2011, ( **"March 2011"** )

[113] March 2011

management is to conserve archaeological material and sites *in-situ* as far as is humanly possible.[114]

92. The HIA 2010 with reference to Thyspunt states that,

> "[m]itigation without significant impact is going to be technically difficult to achieve due to the character of the site and difficulties with respect to accessibility"[115]

93. The March 2011 status report[116] **identified Thyspunt as the least desirable** of the three proposed nuclear sites because mitigation of the archeological material would be

> "extremely costly, resource sapping and would tax the limited storage capacity of Provincial museums".[117] (own emphasis)

94. In the HIA 2012 it is submitted that

> "[t]he increase in the coastal set back zone from 60m to 200m has substantially reduced the impacts on archaeological sites. As a result of findings of extensive surveys, including a trial excavation program, it is possible to position the proposed nuclear power station in such a way that physical impacts to heritage sites of an archaeological nature are minimized. Mitigation of any heritage material through sampling by controlled excavation, or creation of local exclusion areas is considered feasible with resources currently available. Some on site storage (small museum) may be necessary".[118]

**Survey and set back area**

95. The HIA 2012 estimates that less than 20% (twenty percent) of the study area could be surveyed prior to 2011. Without disclosing what percentage has since been surveyed, it is asserted that the area has been well surveyed and is understood.[119] On this basis the HIA 2012 concludes that physical impacts to heritage resources can be minimized.
96. This assertion is made despite the same report finding that

[114] March 2011

[115] March 2011

[116] March 2011

[117] March 2011

[118] HIA 2012 pg. 46

[119] HIA 2012 pg. 14

> "[d]ue to the dynamic state of dunes, surveys should ideally be repeated over a number of years before a comprehensive picture can be determined."[120]

97. The HIA 2012 further states that

> "[g]iven the comprehensive amount of work that has taken place to date, good information about the distribution of archaeological sites may be deduced. The area within 300m of the rocky shoreline was densely occupied, and probably contains more than seventy percent of the archaeological sites in the entire study area".[121]

98. The HIA 2012 submits that a possibility of a less sensitive option within the proposed nuclear corridor was identified by a recent survey of land adjacent to Thysbaai. This is asserted despite acknowledging that the survey was very restricted by the dense vegetation growth".[122] *This is contrary to the maxim, "Absence of evidence is not necessarily evidence of absence".*[123]
99. No valid justification is provided for making the coastal set back zone 200m when the 2012 HIA acknowledges that seventy percent of the archaeological sites are contained within 300m. At that ratio the difference of 100m is significant.

**Minimum requirements not complied with**

100. Several of the minimum requirements for HIA set out in section 38(3) of NHRA have not been complied with. An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development is not provided as is required by section 38(3) (d). Evaluation "means the process of ascertaining the relative importance or significance of information, in the light of people's values, preferences and judgements, in order to make a decision"[124].
101. The 2012 HIA acknowledges that the cost to the national estate is going to be high, unless properly mitigated.[125] The justification for this high cost is a single sentence' "given the broader picture, the procurement of power (…) is critical for the future well-being of the nation, which is currently suffering from an energy shortage"[126].

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[120] HIA 2012 pg. 46

[121] HIA 2012 pg. 46

[122] HIA 2012 pg. 46

[123] SG 2.2 APM Guidelines: Minimum Standards for Archaeological and Paleontological Components of Impact Assessment Reports

[124] National Environmental Management Act 107 of 1998, ("NEMA") section 1

[125] HIA 2012 pg. 86

[126] HIA 2012 pg. 86

102. It is submitted that a single sentence does not constitute an evaluation as defined in NEMA and thus is not in compliance with section 38(3) (d). Section 38(3) (e) of the NHRA requires that the results of consultation with communities and interested parties must be included in the HIA. In the HIA 2012 this is limited to an acknowledgement that the Gamtkwa community is concerned about their heritage. The nature and extent of these concerns are not explored.
103. The HIA 2012 further avers that Dr. Johan Binneman of Albany Museum, Grahamstown[127] was consulted but the outcome of this consultation is not included in the HIA 2012. In this regard, the HIA 2012 does not comply with section 38(3)(e)
104. Save for the no-go alternative, there is no consideration of other alternatives as is required by section 38(3) (f) of the NHRA. The 2012 report argues that the no-go alternative would not necessarily be the best option for the sites in general terms of heritage conservation due to Eskom's intention to sell the land should it not be able to develop a nuclear power plant on it is without substance. This argument cannot be accepted as a relevant consideration as envisaged in terms of section 6 of PAJA[128], as no information is provided as to the nature of future possible developments and it is also not possible to speculate what the potential public response thereto might be.
105. No mitigation plan is included in the HIA 2012. Although it is acknowledged that a 'mitigation plan' is necessary the report submits that the scope of mitigation work will have to respond to the final layout[129] which is yet to be determined.

**GENERAL FAILURE TO PLACE RELEVANT CONSIDERATIONS IN FRONT OF THE DECISIONMAKER VIOLATES PAJA 6(2)(E)(III).**

106. Failures to assess socio-economic impacts, worst-case scenario impacts, waste impacts, a no-go option, project alternatives, and purpose and need (in addition to violating substantive provisions of NEMA and the EIA Regulations), also amount to the withholding relevant information from the decision-maker in violation of PAJA 6(2)(e)(iii).
107. Because of NEMA's repeated emphasis on the integrated nature of environmental management, the socio-economic impacts of the NPS (most notably the impact on electricity prices and the economic fallout from a disaster) is relevant information that must be brought before a decision-maker. Because NEMA places such a high premium on minimisation of impacts and investigation of mitigation, a worst-case scenario analysis is also clearly relevant information, as it will bring to light the full extent of potential impacts and all possible safety measures.[130] Because of NEMA's life cycle and

[127] HIA 2012 pg. 10

[128] Promotion of Administrative Justice Act 3 of 2000

[129] HIA 2012 pg. 73

[130] *See supra* Section (b)(ii) at p. 13–15 & n. 30.

intergenerational provisions, waste impacts are also relevant. Assessment of project alternatives and a no-go option are relevant because NEMA and the EIA Regulations have specified them as such.[131] Any approval made without such information will be one in which relevant factors were not considered.

## CONCLUSION

108. The HIA 2010 as well as the March 2011 Status Report submit that mitigation will be extremely costly and technically difficult. In the HIA 2012, this position dramatically shifts to mitigation being considered feasible with available resources. No adequate explanation or justification for this shift is provided, nor is there any indication of the available resources or projected costs.
109. Several statutory requirements in terms of section 38(3) have not been complied with, particularly 38(3) (d); 38(3) (e); 38(3) (f) and 38(3) (g). With at least four of the seven minimum requirements not being met, it cannot be said that the 2012 report constitutes a Heritage Impact Assessment.
110. It is submitted that the decision maker cannot make a valid and lawful decision based on the HIA 2012 because of the absence essential information required by statute.

## OVERALL CONCLUSION OF THIS SUBMISSION

It is submitted that the failure to properly assess the impacts referred to above creates a real risk that if the project is authorized it will infringing the environmental rights of both present and future generations. Further, Version 2 of the RDEIA report does not place all relevant information that could materially influence the decision maker before it, and therefore a decision to authorise the construction of a nuclear power station based on this report would be open to legal challenge.[132]

Yours faithfully,
**LEGAL RESOURCES CENTRE**
**PER:**

**Angela ANDREWS**

[131] NEMA s 24(b)(ii); EIA Regulation 31(g), 1 (definition of “alternatives”).

[132] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000.

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LRC
Legal Resources Centre

Your Ref: Nuclear 1 DEA Ref. No.:12/12/20/944

Our Ref: AA

12th May 2016

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**RE: Final Environmental Impact Assessment Report for the Eskom Holdings Ltd - Nuclear Power Station and Associated Infrastructure (Nuclear-1) - DEA Ref. No: 12/12/20/944 ("FEIA report").**

We act for Earthlife Africa, Johannesburg, South African Faith Communities Environmental Initiative, and Greenpeace Africa. We submit our clients' comments on Final Environmental Impact Assessment Report (**FEIA report**) for the proposed Nuclear-1 Power Station (**NPS**).
We are assisted in making this submission by Dr Mark Chernaik PhD,[1] and Professor Stephen Thomas.[2]

[1] Staff Scientist, E Law (Environmental Law Alliance World Wide), Eugene, Oregon, USA

[2] Professor of Energy Policy, Public Services International Research Unit (PSIRU), Business School, University of Greenwich 30 Park Row London SE10 9LS UK

1. We will refer to our previous submissions to two draft versions of the environmental impact assessment report dated 5th August 2015 and 9th December 2015. Many crucial issues raised repeatedly in those submission have not been addressed, or have been addressed in a manner which is non compliant with the requirements for environmental impact assessments under section 24 of the National Environmental Management Act.[3] Where necessary our previous submissions will be updated, summarized, and repeated where necessary for completeness. We request that this entire letter is placed before the decision maker.
2. It is submitted the FEIA report fails to place material relevant considerations before the decision maker as required by the Promotion of Administrative Justice Act[4] (**PAJA**) and violates several provisions of the National Environmental Management Act[5] (**NEMA**) and applicable regulations promulgated thereunder.[6] As such it does not comply with the regulatory requirements for the granting of an authorization under section 24 of NEMA and should such authorization be granted it stands to be reviewed and set aside by the High Court,

The following issues raised in our submission were not addressed and remain key concerns.

**FAILURE TO ASSESS ECONOMIC AND SOCIO-ECONOMIC IMPACTS OF THE PROPOSED PROJECT VIOLATES NEMA AND THE EIA REGULATIONS, READ TOGETHER WITH PAJA SECTION 6(2)(e).**

3. We have repeatedly emphasized that the EIA fails to take into account the most important and far reaching potential social and economic impacts of the construction of the proposed nuclear power plant. These impacts have not been adequately assessed and mitigated in terms of the applicable legislation.

4. These above impacts include:
   a) the economic impact of a worst case scenario radiation release. The Fukushima, Chernobyl and Three Mile Island disasters have demonstrated the devastating socio economic effect of a major nuclear accident.
   b) the economic impact of the project on consumers due to the cost of the nuclear build program and its impact on vulnerable and disadvantaged communities
   c) the inter generational impact of disposing of nuclear waste.

[3] 107 of 1998

[4] 3 of 2000

[5] 107 of 1998

[6] EIA Regulations 2006, GNR 385 GG 28753 of 21 April 2006 ("**2006 EIA Regulations**")

**We reiterate the legislative requirements for the assessment of these socio economic impacts under "Legislative context and duty to assess economic impacts" in paragraph 49 below.**

**Economic impacts of a worst case scenario radiation release** (see paragraphs 72 to 97) below

**Economic impacts of the NPS on the consumer**

5. In response to concerns raised that the EIA fails to assess economic impacts of the NPS including the impacts on the consumer, the FEIA introduces two assumptions, namely
   - "The need and desirability for the Nuclear Power station is adequately defined by the current IRP.[7] If the future IRP does not include the option for nuclear power as a result of a change in demand patterns and supply options then the need and desirability will fall away.
   - That the NPS will be financially feasible to the country taking into account he risks associated with the technology including the possibility of a core meltdown."[8]
6. The FEIA report provides no legal authority for substituting the legal duty to assess social and economic impacts in an EIA with assumptions that impacts, such as financial or economic impacts, will be acceptable. Regulation 32(2)(d)[9] requires that the report provide :

   > "a description of the environment that may be affected by the activity and the manner in which the physical, biological**, social, economic** and cultural aspects of the environment may be affected by the proposed activity"

7. Regulation 23(2)(g) requires:

   > "a description of the need and desirability of the proposed activity and any identified alternatives to the proposed activity that are feasible and reasonable, including the **advantages and disadvantages** that the proposed activity or alternatives will have on the environment and on the **community that may be affected by the activity;"**

[7] The Electricity Regulations on the Integrated Resource Plan 2010-2030[7] ("**the IRP2010-2030**")

[8] FEIA report executive summary page 3

[9] EIA regulations 2006, GNR.385 of 21 April 2006: Regulations in terms of Chapter 5 of the National Environmental Management Act, 1998

8. In terms of regulation 34 the competent authority must reject a report that is non-compliant with regulation 32(2). See:

> Reg 35. Consideration of environmental impact assessment reports.
> (1) The competent authority must, within 60 days of receipt of an environmental impact assessment report, in writing….
>
> (*d*) reject the report if it does not comply with regulation 32 (2) in a material respect.

9. The FEIA report argues that it is not the function of an EIA to assess "potential socio-economic impacts of an electricity price increase as the National Energy Regulator determines the price of electricity." [10] The social and economic impacts of a project of this scale are required to be assessed in terms of the regulations as well as its need and desirability.[11] If the FEIA is unable to assess these impacts due to not having the requisite tools (which is disputed) or if it claims there is a change in regard to need and desirability and it does not have the information required, it should recommend delaying the granting of the environmental authorization until this information has become available through other policy and regulatory processes which are currently under way.ie until the requisite information is available for it to complete the report..
10. We submit that need and desirability of the NPS cannot be defined by the current IRP (IRP 2010 -2013) as this document is both incomplete and out of date. By doing so the FEIA report places irrelevant considerations before the decision maker and fails to place relevant consideration before the decision maker, rendering an authorization based on the FEIA report judicially reviewable in terms of section 6 of the Promotion of Administrative Justice Act.[12]
11. In 2013 the Department of Energy published a draft update to the IRP 2010-2030 on its website, inviting public comment. It acknowledged that there have been a number of developments in the energy sector in South and Southern Africa since the IRP2010-2030 was promulgated, and that the electricity demand outlook has changed markedly from that expected in 2010, dropping from a projected demand of 454 TWh to a figure in the range of 345-416 TWh. In effect it predicted that 6.6 GW less capacity is required in terms of reliable generating capacity. The demand projections that were used to justify 9600

[10] Response 4 to LRC submission dated 9th December 2015 to GIBB states

"It is the EAP's opinion that assessing the potential socio-economic impacts of an electricity price increase is outside the scope of this EIA as National Energy Regulator determines the price of electricity. The NEMA does not provide the EIA the appropriate tools to assess a multifaceted matter such electricity price increase due to a multitude of variables impacting on the electricity price, one of which may be due to the proposed project, however this has not been confirmed. The determination of electricity price increases fall within the ambit of the National Energy Regulator of South Africa."

[11] Regulation 32(2) – EIA regulations 2006

[12] Section 6(2)(e)(iii)of Act 3 of 2000

MW of additional nuclear energy have thus been reduced by 6600 MW, eliminating the need for the nuclear fleet. Unsurprisingly, a draft IRP update recommended in 2013 that a more cautious and phased-in approach to nuclear energy, with cost limitations, be adopted.

12. The IRP 2010 -2030 is out of date, and the IRP update[13] has not been finalised:

The IRP2010-2030 indicates that the IRP is a:

> '…living plan that is expected to be continuously revised and updated as necessitated by changing circumstances. At the very least, it is expected that the IRP should be revised by the Department of Energy's every two years, resulting in a revision in 2012.'

A decision of the magnitude of the NPS would be required to be based on relevant up to date information, in order to comply with section 6 of PAJA.

13. The IRP 2010-2013 is also incomplete as per the report itself which states:

> "It is relevant to note that the IRP2010-2030 acknowledges that further research is required on the full costs relating to specific technologies (including nuclear) around the costs of decommissioning and managing waste (in the case of nuclear specifically spent fuel)."[14]

14. The FEIA report's assumption that the NPS is financially feasible is not supported by publications of the competent authority dealing with this issue, namely the Department of Energy. No basis for this assumption is given and it is disputed.

15. The Draft IRP Update identified various uncertainties in this regard, including uncertainty in the cost of nuclear capacity and future fuel costs (specifically coal and gas), as well as in fuel availability. It is stated that:

> "[a] persistent and unresolved uncertainty surrounds nuclear capital costs"[15] and goes on to state that "[i]f it is clear that there is no commitment to nuclear capital cost below $6500/KW then procurement should be abandoned as the additional cost would suggest an alternative technology instead."[16]
>
> '[A]ll these uncertainties suggest that an alternative to a fixed capacity plan (as espoused in the IRP 2010) is a more flexible approach taking into account the different outcomes based on changing assumptions (and scenarios) and looking at the determinants required in making key investment decisions'.[17]

16. The Draft IRP Update indicates further that in the shorter term there are clear guidelines arising from the scenarios, including that the nuclear decision can be delayed and that there are indeed alternative options:

[13] Published in GNR.400 of 6 May 2011

[14] IRP2010-2030 paragraph 7.11.

[15] IRP2010 update report para 3.3.

[16] Ibid para 12.5.2 (emphasis added).

[17] Op cit note 49.

> ‘The nuclear decision can possibly be delayed. The revised demand projections suggest that no new nuclear base-load capacity is required until after 2025 (and for lower demand not until at earliest 2035) and that there are alternative options, such as regional hydro, that can fulfil the requirement and allow further exploration of the shale gas potential before prematurely committing to a technology that may be redundant if the electricity demand expectations do not materialise.’[18]

17. The Department of Energy advised stakeholders that a final IRP Update would be submitted to Cabinet for final approval by March 2014, where after the approved document would be promulgated and published in the Gazette.[19] The Draft IRP Update also indicates that the new iteration of the IRP would be influenced by the approved IEP (which has not yet been finalised). The IRP update has however never been finalised and remains in limbo.
18. On 21st December 2015 the Department of Energy published a determination in terms of section 34(1) of the Electricity Regulation Act 4 of 2006, which states that 9 600 megawatts (MW) should be procured to be generated from nuclear energy, “which is in accordance with the capacity allocated under the Integrated Resource Plan for Electricity 2010-2030 (published as GN 400 of 06 May 2011 in GG 34263) (“the IRP 2010-2030” or as updated).[20] The determination itself was already two years old but had not been made public because, according to a Department of Energy statement it was “withheld until such stage that government had agreed to proceed with the request for proposals.”[21] The decision to gazette the section 34 nuclear determination was thus taken on the basis of an out of date and incomplete policy, the IRP 2010-2030, and is not a basis to exclude from the EIA study the assessment of the economic impacts of the NPS, its need and desirability and alternatives.

**Need and desirability report**

19. The need for and desirability of the NPS is not established by the FEIA report, a fatal flaw, since this is a mandatory requirement in environmental impact assessments.[22] What is expressed instead is the opinion of the consultants, unsupported by up to date information as to need and desirability, and replete with contradictory statements..
20. We reiterate our submissions regarding guidance for interpreting this requirement of the 2006 EIA regulation, which is provided in the national[23] and provincial[24] guidelines 2010 guidelines. The DEA 2010 guidelines state:

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[18] Op cit note 49.

[19] http://www.doe-irp.co.za/ (accessed 13 January 2015).

[20] GNR 1268 published in Government Gazette number 39541 dated 21 December 2015

[21] Department of Energy Media Statement - Progress with the Nuclear New Build Program dated 26th December 2015.

[22] Regulation 32(2)(f), EIA regs 2006

[23] DEA (2010), Guideline on Need and Desirability, Integrated Environmental Management Guideline Series 9, Department of Environmental Affairs

"While NEMA (and its predecessor the Environment Conservation Act, 1989 (Act No. 73 of 1989) does not specifically refer to "need and desirability", the Constitutional Court in the Fuel Retailed case in 2007 already confirmed that "need and desirability" is a relevant consideration and the Constitutional Court at that time equated it to the socio-economic considerations. Since then the EIA Regulations, as highlighted above, has specifically included the requirement that the "need for and desirability of the proposed activity" must be considered. With the EIA Regulations specifically calling for the consideration of how the "geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity"[8], "need and desirability" relates to all of these considerations and not only to socio-economic considerations.[25]

With regard to the issue of "need", it is important to note that this "need" is not the same as the "general purpose and requirements" of the activity. While the "general purpose and requirements" of the activity might to some extent relate to the specific requirements, intentions and reasons that the applicant has for proposing the specific activity, the "need" relates to the interests and needs of the broader public. The consideration of "need and desirability" in EIA decision-making therefore requires the consideration of the strategic context of the development proposal along with the broader societal needs and the public interest."[26]

"Financial viability must be considered within the context of justifiable economic development, measured against the broader societal short-term and long-term needs. While the financial viability considerations of the private developer might indicate if a development is "do-able", the "need and desirability" will be determined by considering the broader community's needs and interests as reflected in an IDP, SDF and EMF for the area, and as determined by the EIA. While the importance of job creation and economic growth for South Africa cannot be denied, the Constitution calls for *justifiable* economic development. The specific needs of the broader community must therefore be considered together with the opportunity costs and distributional consequences in order to determine whether or not the development will result in the securing of ecological sustainable development and the promotion of justifiable social and economic development - in other words to ensure that the

[24] DEA and DP 2011- EIA Guideline and Information Document Series Guideline On Need And Desirability

[25] DEA Guideline On Need And Desirability- page 13

[26] id page 14

development will be socially, economically and environmentally sustainable."[27]

21. The Need and Desirability Report for the FEIA report[28] is clearly intended to motivate for the authorisation of the application for the NPS, rather than being a neutral statement which addresses the imperative that development must be justifiable, as envisaged in the previous paragraph. It states:

> "This chapter provides an overview of the interaction between electricity demand and supply and the impact of the delay in the implementation of capacity expansion and the economic recession on electricity demand and the various options being explored to balance these. **It further provides a motivation for** the need and desirability for additional base load generation capacity and specifically nuclear generation capacity."[29]

22. This approach is inappropriate for reasons set out below and constitutes an irregularity.
23. The Need and Desirability Report starts out by endeavouring to argue that a component of nuclear energy is essential.[30] However by the end of the report it is far more tentative and concedes that:

> "the case for nuclear power needs to be supported by the revised IRP which is expected to be published in 2016. This chapter on need and desirability is based on the 2010 IRP. The demand in electricity has not increased as predicted in the IRP 2010. If the revised IRP dictates the requirement for nuclear power as part of the generation technology mix then the need and desirability will be confirmed."[31]

24. The above quote above makes it clear that the need component of the FEIA report is based on outdated information and is incomplete. The FEIA report therefore does not meet the requirement of providing a need and desirability study as contemplated in regulation 32(2)(f).[32]
25. Decisions based on materially incorrect and/or irrelevant considerations stand to be set aside on review. So too are decisions based on the failure to take into account relevant information.[33] Environmental authorization decisions based on outdated information, such as the IRP 2010 thus stand to be set aside on review. See *Sea Front for All and Another v the MEC: Environmental and Development Planning Western Cape Provincial Government and Others.*[34] As stated in this judgment,

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[27] id page 11

[28] FEIA report paragraph 4

[29] id

[30] Summary 4.6

[31] FEIA report page 4-20

[32] EIA regulations 2006

[33] PAJA section 6(e)(iii)

[34] Paragraph 39

"The integrity of the environmental impact assessment process will be seriously undermined if decision makers are to base their decisions on substantially outdated information."[35]

26. The FEIA report adopts a contradictory and irrational approach to the fact that it is dependent on information that is not yet available, in order to complete the need and desirability requirement. The reort refers to the fact that during the public participation process for the EIA questions were raised as to whether a NPS was still needed, given the fall off in electricity demand:

> "A key argument presented in these discussions was that demand for electricity has simply not followed the projected growth demand that is contained in IRP 2010. The 2010 IRP is the underpinning document of the need and desirability for the proposed NPS, and as such the fact that the current demand does not meet that projected in IRP 2010 questions the need for the proposed NPS."[36]

27. The report deals with this issue as follows:

> "The key issue is whether nuclear power remains part of the generation options contained within the IRP, and if it does then the "No-go" option would not be considered tenable. From the CSIR publication, it is clear that the 2010 IRP is outdated and must be updated as a function of currently projected demand for it to be defendable in defining the need and desirability for nuclear power. However, until such policy updates are made this document remains the reliable and official reference document for this project.[37]"

28. The FEIA report therefore concedes that it is reliant on policy updates to determine need and desirability. However, in a contradictory and irrational manner, it states that until such update is done an out of date policy namely the IRP 2010-2013 remains the "reliable and official reference" for this project. It is not clear what "reliable and official reference" means in this context. Being out of date this document cannot be considered reliable. This is all the more bizarre when regard is had to the following statement made in in response to our submissions:

> "it is clear that the IRP 2010-2030 is outdated and must be updated as a function of currently projected demand for it to be defendable in defining the need and desirability for nuclear power."[38]

29. The IRP 2010-2030 is also incomplete by virtue of the fact that it requires certain factual information about costs to be established.[39] The FEIA report should advise the decision maker of this deficiency and incompleteness of the

[35] Paragraph 73

[36] FEIA report 5.9

[37] FEIA report - Executive summary p41

[38] Response 63 to LRC submission dated 9th December 2015 to GIBB

[39] See above

costing of future nuclear power, but fails to draw attention to this, thus failing the requirement of placing relevant considerations before the decision maker.

30. The FEIA report this abdicates responsibility for determining need and desirability of the project, relying on a policy process external to the EIA to determine this. It may only lawfully do this if the policy process that it defers to is up to date. For if it is out of date this constitutes placing irrelevant and incorrect information before the decision maker, and failing to place relevant information before the decision maker, such as the fact that the decision is premature in the absence of an up to date IRP, and costing of aspects of the nuclear program.
31. The EIA consultants, faced with this quandary of no up to date IRP should have recommended postponing the EIA decision until the IRP is updated and the cost of decommissioning and management of nuclear waste has been determined, so that it is in a position to make recommendations on accurate, up to date and relevant information as to cost, purpose, need and the no-go option.

**Electricity demand and predicted future trends**

32. The arguments that increased economic growth will necessarily give rise to increased energy consumption are also questioned.[40] Such conclusions should be based on independently verifiable reports based on up to date factual information, and the FEIA report does nor provide this nor, does the IRP 2010-2030.
33. There are in any event counter arguments to the assertion that economic growth inevitably leads to electricity demand growth, and that new generating capacity must be installed to cater for the growth in energy demand.[41] In UK, electricity demand in 2015 was less than 50% higher than in 1973 while GDP was had nearly tripled. With a strong energy efficiency policy, it should be possible for SA to substantially improve living standards without increasing electricity demand. Energy efficiency gains should more than cover increased usage. Another statistic on energy efficiency shows that UK electricity demand has declined by about 12% since 2000 despite GDP increasing by about 15% in the same period.[42]

[40] FEIA report paragraph 4

[41] FEIA report paragraph 4

[42] See for example:
http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/datasets-and-tables/data-selector.html?cdid=ABMI&dataset=qna&table-id=A2 GDP in real terms in 2000 was £1377611m and in 2014 was £1749712m, an increase of 27%

According to
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/449134/ECUK_Chapter_3_-_Domestic_factsheet.pdf UK electricity consumption in 2000 was 28325 thousand tonnes of oil equivalent (I assume the conversion factor to kWh is not needed and in 2014 was 26088 thousand toe, a fall of 7.9%

34. The opinion that base load cannot be met except with coal or nuclear power is materially incorrect and/or incomplete and/or a non expert opinion, and therefor constitutes an irrelevant consideration. It cannot form the basis of a lawful decision on the application for authorization.

**The no-go option**

35. It is submitted that the FEIA report fails to properly assess the no- go option despite complaints in this regard, raised in submissions to the draft EIA. The FEIA report states that the purpose of the no go option is to compare the benefits and detriments of not going ahead with the project.

> "The principle of the "No go" alternative, is, at its simplest, that the benefits of the proposed activity will not be realised with the status quo remaining and neither will the associated negative impacts/risks. In terms of the benefits of the proposed activity, these centre principally around the provision of sustainable, reliable and affordable baseload power within the overall energy supply mix needed for South Africa. "[43]

36. This glib statement of opinion, unsupported by up to date information and independent and scholarly analysis cannot go unchallenged. Without burdening this submission with detailed counter arguments we draw the decision maker to the following examples which challenge this assertion:.
37. It is disputed that nuclear technology is sustainable, reliable and affordable, without qualification, for example
    a) Sustainability – given the long term liability of and danger posed by storage and disposal of nuclear waste, which this EIR cannot and does not address, the project is not sustainable; this issue is acknowledged in parag 5.9 of the report.
    b) Reliability – no justification is given for this sweeping statement. Nuclear reactor reliability would be dependent on a number of variables including design, reliability and skill of personnel, and management systems. Reliability in manufacturing of nuclear parts is also an important issue. It has recently come to light, for example, in the case of the French nuclear power company Areva, that as a result of an investigation at the instance of the French nuclear safety regulator (Autorite de Surete Nuclear (ASN)) up to 400 irregularities in manufacturing checks have been found at its forge plant where parts for the Flamaville reactor are to be manufactured.[44]

> "On 25th April 2016, AREVA informed ASN of the initial results of this additional analysis. They revealed irregularities in the manufacturing checks on about 400 parts produced since 1965, about fifty of which would appear to be in service in the French

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[43] 5.9 FEIAR

[44] http://www.french-nuclear-safety.fr/Information/News-releases/Irregularities-concerning-components-manufactured-in-its-Creusot-Forge-plant

NPPs. These irregularities comprise inconsistencies, modifications or omissions in the production files, concerning manufacturing parameters or test results"[45]

c) Affordable – as stated in the IRP update the issue of cost and affordability is still very contested and far from certain – see paragraph 15 of this submission, above. The University of Cape Town[46] has produced a study which shows the following:

> "if economic growth is lower, and nuclear costs are high, the impacts of committed fleet of nuclear plants are substantial and negative. Electricity prices will be higher over the period 2030-2040 …The investment required will be significant, with impacts on investment in other sectors and the electricity price. This leads to substantial job losses if the nuclear commitment goes ahead,…. with up to 75000 jobs lost as the economic contracts in response to higher electricity prices. Given high levels of unemployment amongst unskilled workers, they are most likely to face the worst impacts of growing unemployment. In turn, household consumption will drop for all consumer groups, with potentially serious ramification on welfare."

d) Baseload – in a rapidly changing and evolving energy landscape approaches to baseload are also changing. See for example the following statement by Steve Holliday, CEO of UK's National Grid that operates the gas and electricity transformation and distribution systems in the UK,[47]:

> "What is the future of baseload generation in such a system? 'That's asking the wrong question…the idea of baseload power is already outdated…."

**38.** South African legislation, case law and international best practice[48] requires the environmental impact assessment to be based on a consideration of scientific and technical reports. The environmental practitioner is required compile reports on the basis of expertise and by implication not on the basis of its own opinion.[49] Notwithstanding the requirement[50] the FEIA "no go option" report

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[45] id

[46] Energy Research Centre. 2015. South Africa's proposed nuclear build plan: An analysis of the potential socioeconomic risks. Energy Research Centre, University of Cape Town, South Africa.

[47] http://worldenergyfocus.org/wp-content/uploads/2015/09/EP_WEF_2015_15_MR01.pdf

[48] See *Sea Front For All and Another v the MEC: Environmental and Development Planning Western Cape Provincial Government and Others* 2011 (3) SA 55 (WCC). paragraph 30; and NEMA section 24(1)

[49] 2006 EIA Regulations, regulation 18(b)

[50] See *Sea Front For All and Another v the MEC: Environmental and Development Planning Western Cape Provincial Government and Others* 2011 (3) SA 55 (WCC). paragraph 30; and NEMA section 24(1)

contains no such reports. The opinions of the authors, if not supported by such reports constitutes an irrelevant consideration.

39. The FEIA report rejects the possibility of alternatives, premising this recommendation on the existence of the IRP 2010 policy and the opinion that base load cannot be met through anything other than coal and nuclear power. We reiterate our submissions above, that the IRP 2010 is both out of date, incomplete and in any event did not, at the outset, preclude the consideration of a non-nuclear option (see paragraph 41 below) In other words it did not indicate that there are not feasible alternatives to Nuclear 1.
40. In circumstances such as the present, where the policy on nuclear energy is under review and is being updated, it is inappropriate to be conducting an environmental impact assessment, as it will obviously be based on out of date information. The result can only be an irregular authorization. Since Eskom's consultants contend that the environmental impact assessment process is a

> "project specific environmental management tool does not have the mandate, neither is it equipped to revisit the strategic analysis of power generation alternatives that was completed in the IRP,"[51]

the application for authorization should be suspended until the requisite information has been generated, by means of the policy and regulatory processes, such as the Integrated Energy Plan and the Integrated Resource Plan (provided for under the National Energy Act,[52] the Electricity Regulations Act,[53]) which the public has been advised are being reviewed.

**The arguments made in support of the claim that nuclear energy is essential are in any event fallacious.**

41. Firstly in response to public concern, the IRP2010-2030 generated a non-nuclear option, at a time of far greater predicted electricity demand than at the current time.[54] But cost-optimal solutions were replaced after a "revised balance scenario" was developed, (which 'balanced' the cost-optimal solution in accordance with qualitative measures such as local job creation) culminating in the department accepting the nuclear fleet policy option. Notably a second round of public participation led to several changes in IRP assumptions, including the adjustment of investment costs for nuclear units by an increase of 40% based on recent construction experience.[55]
42. Secondly the IRP 2010 update, which is a detailed analysis, argues for a cautious approach to the procurement of additional nuclear power and certainly does not regard nuclear power as the only reliable form of base load for the Western Cape. It is also conceded by the Need and Desirabilty study of the

[51] Letter from Gibb to Legal Resources Centre dated 5th August 2015.

[52] 34 of 2008

[53] 4 of 2006

[54] Purpose and need study, page 4-1 and 4-2 provide demand projections used in the IRP 2010-2030,

[55] Ibid, Summary (GNR.400).

FEIA report that the need for and timing of the proposed NPS could well change given the change in demand for electricity that has manifest in the period from 2010 to 2015.[56] This supports the case made in this submission that the environmental authorisation of such a significant project, in the absence of up to date information as to purpose and need, is premature and should be delayed until all the relevant information is available for the decision maker to consider.

43. The Need and Desirability Report ends with an out of date quote from Deputy President Motlanthe[57] which is inappropriate in a report of this nature given that there are policy processes underway which are as yet incomplete for determining the need and desirability of new nuclear power stations. The comment constitutes an irrelevant consideration and should be ignored.
44. The concluding statement in the Need and Desirability Report is in fact far more tentative. It concludes that the need for the project is at best tentative and requires to be supported by an updated IRP "if the revised IRP dictates that requirement of nuclear power as part of the generational technology mix, then the need and desirability will be confirmed."[58] Therefore the FEIA Need and Desirability Report does not form a basis to conclude that at the current time the NPS is needed or is desirable as part of South Africa's energy future
45. The fact that in December 2015 a determination in terms of section 34 of the Energy Regulatory Act was made does not remove the requirement that a social and economic impact assessment be undertaken for an environmental authorisation to be granted under section 24 of the NEMA. This determination was in any event based on the IRP 2010 – 2013 and even though it stated that it was also based on the IRP "as updated", this update has never been completed and was still the subject of public comment at the time when the section 34 determination was made. It can therefore not replace a legal requirement in terms of s24 of NEMA and the 2006 EIA regulations that need and desirability must be established and that social and economic impacts of the proposed activity must be assessed.

**Assessment of costs is flawed**

46. A proper assessment of the social and economic impacts of the waste could have a significant effect on the financial viability of the project, in turn impacting on the need and desirability of the project. We refer to the German case mentioned in paragraph 68 below. The costing of decommissioning and the management of waste for thousands of years into the future was required by the IRP 2010-2013 but has to date not been done. This means that the assessment of economic impacts of the NPS is not possible.

[56] FEIA report page 4-12

[57] FEIA report p 4-20

[58] FEIA report p 4 -20

47. We submitted in comments on the draft EIA that cost estimates were provided without justification or authority and as such these constitute irrelevant considerations that should be disregarded by the decision maker.[59] We annexed the expert report by Professor S Thomas which disputes the basis given for these cost estimates. The response to this report is that the information supplied was correct at the time, and that the assumption of this EIA is that the Nuclear 1 is financially feasible. No independently verifiable expert justification is provided for this statement or any costing details.
48. It should be noted that to date the costs of the NPS have not been determined. See Department of Energy's Draft Integrated Resources Plan, published in 2013 that the costs of the nuclear new build program are at this stage not determined.[60]

**Legislative context and duty to assess economic impacts.**

49. The EIA avoids addressing important aspects of the economic assessment, despite these issues having been raised. As regards the impacts of nuclear waste it states that it is assumed that by the time the decommissioning takes place. SA will have implemented an effective nuclear waste management strategy. It also states that the project has been based on the assumption that the nuclear power is financially feasible. "it is not the purpose of the EIA process to deal with the impact of electricity prices and make a recommendation on this issue to the environmental decision maker"[61] is incorrect.
50. Nowhere is a legal justification given for replacing the requirement for an assessment of a potential impact with an assumption that the impact will be acceptable, which is really what this argument is saying. This constitutes an unlawful abrogation of the duty to assess economic impacts. The Fukushima, Chernobyl and Three Mile Island disasters have demonstrated the devastating effect of a major nuclear accident. The failure to do so is a material flaw in the decision making process and will result in a reviewable decision.
51. The legislative basis for considering the economic impacts of a major accident are repeated here for ease of reference
    The EIA report requires an assessment of each identified potentially significant impact, including cumulative impacts, nature extent and duration of impact, probability of impact, degree to which it can be reversed and mitigated.[62]

52. Socio economic impacts are recognized as requiring assessment by virtue of the following provisions of NEMA. The preamble and principles laid out in section 2 of NEMA recognizes that sustainable development requires the

[59] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000

[60] See paragraph 15 above

[61] Version 2 DEIA report 2 Table 7-22 Common thematic issues and responses page 7-64

[62] 2006 EIA Regulations, regulation 32 (2) (k)

integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations. Section 23 of NEMA requires the actual and potential impacts on the environment, socio-economic conditions, and cultural heritage to be taken into account in environmental management. Regulations 32(2)(d) of the 2006 EIA regulations requires a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity.

53. Added to this section 2(4)(b) of NEMA states that environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option. The best practicable environmental option is defined in section 1 of NEMA as the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.

54. Guidelines published in 2005 by the Provincial Government of the Western Cape determine how economists are to be involved in the EIA process, and are clearly a relevant consideration.[63] They stated that the basic function of economic specialist input is to assist in the determination of whether a project will enhance the net social welfare. This involves considering the efficiency, equity and sustainability of the project. Input from an economic specialist is especially required if there is a chance that economic impacts are likely to influence the decision of whether or not a project is desirable. The guidelines further state that macro-economic risks need to be taken into account. In fact they clearly state that where the **size of the project is such that it could influence relative prices then further analysis is required to identify and assess potential risks[64].** The guidelines go on to state that the report also needs to take into account the vulnerability of the groups impacted on. Part of the assessment should include a consideration of who benefits and who loses from the impacts associated with the project.

55. It is submitted that the legal context set out above requires the EIA report to consider the economic impacts that the construction of the NPS will have on broader South Africa and in particular the following aspects which were listed in our clients' submission to Version 1 of the RRDEIA report.
    a. the impact on the price of electricity of the expenditure of R120bn on a NPS and how this will affect consumers, particularly the poor;
    b. the impact on household income and the taxpayer;
    c. the economic impact of a catastrophic incident on adjacent communities;

[63] Van Zyl, H.W., de Wit, M.P. & Leiman, A. 2005. *Guideline for involving economists in EIA processes: Edition 1*. CSIR Report No ENV-S-C 2005 053 G. Republic of South Africa, Provincial Government of Western Cape, Department of Environmental Affairs & Development Planning, Cape Town. These guidelines are relevant to the extent that the NPS will be built in the Western Cape.

[64] id page 35

d. the economic impact on all phases of the NPS's life including decommissioning which could be of the same order as commissioning;
e. an indication of the costs and benefits to assess the socio-economic impacts of the project;
f. the economic impacts of a major or serious accident on the broader community of Cape Town and environs;
g. waste storage costs (current and cumulative).

56. It is submitted that the failure to assess these impacts results in the infringement of the environmental rights set out in both the Constitution and NEMA. Our client is concerned that the costs involved in the construction and operation of the NPS will be passed on to electricity consumers, including those from disadvantaged backgrounds, and will be intergenerational for thousands of years, being visited on future generations long after these plants have been decommissioned and who therefore have not had any benefit from them.[65] Both the Constitution and NEMA make specific mention of the right to have the environment protected for the benefit of both present and future generations and that development should be sustainable. It is submitted that the assessment of the above socio-economic impacts as well as the assessment of cumulative economic impacts is required in order to ensure that these constitutional imperatives are complied with. [66]

57. In addition to the concerns canvassed in earlier submissions, we reiterate that it is not possible for the applicant to come into compliance with the EIA requirements for assessing the economic impacts of the project at this stage because of lack of certainty as to the specific type of plant, its design and safety mitigation features. Different types of nuclear power plants, and their safety mitigation features will generate different consequences in a major accident which will in turn result in different economic impacts. The monetary value of such economic impacts will also be different for different sites, based on issues such as population densities and the nature of the surrounding economy. Factors which may determine the range of impacts include:
    a. fuel storage options including alternatives;
    b. waste facilities and disposal methods;
    c. number of containment hulls and their quality;
    d. whether a core catcher is implemented (such technology is dependent on the type of design);
    e. the emergency zones that need to be determined;
    f. the source term;
    g. possible cost overruns;
    h. labour, expertise and material required etc;
    i. the nature of the adjacent economy, and population densities e.g. types of agriculture undertaken;
    j. the extent of emergency zones

[65] NEMA s 1 (definition of "sustainable development").

[66] 2006 EIA Regulations, regulation 32 (2)(k)

**Land use planning**

58. Our clients submitted in comments on draft EIA, stating that the report fails to address the impact that the construction of future nuclear power stations at Duynefontein would have on the development and expansion of Cape Town and surrounding areas such as Atlantis. The report therefore fails to place a relevant consideration before the decision maker, in matters which is of high importance to the City of Cape Town and its residents.
59. The anticipated closure and decommissioning of the Koeberg power station in the course of the next few decades would have meant that areas around Koeberg, which are currently too close to the power station, would become available for development. The Koeberg nuclear power station is thirty years old and due to be decommissioned over the next two decades.[67] Hence in the next two decades land closer to Koeberg Power station will become available for development.
60. The FEIA report gives contradictory responses to this submission. In its response to our submission on 9th December 2016 it replies that the Koeberg Nature Reserve ie land within the 5km PAZ is a proclaimed protected area and does not automatically become available after decommissioning, ignoring the obvious concern of our submission, which relates to land close to, not next to the power station.[68] Elsewhere in the FEIA report it is conceded that land close to Koeberg will not be available for development if the NPS is built.[69] The FEIA Town Planning Assessment report, states "The proposed development will have an impact on future development of the region in terms of land that can be utilised for future development. Areas around the site will need to be protected, densities may need to be lower than if the development was not there and infrastructure upgrades will be required, especially roads.
    The report however gives contradictory information on this impact though, stating in Chapter 10
        > "It is therefore foreseen that the development of the power station is unlikely to result in the restriction of land uses, which cannot be appropriately dealt with through existing planning tools / legislation."[70]
61. Clearly our submission was referring to all land not just nature reserve land in the vicinity of Koeberg. Land beyond the nature reserve will not be freed up for development if more nuclear reactors are to be built on the site. This is a highly relevant consideration in Cape Town which has a critical land and housing shortage and is rapidly developing.

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[67] "It is accepted, however, that the Koeberg design in conjunction with the initiative contained in the station Life of Plant Plans, currently supports an operational life of 40 to 50 years. By 2014, unit 1 will have been in operation for 30 years, with unit 2 reaching the equivalent operational age by 2015." Johannes Kotze, Project Director: Strategic Nuclear Projects at Eskom, http://www.pragmaworld.net/media-centre/news-articles/long-term-asset-management-of-koeberg-nuclear-power-station-to-be-addressed-at-physical-asset-management-conference.php

[68] Response 19 to LRC submission dated 9th December 2015 to GIBB

[69] Page 41

[70] Chapter 10 p 236

62. The application for authorization of a further 4000MW of nuclear power envisages the construction of facilities which could generate 4000MW of nuclear power and which will have a life span of between fourty and sixty years and perhaps longer.[71] Added to this would be the construction and decommissioning time. In total, the planned building of addition nuclear power will constrain development around the northern suburbs of Cape Town, a large metropolis **for another eighty or more years**. This is a very significant socio economic impact as the city has a rapidly increasing demand for housing and is landlocked by mountains and ocean, placing pressure for development on the zone to the north of the city between Cape Town and Dynefotein as well as to the north of Dynefontein. Also Atlantis, which is 23 km north of the Koeberg, has a critical need for investment in job creating industries in order to address the legacy of apartheid planning which put this residential area very far from economic activity. According to the Cape Town City Council website:[72]

> "Job creation and economic development are two of Cape Town's biggest priorities. The unemployment rate in Atlantis is one of the highest in the metropole. [73]

In the experience of one of our clients, Greenpeace, in the case of nuclear plant construction, that construction workers need to be certified for this work, and only a small fraction are usually sourced locally due to certification requirements.[74]

63. The responses to our submission do not address the latter points and fail to properly appraise the decision maker of this highly significant impact and relevant consideration. Therefore a decision to authorise the construction of a nuclear power station based on this report would be open to legal challenge, on the basis that relevant considerations were not placed before the decision maker.

**FAILURE TO ASSESS ALL POTENTIAL IMPACTS OF NUCLEAR WASTE VIOLATES NEMA AND THE EIA REGULATIONS, READ TOGETHER WITH PAJA 6(2)(e).**

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[71] http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Power-Reactors/Nuclear-Power-Reactors/

[72] http://www.capetown.gov.za/en/MediaReleases/Pages/CityReleasesIndustrialLand.aspx

[73] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000.

[74] This has been their experience on all of the roughly 20 construction projects that they have been involved in. In the case of Olkiluoto in Finland these workers came from Portugal, Poland and Ukraine, not from Finland. In the case of the Temelin in the Czech Republic, these workers came the entire republic, as well as from Ukraine and Russia, but not from Ceske Budejovice, the nearest major town. In Flamanville there were hardly any Bretons among the workers - they came from the entire country of France.

64. The FEIA report assessment of impacts of waste costs is non compliant with the requirements of NEMA EIA regulation 32(2).[75] The report concedes that the intergenerational cost of treatment of nuclear waste will be a significant negative impact of nuclear power.[76] However it fails to assess the social, economic and environmental impact thereof based on grounds which are legally invalid.

65. Radioactive waste is certainly a "significant impact" under a common sense reading of the definition, provided in the 2006 EIA regulations,[77] and it has been identified as such by numerous public participants,[78] the DEA,[79] and the applicant itself.[80]

66. However the FEIA report fails to undertake an environmental impact assessment of waste to be generated by the NPS. It concedes that the impact of nuclear waste disposal has not been presented in the EIA.[81] This is the admission of a fatal flaw. Yet the FEIA report attempts to justify this failing stating that:

> "This is because the NNR has strict requirements regarding the disposal of radioactive waste and the assessment would have inevitably simply presented those requirements, which are deemed by the NNR to result in the safe handling and disposal of radioactive waste. In the safety case the applicant would have to prove to the NNR that the waste management approach would be consistent with the requirements for safe disposal of radioactive waste."[82]

67. This statement demonstrates the FEIA report fails to understand and fulfil the requirements set out in the regulations for environmental impact assessments (in particular regulation 32(2) of the 2006 EIA regulations, and the NEMA principles) for activities giving rise to major social economic and environmental impacts. We repeat these requirements. An exposition of the disposal requirements of the NNR for radioactive waste is obviously not an assessment of the impacts of the waste. As will be discussed below, nuclear waste is material which is extremely hazardous and will require to be managed for several thousands of years, and this will necessarily have cost impacts, and thus socio and economic impacts.[83] The failure to assess these is a fatal flaw made worse by the current economic challenges that South Africa faces.

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[75] EIA regulations 2006

[76] Response 3 to LRC submission dated 9th December 2015 to GIBB

[77] 2006 EIA Regulations, regulation 1

[78] Revised DEIR App D8 Combined IRR Volumes Final at 157–186.

[79] Letter from Ms. Joanne Yawitch, Deputy Director General of Environmental Quality and Protection, DEA, to Mr. Tim Liversage, Arcus Gibb (Nov. 19, 2008) (laying out conditions under which the scoping report was to be accepted, which included assessment of nuclear waste).

[80] Revised DEIR, Chapter 9, Impact Analysis 9.29 and APP E29.

[81] Response 52 to LRC submission dated 9th December 2015 to GIBB

[82] id

[83] id

68. In order to illustrate the point that the cost of safe disposal of waste may have very significant consequences, we refer to a recent situation in Germany where the cost of management of hazardous nuclear waste created significant concerns as to the viability of this source of power. We refer to a recent report in a German newspaper, Handlesblatt report[84] which stated:

> "Germany's largest utility E.ON is now ready to accept a deal proposed by the government that makes nuclear power plant operators pay for a significant portion of the phase-out of nuclear energy in the country, Handelsblatt has learned, making it the first major utility to signal its willingness to co-operate. The move two weeks after a German government-backed commission proposed that utilities pay a total of €23 billion, or $26 billion, into a publicly-managed fund, which will cover the cost of the long-term storage of nuclear waste. The plan solicited resistance from Germany's four largest utilities E.ON, RWE, EnBW and Vattenfall, which have so far only set aside €17 billion to cover the cost of the phase out."

69. Also, as stated in paragraph 78 and elsewhere in this submission the function of the NNR is not to conduct environmental impact assessments, and the requirements of an EIA under regulation 32(2) are not fulfilled nor can they be lawfully fulfilled by the NNR

**The following specific concerns were raised but not addressed in the FEIAR**

70. Instead of assessing the impacts of storage of waste in perpetuity the FEIA report states that the EIA is based on the assumption that by the time the NPS needs to be decommissioned South Africa will have implemented an effective nuclear waste management approach that will ensure the safe disposal of radioactive waste in perpetuity but that circumstance down not prevail currently.[85] There is no basis provided for this assumption in fact. There is also is no legal basis for replacing compliance with an assessment requirement with a statement that it assumes that the problem will go away. And finally even it if is correct that the state will be able to effectively manage waste which will be active and pose a risk for thousands of years, this is still not an assessment of the impacts of the waste. This is a fatal flaw. The liabilities of NECSA for cleaning up the contaminated sites in South Africa are now a matter of dispute between NECSA and the AG.[86] Current generations will have to pay for the costs of historical nuclear waste. Given that we have the

[84] Report no 427 11 May 2016
Exclusive: E.ON Open to Government Deal on Financing Nuclear Waste Disposal - https://global.handelsblatt.com/breaking/exclusive-e-on-open-to-government-deal-on-financing-nuclear-waste-disposal

[85] Response 3 to LRC submission dated 9th December 2015 to GIBB

[86] http://www.bdlive.co.za/business/energy/2016/01/28/necsa-now-embroiled-in-nuclear-waste-row

polluter pays principle in our legislation, the costs of future remediation need to be included in the EIA.

**Inadequate Plans for the Interim Storage of Spent Fuel**

71. The FEIAR fails to assess and suggest mitigation of the serious risks posed by the storage of spent fuel. Once again the reason given is that the safety case will be assessed by the NNR. We repeat our assertion that the assessment of impacts and mitigation measures is an integral part of the EIA and is not provided for in the NNR process.

**FAILURE TO ASSESS WORST-CASE SCENARIO IMPACTS VIOLATES NEMA AND THE EIA REGULATIONS, READ TOGETHER WITH PAJA 6(2)(B).**

72. The FEIA report fails to properly assess the radiological, social and economic impacts of a worst case scenario, or catastrophic release of radiation, notwithstanding the fact that this this issue was pertinently raised in response to two draft EIA submissions. The issue will be dealt with in two parts namely:

(i) Failure to assess radiological impacts of a beyond design basis accident;

(ii) Failure to assess economic and social impacts of a major beyond design basis accident.

73. As will be argued below, the failure of the FEIA report to undertake an impact assessment of the radiological, social and economic impact of a worst case scenario, or catastrophic incident makes it impossible for a proper assessment of the relative merits of the various sites to take place. A catastrophic incident would obviously make a greater impact on a city of over 3 million in habitants, as compared with a rural site. However this comparison does not take place by virtue of the fact that the scale of such potential impact is not studied. We submit that this is a fatal flaw in the assessment process.

**Failure to assess radiological impacts of a beyond design basis accident**

74. The FEIA report fails to provide an assessment of the radiological impacts of a severe (beyond design basis) accident at the proposed facility, a fatal flaw in an impact assessment under section 24 of the NEMA. It states that:

> "radiological safety issues lie firmly within the ambit of the NNR process ( as stipulated within the cooperative agreement between the

NNR (National Nuclear Regulator) and the DEAT").[87]

75. Instead of addressing the requirement that such impacts be assessed, the FEIA report, provides two reports, namely the "Beyond Design Basis Accidents" report, and the "Radiological Assessment Report stating that the purpose of these reports is as follows:

> "The intention here was to detail the circumstances that occurred during the beyond design events of Chernobyl, Three Mile Island and Fukushima. The principle here is that in the design of the proposed NPS that will be reviewed by the NNR, each of the conditions that lead to the beyond design events described above will have to be mitigated in the design of the proposed NPS. Stated differently the risk factors that resulted in the beyond design events will be mitigated in the design of the proposed NPS so as to minimise the probability of their reoccurrence. Refer to Response 21 above."

76. The purpose of these reports is clearly not to provide an environmental impact assessment of the radiological impacts of a worst case scenario. It is also stated in response to concerns raised regarding these reports:

> "The Beyond Design Accidents Report (Appendix E33) has been included for information purposes and in an effort to show how the three (3) major radiation release events from NPS's have been taken into consideration within the design of Nuclear-1. Furthermore the Radiological Assessment (Appendix E32) has been included to assess the normal operations of the NPS and illustrates that the NPS can meet the NNR's normal operations safety standards, and is thus acceptable for this EIA process. Any assessment beyond normal operations lie firmly within the NNR's mandate."[88]

77. This constitutes and incorrect, and fatally flawed approach to the undertaking of an environmental impact assessment, the purpose of which is to assess and mitigate potential impacts,[89] which this approach fails to do.

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[87] Response 21 to LRC submission dated 9th December 2015 to GIBB

[88] Response 21 to LRC submission dated 9th December 2015 to GIBB

[89] NEMA section 24(4)(a)(iv) and EIA regulations 2006 regulation 32(2) (mitigation)

Regulation 32(2)(k) requires impacts to be described, assessed for probability, extent, duration and degree of reversibility and extent to which they can be mitigated, see :

> 32(2) An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in regulation **36,** and must include an assessment of each identified potentially significant impact, including—
>
> (i) cumulative impacts
> (ii) the nature of the impact;
> (iii) the extent and duration of the impact;
> (iv) the probability of the impact occurring;
> (iv) the degree to which the impact can be reversed;
> (v) the degree to which the impact may cause irreplaceable loss of resources; and
> (vii) the degree to which the impact can be mitigated;

78. The National Nuclear Regulator Act[90] (**NNRA**) does not have the legislative mandate to assess the radiological impacts of a major accident, in a manner which will effectively comply with all the detailed requirements of regulation 32(2)(k) and this is also not its legislative purpose. The EIA report is required to undertake this assessment and the failure to do so is a fatal flaw.

79. The apparent difficulties posed in reconciling the assessment provisions of the NEMA with those of the NNRA would have been overcome if the NNR assessment had preceded that of the EIA. This sequencing approach has been adopted in other jurisdictions,[91] and would have efficiently addressed any potential duplication in assessments under the two legal regimes.

80. An environmental assessment report must include

> "an assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of an impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can be mitigated."[92]

"Significant impact" is defined in the Regulations as

> "an impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment."[93]

Under this definition, "significant impact" includes a catastrophic, worst-case scenario impact. In addition, NEMA's repeated focus on minimisation,

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> (*l*) a description of any assumptions, uncertainties and gaps in knowledge;
> (*m*) an opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation

[90] Act of 47 of 1999

[91] Compare for example the approach of the UK Health and Safety Executive regarding the licensing procedures for new nuclear reactors. The HSE propose a two phase process: the first phase would be a Generic Design Assessment which is the HSE's Nuclear Installations Inspectorate's (HSE NII) assessment of the safety case for generic design, leading to the issue of Design Acceptance Confirmation if the outcome is positive. (see Health and Safety Executive: New Nuclear Power Stations Generic Design Assessment Guidance to Requesting Parties, 2008 page 4. See http://www.hse.gov.uk/newreactors/latest.htm?ebul=newreactor/09-October-2008/) The second phase, the nuclear site licensing is the HSE NII's assessment of the application for a nuclear site license and is therefore site, reactor type and operator specific. There is no guarantee that phase 1 will lead to successful Design Acceptance. This will depend on whether the design and submissions meet HSE standards and expectations. Similarly a positive Design Acceptance Confirmation does not guarantee that a subsequent Phase 2 licensing application will be successful, as the latter phase **covers wider issues.** This is the reverse of the process being currently followed in South Africa in respect of the NPS and which we submit is contrary to SA administrative and environmental laws.

[92] EIA Regulations 2006 regulation 32

[93] op cit: regulation 1 "definitions"

prevention, and mitigation of environmental degradation[94] mandates an assessment of the impacts of a severe accident because such an assessment will lead to better prevention and mitigation measures.

81. The NNR, although empowered to assess the safety of a particularly installation it is not empowered to undertake "an assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of an impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can be mitigated."[95] The NNR Act's provisions pertaining to the assessment of the safety case, are not provisions which require and regulate an assessment and mitigation of environmental impacts, and consideration of alternatives, in the same way as is required in an EIA under NEMA.

82. For example without quantitative description of what a worst-case scenario looks like, including an estimate of the extent of radiation dispersal, the number of radiation exposure and cancer cases and all other injuries and fatalities among the local population, and a realistic estimate of economic costs, (including contamination of land and loss of agricultural land)[96] decision-makers will be unable to make a rationally informed choice about whether the purported benefits of the project outweigh its risk. The nature of this type of assessment – an EIA – which deals with external consequences of the activity, falls exclusively within the domain of environmental legislation ie NEMA.

**NNR DEAT co-operative agreement**

83. The co-operative agreement between the NNR and the DEAT[97] states that it has been concluded in terms of section 35 of the NEMA and section 6 of the NNR Act. Section 35 of the NEMA only allows for agreements to be entered into for the purpose of **promoting compliance with the principles of NEMA**.

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[94] NEMA s 2(4)(a)(i)–(iii), (vii), s 23(2)(a)–(b), s 24(1), (4)(b)(ii), (4A).

[95] EIA Regulations 2006 regulation 32

[96] These costs have been assessed with reference to recent serious accidents by competent institutions - See the European Commission estimates contained in COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT - Accompanying the document - Proposal for a Council Directive amending Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations - {COM(2013) 343 final} - {SWD(2013) 200 final} - {SWD(2013) 201 final})
http://eur-lex.europa.eu/resource.html?uri=cellar:f15c5932-a8c5-4f00-b681-dc132ce667cb.0001.02/DOC_1&format=PDF
Another important recent study was that of the French nuclear institute IRSN , which calculated that the total costs of a typical large scale nuclear accident in France would cost around 430 Billion Euro
http://www.irsn.fr/FR/Actualites_presse/Actualites/Documents/EN_Eurosafe-2012_Massive-releases-vs-controlled-releases_Cost_IRSN-Momal.pdf
http://www.reuters.com/article/2013/02/07/us-france-nuclear-disaster-cost-idUSBRE91603X20130207#UFuKLRqw62Wtmyh4.97

[97] Co-operative Agreement in Respect of the Monitoring and Control of Radioactive Material and Exposure to Ionising Radiation GN 759 GG no 31232 published in Government Gazettte 18 July 2008

This section does extend to permitting mandatory functions of the DEA under section 24 (environmental authorisations) to be undertaken by a separate government department. This is so notwithstanding the fact that this agreement purports to allow the issuing of "Environmental Impact Assessment Authorisations" to be under taken "through a mechanism and process to be established by the DEA and NNR." Any such mechanism would have to be compliant with the limitations of section 35 of the NEMA.

84. The letter from the Director General, Department of Energy dated 30th January 2009 refers to the NNR co–operative agreement dated 2006, but does not provide this document. It is presumed that it has the same content as the co-operative agreement published in July 2008 referred to above. Although the letter refers in vague terms to issues of nuclear safety, radiation and radiology and their being "better placed within the regulatory processes of the NNRA and that the consideration of the same issues in an EIA process would result in unnecessary and avoidable duplication" the letter does not distinguish between issues that are governed by the NNRA and those that are governed under NEMA and where there is no duplication. This letter cannot lawfully delegate all functions relating to the assessment of the impacts of a nuclear plant to the NNR in terms of the provisions of NEMA. The letter does not remove the duty of the DEA to assess the impacts of a catastrophic release of radiation.
85. Hence the co-operative agreement cannot be utilised to substitute mandatory provisions of the Act which must be carried out by the DEA with the functions undertaken by a separate government department under a different statutory regime. This would constitute an unlawful delegation requiring the DEA to act under instruction by a separate department. The DEA must undertake an assessment of the radiological, social and economic impacts of a catastrophic incident itself and the failiure to do so is a fatal flaw in the EIA process.
86. The repeated assertion that a nuclear accident is highly improbable[98] does not remove the legal duty to assess the radiological impacts of such an event. Probability in any event cannot be considered in isolation, nor equated to the risk of other every day events such as motor vehicle accidents. What is highly relevant to the need for such an assessment is the potential scale of impact from a nuclear accident, which can be catastrophic.
87. The following information was provided in our submission on Draft 2 of the Final EIA but was simply noted. It is therefore repeated in order to give the decision maker a good sense of what would be reasonably required in an EIA for the assessment of the radiological impacts of a worst case scenario, which this FEIAR report has failed to provide.
88. As stated in our response to the Draft 2, the consultants for Eskom could look to the following report as examples of site-specific assessments of the radiological impacts of a severe (beyond-design basis) accident at individual nuclear facilities: Nuclear Regulatory Commission. (1990). Severe accident

[98] Response 24 to LRC submission dated 9th December 2015 to GIBB

risks: an assessment for five US nuclear power plants. *NUREG-1150, Final Report, 1*.[99]

89. It is not the purpose of this submission to suggest that South Africa should follow the methodologies for impact assessments of other jurisdictions. However by way of example, the USA demonstrates a rational approach to the issue of assessing the impacts of a worst case scenario and is included here for information and to guide the decision maker as to whether sufficient information has been placed before it. The U.S. Nuclear Regulatory Commission requires a radiological impact assessment of the worst-case scenario in environmental impact statements for proposed new nuclear power plants in the United States. The document: Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan (NUREG-1555) sets out what information needs to be in the environmental review of a proposed new nuclear power plant.[100] The document contains a chapter titled "Environmental Impacts of Postulated Accidents Involving Radioactive Materials" (NUREG-1555, Chapter 7)[101] which sets out the requirement for assessing the radiological impacts of a severe (beyond-design basis) accident.[102]

90. The U.S. Nuclear Regulatory Commission specifies the methodology for how to assess the radiological impacts of a severe (beyond-design basis) accident[103] A critical step is the use of appropriate 'source terms' – that is, the amount of individual radioisotopes that would be released during a severe accident. For the type of reactor that Eskom is proposing - a light-water Pressurized Water Reactor – the source terms for assessing the radiological impacts of a severe (beyond-design basis) accident is specified in the following additional document of the Nuclear Regulatory Commission: Soffer, L., Burson, S. B., Ferrell, C. M., Lee, R. Y., & Ridgely, J. N. (1995) "Accident source terms for light-water nuclear power plants" (NUREG-1465)[104]

91. The KEY & CRITICAL aspect of this document is that for selection of source terms, one assumes release of certain fractions of the total amount of individual radioisotopes in the reactor core (core inventory) according to the following table in NUREG-1465 and based on the kind of PWR and the kind of containment structure (see below).

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[99] http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1150/

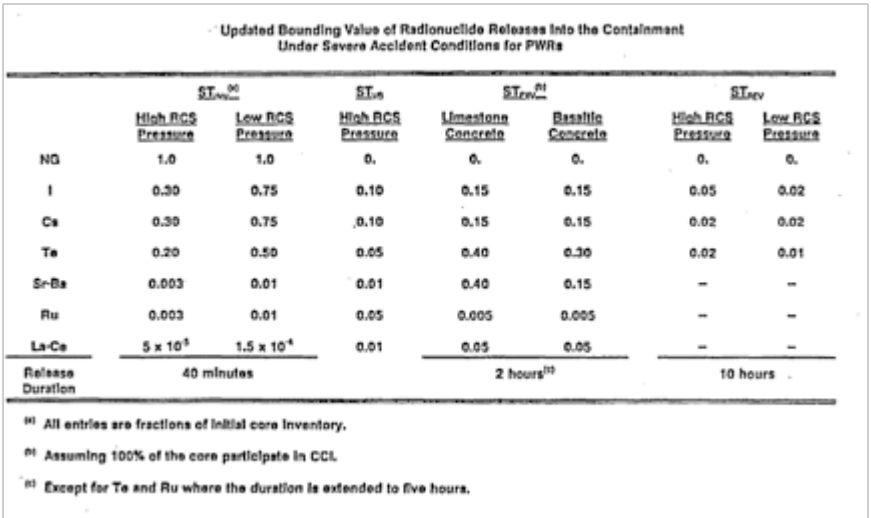
100 http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1555/

101 http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1555/toc/ch7/

102 http://pbadupws.nrc.gov/docs/ML0716/ML071690007.pdf

103 "The environmental consequences of severe accidents are estimated using acceptable methodology (such as the MACCS2 code package; Chanin and Young [1997]. … Chanin, D. L. and M. L. Young. 1997. Code Manual for MACCS2: Volume 1, User's Guide. SAND97-0594, Sandia National Laboratories, Albuquerque, New Mexico (Also published as NUREG/CR-6613 in 1998)." http://nnsa.energy.gov/sites/default/files/nv_sweis/appendixG/Chanin%20and%20Young%201997.pdf

104 http://www.nucleartourist.com/events/NUREG-1465.pdf



Updated Bounding Value of Radionuclide Releases into the Containment Under Severe Accident Conditions for PWRs

| | $ST_{ex}$[a] | | $ST_{in}$ | $ST_{ex}$[b] | | $ST_{erv}$ | |
|---|---|---|---|---|---|---|---|
| | High RCS Pressure | Low RCS Pressure | High RCS Pressure | Limestone Concrete | Basaltic Concrete | High RCS Pressure | Low RCS Pressure |
| NG | 1.0 | 1.0 | 0. | 0. | 0. | 0. | 0. |
| I | 0.30 | 0.75 | 0.10 | 0.15 | 0.15 | 0.05 | 0.02 |
| Cs | 0.30 | 0.75 | 0.10 | 0.15 | 0.15 | 0.02 | 0.02 |
| Te | 0.20 | 0.50 | 0.05 | 0.40 | 0.30 | 0.02 | 0.01 |
| Sr-Ba | 0.003 | 0.01 | 0.01 | 0.40 | 0.15 | – | – |
| Ru | 0.003 | 0.01 | 0.05 | 0.005 | 0.005 | – | – |
| La-Ce | $5 \times 10^{-5}$ | $1.5 \times 10^{-4}$ | 0.01 | 0.05 | 0.05 | – | – |
| Release Duration | 40 minutes | | | 2 hours[c] | | 10 hours | |

[a] All entries are fractions of initial core inventory.

[b] Assuming 100% of the core participate in CCI.

[c] Except for Te and Ru where the duration is extended to five hours.

92. The FEIA report provides sufficient certainty about the project for Eskom to provide an assessment of the radiological impacts of a severe (beyond-design basis) accident.
93. First, we know that Eskom's first choice of technology is a light-water Pressurized Water Reactor. Page 7 of the Executive Summary states:

> "Pressurised Water Reactor (PWR) technology, which uses water as a coolant and moderator, was chosen by Eskom for Nuclear-1. PWRs are the most commonly used nuclear reactors internationally. Eskom is familiar with this technology from a health and safety, as well as an operational perspective, having used it for the past 30 years at the Koeberg Nuclear Power Station (KNPS)."

94. Second, because we know the size of the plant (4000 MW) and the quality of the enriched uranium that would be used by the plant, Eskom's consultants have a reasonably certain idea of the amounts of radioisotopes (e.g. radioactive isotopes of noble gases, iodine, cesium, tellurium, strontium, etc.) in the "core inventory" for purposes of **using the table above in NUREG-1465 to estimate the amount of individual radioisotopes that would blow out of the facility if there were a severe accident**
95. Another estimate of a potential source term for three of the considered reactor designs (the Hitachi / GE ABWR, the Westinghouse AP1000, and the Areva / EdF EPR) can be found in a recent study from the Institute for Safety and Risk Studies of the BOKU University in Vienna.[105]

| **Reactor design** | **Release fraction Iodine group,** | **Release fraction Cesium** |
|---|---|---|

105 Sholly, Steven, Nikolaus Müllner, Nikolaus Arnold, Klaus Gufler, Source Terms for Potential NPPs at the Lubiatowo Site, Poland, Vienna (2014) Institut für Sicherheits- und Risikowissenschaften (ISR) BOKU; https://www.greenpeace.de/sites/www.greenpeace.de/files/publications/20140304-irs_report_source_terms_poland.pdf

| | source term 2 | group, source term 2 |
|---|---|---|
| ABWR | 49% | 58% |
| AP1000 | 44.70% | 27.20% |
| EPR | 17.80% | 17.80% |

**Failure to assess economic impacts of a major beyond design basis accident - critique of economic impact assessment**

96. The FEIA report fails to assess the social and economic consequences of a worst case scenario, or even a serious incident, at the proposed nuclear power plant. It deals with this issue in the same way as the failure to assess the radiological impacts of a major accident discussed above.[106] It indicates instead that such an event is highly unlikely, so unlikely that it renders the question academic. It concludes however the economic impacts would be greatest at the Dynefontein site and states that it would affect the economy of the entire Cape Town Metropolitan region and large parts of the neighbouring municipalities. The extent and nature of the impact of such an abnormal event or range of events is not considered, despite the requirements of Regulation 32(2)(k).[107] This is a fatal flaw and should the authorisation be granted it will be reviewable.
97. The failure of the FEIA report to undertake an impact assessment of the radiological, social and economic impact of a worst case scenario, or catastrophic incident also makes it impossible for a proper assessment of the relative merits of the various alternative sites to take place, as required in regulation 32(2)(h).[108] A catastrophic incident would obviously make a greater impact on a city of over 3 million in habitants, as compared with a rural site. However this comparison does not take place by virtue of the fact that the scale of such potential impact is not studied. We submit that this is a fatal flaw in the assessment process.

**GENERAL FAILURE TO PLACE RELEVANT CONSIDERATIONS BEFORE THE DECISIONMAKER VIOLATES PAJA 6(2)(e)(iii).**

98. Failures to assess socio-economic impacts, worst-case scenario impacts, and waste impacts, (in addition to violating substantive provisions of NEMA and

[106] Response 42 to LRC submission dated 9th December 2015 to GIBB

[107] 2006 EIA Regulations

[108] 32 (2) An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in regulation **36,** and must include……. (*h*)a description and comparative **assessment of all alternatives** identified during the environmental impact assessment process;

the EIA Regulations), also amounts to the withholding of relevant information from the decision-maker in violation of PAJA 6(2)(e)(iii).

99. Because of NEMA's repeated emphasis on the integrated nature of environmental management, the socio-economic impacts of the NPS (most notably the impact on the consumer and the economic fallout from a disaster) is relevant information that must be brought before a decision-maker. Because NEMA places such a high premium on minimisation of impacts and investigation of mitigation, a worst-case scenario analysis is also clearly relevant information, as it will bring to light the full extent of potential impacts and all possible safety measures.[109] Because of NEMA's life cycle and intergenerational provisions, waste impacts are also relevant. Any approval made without such information will be one in which relevant factors were not considered.

## OVERALL CONCLUSION OF THIS SUBMISSION

100. It is submitted that the failure to properly assess the impacts referred to above creates a real risk that if the project is authorized it will infringe the environmental rights of both present and future generations. Further, the FEIA report does not place all relevant information that could materially influence the decision maker before it, and therefore a decision to authorise the construction of a nuclear power station based on this report would be open to legal challenge.[110]

101. The FEIA report recommends the authorization of the nuclear plants, basing its recommendations on outdated and incomplete and erroneous information, as well assumptions that are not justified, or justifiable. Reliance on information of this nature will preclude the decision maker from performing the required balancing exercise, namely the balancing of the socio-economic consequences of the development against the negative environmental consequences and potential consequences, and stands to be set aside as unlawful. [111]

102. In circumstances such as the present, where the policy on nuclear energy is under review and is being updated, it is inappropriate to be conducting an environmental impact assessment, as it will obviously be based on out of date information. The result can only be an irregular authorization. Since Eskom's consultants contend that the environmental impact assessment process is a

> "project specific environmental management tool does not have the mandate, neither is it equipped to revisit the strategic analysis of power generation alternatives that was completed in the IRP,"[112]

the application for authorization should be suspended until the requisite information has been generated, by means of the policy and regulatory

[109] *See supra* Section (b)(ii) at p. 13–15 & n. 30.

[110] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000.

[111] *Seafront For All* at paragraph 75

[112] Letter from Gibb to Legal Resources Centre dated 5th August 2015.

processes, such as the Integrated Energy Plan and the Integrated Resource Plan (provided for under the National Energy Act,[113] the Electricity Regulations Act,[114]) which the public has been advised are being reviewed.

103. Based on the analysis above our clients submit that the FEIA report is in many respects not an independent assessment as required by NEMA, but instead a reflection of Eskom's views, that since the IRP2010 chose to commit to 9600MW of nuclear, this obviates any need to investigate alternative forms of power because it has already established the optimal energy mix. However, such rigid adherence to policy in making an administrative decision fetters the decision maker's discretion, in violation of basic principles of just administrative action. While policies in keeping with the empowering legislation may be used to assist decision making, they may not inevitably determine the outcome of the decision, lest they "preclude the person exercising the discretion from bringing his mind to bear in a real sense on the particular circumstances of each and every individual case coming up for decision."[115]

Yours faithfully,
**LEGAL RESOURCES CENTRE**
**PER:**

**Angela ANDREWS**

[113] 34 of 2008

[114] 4 of 2006

[115] *Richardson v Administrator, Transvaal* 1957 (1) SA 521 (T) at 530.

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LRC
Legal Resources Centre

Your Ref:
Our Ref: A Andrews

29 th August 2016

National Nuclear Regulator
PO Box 7106,
Centurion 0046
NISLcomments@nnrco.za

Att: Peter Bester: Special Nuclear Projects

Dear Sir

**RE: NOTICE OF APPLICATION FOR A NUCLEAR INSTALLATION SITE LICENCE IN TERMS OF GOVERNMENT NOTICE NO. R.927 OF 11 NOVEMBER 2011, REGULATIONS IN TERMS OF SECTION 36, READ WITH SECTION 47, OF THE NATIONAL NUCLEAR REGULATOR ACT, 1999 (ACT NO 47 OF 1999) ON LICENSING OF SITES FOR NEW NUCLEAR INSTALLATIONS**

We act for South African Faith Communities Environmental Institute (SAFCEI). We are instructed to submit the following comments in response to the above notice which was dated 29th July 2016:

**Application with a 'plant-type and technology not yet identified' is irregular.**

a. In the letter preceding the application, from Eskom to the NNR Chief Executive Officer[1], Eskom advises that "nuclear installations or prescribed equipment do not form part of this application. The purpose of this application is to license the *site* as a nuclear installation site." Eskom's stated plan is to subsequently apply for nuclear installation licenses.[2]
b. Our client submits that this application is irregular and there is no provision in the legislation for an application of this nature.

[1] Dated 22/2/2016
[2] The letter also states that it is Eskom's plan to "*subsequently apply for nuclear installation licences to construct and operate multiple nuclear installations (power reactors) and associated auxiliary nuclear installations, of a plant-type and technology not yet identified, on the Duynefontein site […] However, to show compliance with the NNR requirements, on among others, radiological doses and risk limits, preliminary information on the design and operation of nuclear installations i.e., a postulated envelope will be used in the Duynefontein Site Safety Report (DSSR). Since the DSSR is based on site-specific data in conjunction with preliminary enveloping data on the nuclear installation(s), the conclusions of the DSSR will be confirmed by the definitive safety analyses conducted in support of the application for the subsequent NILs once the plant-type and technology is known.*"

c. The NNR Act[3] defines the nuclear license with reference to installations only as follows:

**"nuclear authorisation"** means a nuclear installation licence, nuclear vessel licence, certificate of registration or certificate of exemption[4].

**"nuclear installation" is** similarly is defined with reference to facilities and installations and means—

*(a)* "a facility, installation, plant or structure designed or adapted for or which may involve the carrying out of any process, other than the mining and processing of ore, within the nuclear fuel cycle involving radioactive material."

d. There is no mention in the NNR Act of a nuclear site license in the absence of a nuclear installation and the regulations cannot go outside the ambit of the statute to make provision for such license, in a manner not provided for in the statute.

e. The regulations in terms of which the application is brought *(GNR.927 of 11 November 2011)* in any event do not make provision for the licensing of a site without reference to details as to the characteristics of the proposed nuclear installation. The application in the absence of this information is therefore irregular.

f. Regulations GNR 1219 of 21 December 2007 similarly refer only to applications "for a nuclear licence, certificate of registration or certificate of exemption."[5] There is no provision in these regulations for licencing of a nuclear site in the absence of providing details as to the proposed nuclear installation, and in any event the application is not brought in terms of these regulations.

g. More particularly, regulation 4 of the *Regulations: Licensing of sites for new nuclear installations (GNR.927 of 11 November 2011)* states that "factors to be considered in evaluating an application for a nuclear installation site license <u>will include… (2) the proposed nuclear installation design(s),</u> and the characteristics specific to the site. <u>New nuclear installation(s) must reflect through their design, construction and operation an acceptably low probability of postulated events that could result in release of quantities of radioactive material</u>."

h. There is therefore no provision made for a "postulated envelope"[6] of likely radiological dose and risk limits, which may be supplied by the applicant, in

[3] Act 47 of 1999
[4] NNR Act 47 of 1999 section 1 Definitions
[5] Regulation 4(1)
[6] Eskom letter 22/2/2016 page 4

place of providing the information required in regulation 4, of GNR 927, in any nuclear licence or site licence application under the NNR Act.

i. According to the NNR's position paper (PP-0009), entitled "Authorisations for Nuclear Installations," a nuclear installation site license (NISL) "would consider enveloping characteristics of a nuclear installation contemplated to be constructed on the site while a nuclear installation license (NIL) to site construct and/or operate would be for a specific nuclear installation license."[7] The position paper is in effect a policy document. It is not quite clear from it what the meaning of this footnote is, given that a license itself cannot consider the characteristics of a nuclear plant. It appears to wish to convey that a new kind of license is possible, falling outside of the NNR Act, namely a NISL based on an envelope of characteristics.

j. However, the NNR Act is the exclusive statutory instrument governing the siting of nuclear installations, and there is no provision in it for an NISL granted in the manner contemplated in this policy. The position paper cannot supplant the legislation. It is clear that all aspects relating to siting of nuclear installations including permits are governed exclusively by the NNR Act. See:

**"2. Application of Act, and declaration of nuclear installation.**—(1) Subject to subsection (2), this Act applies to—

(*a*) the siting, design, construction, operation, decontamination, decommissioning and closure of any nuclear installation"[8]

k. On the face of it, the application with a 'plant-type and technology not yet identified' appears to be highly irregular. SAFCEI views with concern the manner in which the site licensing application process is unfolding. Any authorization granted on the strength of this application will be unlawful being *ultra vires* the NNR Act, among other things.

**Lack of relevant information on which to comment**

l. The notice of application to which representations are requested provides no information on which to make any informed analysis but refers to the Eskom website site for further information. The Eskom website contains an application letter which refers to a meeting between Mr Tyobeka of the NNR and Mr Masango from Eskom but no minutes of that meeting are attached.

m. In its site license application, Eskom provides no detailed information on which the public can comment. SAFCEI submits therefore that there is insufficient

[7] PP 000 9 page 3
[8] NNR Act

information to make any meaningful comment. As stated above the Eskom letter of 22/2/2016, refers to more detailed information to be provided at some yet to be determined date.

n. SAFCEI submits that the manner in which the NNR seeks the public's comment is in conflict with the NNR website statement on public participation which reads:
*"The NNR is committed to conducting its regulatory responsibilities in an open and transparent manner and keeping the public informed of its oversight activities. We recognize the public's interest in the fair regulation of nuclear activities and therefore provide opportunities for concerned citizens to be heard. The NNR considers public hearings a valued and important part of the licensing process and encourages the public's participation and involvement."*

o. SAFCEI submits the NNR's stated commitment to the public interest, compels it to reject Eskom's superficial application and to not waste the public's time and resources by asking them to comment on something without any substance.

p. We are instructed to refer you to the International Atomic Energy Agency (IAEA) protocols for guidance in attempting to make sense of this process. According to the IAEA, (IAEA 2016 publication "IAEA Safety Standards for protecting people and the environment. Site Evaluation for Nuclear Installations. Safety Requirements No. NS-R-3 (Rev. 1)") "Standards are only effective if they are properly applied in practice"[9].

*q.* The document states:
*"The level of detail needed in an evaluation to meet the requirements established in this publication will vary according to the type of installation being sited. Nuclear power plants will generally require the highest level of detail.[10]"*
*1.11. This publication is concerned with the evaluation of those site related factors that have to be taken into account to ensure that the site–installation combination does not constitute an unacceptable risk to individuals, the population or the environment over the lifetime of the installation."[11]*

r. We refer you to the following quotes from the IAEA document to illustrate some of the considerations that the IAEA recommends in evaluating sites.
*"Units of nuclear power plants and installations within the site boundary) in which flammable, explosive, asphyxiant, toxic, corrosive or radioactive materials are stored, processed, transported and otherwise dealt with that, if*

[9] Foreword by Yukiya Amano Director General – no page number
[10] Paragraph 1.10 pg 3
[11] Paragraph 1.11 pg 3

*released under normal conditions or accident conditions, could jeopardize the safety of the nuclear installation*.[12]"

In the case of Duynefontein, this would indicate the need to include not only the existing nuclear reactors but also the locality of the petrol refineries and hazardous waste site.

*"USES OF LAND AND WATER IN THE REGION*

*The uses of land and water shall be characterized in order to assess the potential effects of the nuclear installation in the region and in particular for the purposes of preparing emergency plans. The investigation shall cover land and water bodies that may be used by the population or that could serve as a habitat for organisms in the food chain.*

*AMBIENT RADIOACTIVITY*

*Before commissioning of the nuclear installation the ambient radioactivity of the atmosphere, hydrosphere, lithosphere and biota in the region shall be assessed so as to be able to determine the effects of the nuclear installation. The data thus obtained are intended for use as baseline data in future investigations.[13]"*

Such detailed records need to be publicly available for the Duynefontein site so that the public can see what the base levels with the existing nuclear installation are.

*"In particular, information on existing and projected population distributions in the region, including resident populations and to the extent possible transient populations, shall be collected and kept up to date over the lifetime of the nuclear installation. The radius within which data are to be collected shall be chosen on the basis of national practices, with account taken of special situations. Special attention shall be paid to the population living in the immediate vicinity of the installation, to densely populated areas and population centres in the region, and to residential institutions such as schools, hospitals and prisons.*

*The most recent census data for the region, or information obtained by extrapolation of the most recent census data, shall be used in obtaining the population distribution. In the absence of reliable data, a special study shall be carried out.*

*The data shall be analysed to give the population distribution in terms of the direction and distance from the nuclear installation. An evaluation shall be*

[12] Paragraph 3.51 pg 17
[13] Paragraph 4.14 and 4.15 pg 20

*performed of the potential radiological impacts of discharges and accidental releases of radioactive material, including reasonable consideration of releases due to severe accidents, with the use of site specific parameters as appropriate*[14].

*6.1 The effectiveness of the execution of the site investigations and assessments and engineering activities performed in the different stages of the site evaluation for the nuclear installation (see Refs [10–12]).*

*6.2. The quality assurance programme shall cover the organization, planning, work control, personnel qualification and training, verification and documentation for the activities to ensure that the required quality of the work is achieved.*

*6.3. The quality assurance programme is a part of the overall quality assurance programme for the nuclear installation. However, since activities for site investigation are normally initiated long before the establishment of a nuclear project, the quality assurance programme shall be established at the earliest possible time consistent with its application in the conduct of site evaluation activities for the nuclear installation.*

*6.4. The results of the activities for site investigation shall be compiled in a report that documents the results of all in situ work, laboratory tests and geotechnical analyses and evaluations.*

*6.5. The results of studies and investigations shall be documented in sufficient detail to permit an independent review.*[15]*"*

The IAEA contains additional detail and we draw the NNR's attention to a phrase which appears in similar forms, commonly throughout the IAEA guide:

*"If the assessment indicates that the hazards are unacceptable and if no practicable solutions are available, then the site shall be deemed unsuitable.*[16]*"*

s. Apart from the arguments made above, regarding the fact that the application has no lawful basis, SAFCEI submits that the information provided by Eskom is in any event not sufficient for the NNR to make any evaluation that could determine in any way if the site would be suitable. It regards the evaluation of "envelope" designs as being of no value and that in order to fulfil it legal mandate, the NNR must require adequate details of design.

[14] Paragraph 4.11, 4.12 and 4.13 pgs 19 and 20
[15] Paragraph 6.1 – 6.5 pg 21
[16] Para 2.2 pg 5, para 2.25 pg 6, para 2.28 pg 9, para 3.36 pg 15, para 3.40 pg 15, Parag 3.47 pg 16, para 3.51 pg 17, para 3.55 pg 18

t. NNR Regulation 3(2)[17] states that an application for a NISL should be accompanied by a 'Site Safety Report'. Regulation 5 outlines what information should be contained in such a report. It is necessary to quote this Regulation in full, as none of the requirements outlined have been complied with in the present case. It states:

"*A site safety report referred to in Regulation 3(2)(a) must contain the following*

*(1) A motivation for the choice of the site to ensure low risk of public exposure from the operation of the nuclear installation(s);*
*(2) A statement as to the proposed use of the site in terms of the range of technologies and plant designs being considered for the nuclear installation(s) and use of the site, including where appropriate the maximum thermal power, general design characteristics such as the engineered safety features of the nuclear installation(s) included safety measures against the hazardous consequences of postulated events and the layout of the site.*
*(3) The characteristics of the site relevant to the design assessment, risk and dose calculations, including inter aliea: (a) external events; (b) meteorological data; (c) land use; (d) population demographics; (e) regional development; (f) projections of the above data commensurate with the design life of the nuclear installation(s).*
*(4) A source term analysis that is representative of the overall potential hazards posed to the public and the environment owing to the new nuclear installation(s). A representative scope of internal and external events enveloping the new nuclear installation(s) must be taken into consideration.*
*(5) A Probabilistic Risk Assessment (PRA) using the site charateristics referred to in Regulation 5(3) and the source terms referred to in Regulation 5(4) to demonsrate compliance with the probabilistic risk limits. This analysis must include the impact of all nuclear installations and actions on the site, existing and proposed, for which authorisations have been granted by the Regulator.*
*(6) An analysis of the impact on the public due to normal operations of the new nuclear installation(s), including minor occurrences that can be kept under control, to demonstrate compliance with the does limits. This analysis must include the impact of all nuclear installations and actions on the site, existing and proposed, for which authorisations have been granted by the Regulator.*
*(7) The identification and determination of emergency planning zones using charateristics of the site, source term analysis and PRA established in accordance with Regulations 5(3), 5(4) and 5(5) respectively. In determining the emergency planning zones due account must be taken of physical boundaries such as rivers, dams, mountain ranges, as well as municipal boundaries. The emergency planning zones include the following:*

[17] GNR 927

*(a) An exclusion zone which is a radius determined for the purposes of evacuating persons in the event of a nuclear accident. Within the boundaries of that zone or within any erven intersecting with that zone there must be no members of the public resident, no uncontrolled recreational activities, no commercial activities, or institutions which are not directly linked to the operation of nuclear installations situated within this zone, or for which an authorisation has been not been granted;*

*(b) An overall Emergency Planning Zone (EPZ) of such size that emergency or remedial measures must be considered where the potential exists that any members of the public may receive more than an annual effective dose of 1mSv due to the source term;*

*(c) A Long Term Protective Action Planning Zone (LPZ), where preparations for effective implementation of protective actions to reduce the risk of stochastic health effects from long term exposure to deposition and ingestion must be developed in advance consistent with international standards.*

*(8) An analysis to demonstrate the viability of an emergency plan taking into account relevant data established in accordance with Regulations 5(3), 5(4), and 5(5), including disaster management infrastructure. It must be shown that risks to the public, as well as the financial consequences caused by damage and radioactive contamination, are as low as reasonably possible.*

*(9) An assessment on the suitability of the site, from a nuclear security perspective as determined by the NNR.*"

u. As can be seen from the above list, the requirements for an application for a site license in terms of the NNR Act are extensive. SAFCEI submits that none of these requirements can and will be met in the present application. Moreover, the letter of application states that Eskom "*will provide the Duynefontein Site Safety Report, containing such information, as listed in Regulation 5(1) to 5(9) once the Seismic Hazard Assessment has been completed, in support of this application in accordance with a schedule to be agreed with the NNR.*" SAFCEI submits that the site safety report, as well as all other necessary reports and plans as outlined in the above quoted Regulation, should accompany the application itself, and without these the application is incomplete. It is unreasonable to expect the public comment meaningfully or in an informed manner on an application that is so vastly incomplete and which is not accompanied by an array of material documents including the Site Safety Report.

v. Regulation 6 indicates that a license issued in terms of these Regulations is valid for an indefinite period. This adds even more emphasis on the fact that any NISL application should be complete and comprehensive before being considered by the NNR, and that the current application is woefully inadequate and entirely incomplete.

w. It should also be noted that the granting of a NISL does not guarantee the automatic granting of a nuclear installation license. As such, the applicant should not be permitted to submit vague documents and descriptions simply because this is an application for a site license. The vagueness adds emphasis to the fact that the site license should not be granted.

x. SAFCEI therefore argues that the NNR will fail in its responsibility by accepting such a non-application from Eskom, and that in turn the acceptance of such application will result in its violation of regulatory duties concerning disclosure of information and public participation under several statutes including but not limited to the Promotion of Administrative Justice Act,[18] the Promotion of Access to Information Act,[19] The National Environmental Management Act[20] and its own NNR legislation. By failing to provide sufficient information for the public to make meaningful representations, the NNR is effectively denying the public's right be heard and to be consulted in matters that affect their safety and well-being.

y. SAFCEI also notes with grave concern the statements made by the NNR officer Mr Moonsamy[21] to the effect that this application is simply to gauge the extent of public interest.[22] Our client is of the view that this attitude displays disregard for the value of public substantive comment. It also suggests that the NNR is not attached to transparent and accountable governance, and that the rights of ordinary citizens to know about the safety impacts of the proposed nuclear build re being disregarded, at the same time flouting their right to dignity and an environment which ensures their safety and well being.

z. SAFCEI has instructed us to demand that the NNR reject Eskom's site application which it believes fails to fulfill the legal requirements at both the national and international level. It also demands an opportunity to present at any public hearing that might be held to evaluate the site license.

We look forward to your response hereto.

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[18] Act 3 of 2000

[19] Act 2 of 2000

[20] Act 107 of 1998

[21] NNR communications and stakeholder relations manager **Gino Moonsamy** told *Engineering News Online* that the organisation would conduct a 45-day due diligence of the applications to determine compliance with relevant regulations and whether they should be accepted for further technical assessments and public comment. http://www.engineeringnews.co.za/article/nuclear-regulator-confirms-receipt-of-thyspunt-duynefontein-applications-2016-03-15

[22] http://www.iol.co.za/capetimes/comment-on-eskom-nuclear-plant-applications-2055152 sourced 19th August 2016

**Yours faithfully**
**LEGAL RESOURCES CENTRE**
**Per:**

**A ANDREWS**

# REPORT OF THE MINISTERIAL ADVISORY COUNCIL ON ENERGY (MACE) WORKING GROUP ON ANALYSIS AND RECOMMENDATIONS ON THE ASSUMPTIONS AND METHODOLOGIES ADOPTED IN THE IRP 2016 BASE CASE SCENARIO

31 October 2016

**Members of the Working Group**

Mike Levington (Chairperson)

Professor Anton Eberhard

Dr. Tobias Bischof-Niemz

Professor Johan van Dyk

## ***Executive Summary***

The Minister of Energy appointed a Working Group on 16 September 2016 to analyse certain concerns expressed by members of the Ministerial Advisory Council on Energy (MACE) on a number of assumptions used to derive the IRP Scenario ***"Base Case A1"*** and to report back to the Minister on their findings.

The Working Group has requested certain information from the Department of Energy (DOE), which was partially received. Based on this information, the Working Group's findings and its recommendations to the Minister are as follows:

Main finding:

**A least cost IRP model, free of any artificial constraints and before any policy adjustments does not include any new nuclear power generators. The optimal least cost mix is one of solar PV, wind and flexible power generators (with relatively low utilisation).**

## ***Recommendations of the MACE Working Group:***

*Recommendation 1*

Consistent with the approach used in IRP 2010, the scenario that forms the **Base Case must be least cost and free of any policy adjustments**. The Working Group therefore recommends that the annual new-build limits imposed on solar PV and wind are removed and this unconstrained scenario (presented in **Table 2 in this document**) forms the **Base Case for the IRP 2016**.

*Recommendation 2*

The input costs assumed for solar PV and wind in the IRP 2016 are significantly higher (in real terms) than what was assumed in the IRP 2010, despite the fact that tariffs actually achieved in the Renewable Energy IPP Procurement Programme (REIPPPP) are lower than what IRP 2010

had assumed. This apparently is a result of technical mistakes made when converting average tariffs achieved in Bid Window 4 of the REIPPPP into model input costs, combined with a reduced cost reduction potential for solar PV compared to IRP 2010. It is therefore recommended to **adjust the currently assumed costs of both solar PV and wind downwards** to correctly reflect South African actual tariffs as well as anticipated cost reductions as per IRP 2010 in the case of solar PV.[1]

*Recommendation 3*

Any policy-adjustment to or the imposing of a constraint on the least-cost unconstrained Base Case will increase the total cost of the power system and therefore the average tariff to the consumer. The Working Group recommends that the **cost differences between the least-cost unconstrained Base Case and each alternative scenarios be reported** so that a value for money case can be assessed by all stakeholders when a certain policy decision or a constraint is proposed.

***Comments received from MACE members***

| MACE Working Group recommendations | MACE comments |
|---|---|
| *Recommendation* 1<br>Least cost should be adopted as the base case before any policy-related constraints | No MACE member has argued against the least cost model run as being the adopted Base Case |
| *Recommendation 2*<br>IRP input costs for solar and PV are higher than they should be and the IRP should adopt lower cost estimates which are proven through contractual agreements recently concluded | No MACE member has contested this<br>• Some have questioned the comparability of some prices, but not in a way that detracts from the Working Group's recommendations.<br>• There is also a call for the use of a consistent methodology of benchmarking prices when deviating from standard pricing models. |
| *Recommendation 3*<br>The cost differential between any policy-related constrained scenarios and the base case should be clearly documented and taken into account by decision-makers | No MACE member has contested this recommendation. |

***Conclusion***

The Working Group is of the view that if the above recommendations are applied to the IRP process, it will result in a methodology that is consistent, will allow the energy planners to achieve the most efficient price path and will lead to an outcome that MACE as a whole will be able to endorse and defend in the public participation phase of the IRP to current and future electricity consumers in South Africa.

[1] It is worth noting that nothwithstanding the need to recalibrate the relative costing of solar PV and wind, the least-cost Base Case still does not include any new nuclear power plants.

This process has raised a number of other issues in respect of the IRP which should receive attention in future:

a) IRP treatment of the risk associated with cost and time overruns exhibited in the construction of megaprojects.
b) Treatment of grid constraints at both municipal and national levels.
c) Introduction of a full macro-economic cost-benefit analysis to assess socioeconomic trade-offs (employment, local manufacturing etc.)

**END**

# 1 Key relevant extracts from IRP 2010

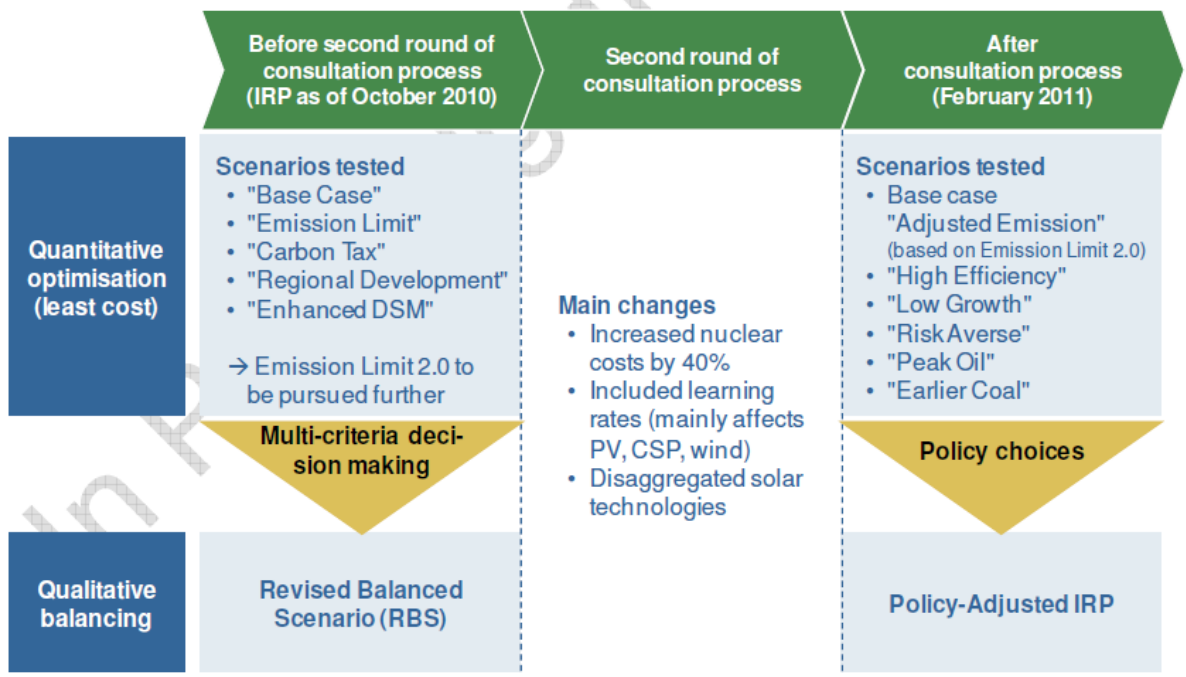
IRP 2010, page 6[2]

*"To account for the uncertainties associated with the costs of renewables and fuels, a nuclear fleet of 9,6 GW is included in the IRP;"*

The main "policy adjustment" away from the mathematical least-cost option in the IRP 2010 was the introduction of a 9.6 GW nuclear fleet to cater for uncertainties (at the time) around the (at the time) forecasted cost reductions of renewables.

IRP 2010, page 10

**Figure 1. Overview of IRP process**




1) In 2010, a number of scenarios were tested, based on the input assumptions that were applicable at that time. All scenarios were optimised to be "least cost" within the boundary conditions imposed on them.
2) The "Base Case" was the least-cost scenario without a CO2-emission limit imposed on the model. It included neither nuclear new-build nor renewables. The "Base Case" was almost exclusively coal-based and reflected the status quo.
3) The "Emission Limit" scenario introduced a CO2-emission limit to the model and as a result the model built a nuclear fleet of 9.6 GW (6 x 1.6 GW units) for the power system to be able to stay within the imposed CO2-emission limit.
4) The Revised Balanced Scenario (RBS) was the synthesis of all least-cost optimised scenarios as of October 2010. It included a nuclear fleet of 9.6 GW.
5) A second round of public consultations was then conducted from October 2010 to January 2011. Following the public input, nuclear and renewables costs were adjusted (nuclear up,

[2] http://www.energy.gov.za/IRP/irp%20files/IRP2010_2030_Final_Report_20110325.pdf

renewables down) and solar technologies were disaggregated. The revised nuclear cost assumption was 5000 $/kW.

6) As a result, the new least-cost base case was now the scenario "Adjusted Emission", which still had the same CO2-emission limit as per the RBS, but did not include the nuclear fleet anymore. The nuclear fleet of the RBS was replaced by a mix of solar PV, wind, CSP and natural gas.
7) The model only built nuclear in the two scenarios "Risk Averse" and "Peak Oil".
    a. The "Risk Averse" scenario limited the amount of allowable imported electricity, which in return required more domestic power generation. Because wind and solar PV were artificially limited to 1.6 GW/a and 1 GW/a speed of roll-out and to 10 GW of total installed capacity each, the model had no other choice but to build nuclear as the only domestic, carbon-neutral source of electricity (more domestic coal was not an option for the model because of the CO2 limit).
    b. The "Peak Oil" scenario assumed higher cost of coal, which made both nuclear and renewables cost competitive to new coal. Therefore less new coal plants were built in this scenario. The gap in electricity could not be filled with wind and solar PV (because of the annual new-build limits and the total capacity cap), and hence the model had no other choice but to build nuclear.
8) The synthesis of the new least-cost scenarios from February 2011, which all imposed a CO2-emission limit, was the Policy-Adjusted IRP. The policy adjustment was to keep a 9.6 GW nuclear fleet in the plan (as per RBS), despite the fact that the new least-cost scenarios "Adjusted Emission", "High Efficiency", "Low Growth" and "Earlier Coal" all did not plan any new nuclear, and the only two scenarios with a nuclear fleet were those where renewables ran into artificially imposed new-build constraints.

Quote IRP 2010, page 11

*"Policy Issue 1: Nuclear options*

*4.2 The scenarios indicated that the future capacity requirement could, in theory, be met without nuclear, but that this would increase the risk to security of supply (from a dispatch point of view and being subject to future fuel uncertainty).*

*4.3 Three policy choice options were identified:*

*a) Commit to the nuclear fleet as indicated in the RBS;*

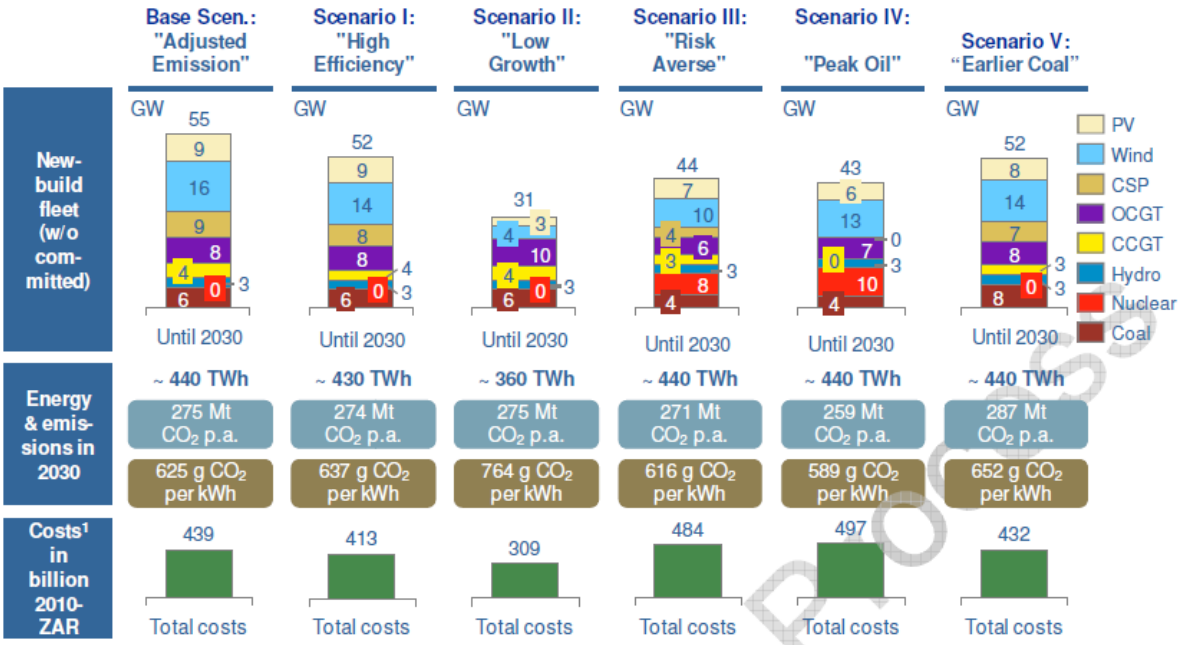
*b) Delay the decision on the nuclear fleet indefinitely (and allow alternatives to be considered in the interim);*

*c) Commit to the construction of one or two nuclear units in 2022-4, but delay a decision on the full nuclear fleet until higher certainty is reached on future cost evolution and risk exposure both for nuclear and renewables.*

*4.4 The Department accepted option 4.3a, committing to a full nuclear fleet of 9600 MW. This should provide acceptable assurance of security of supply in the event of a peak oil-type increase in fuel prices and ensure that sufficient dispatchable base-load capacity is constructed to meet demand in peak hours each year."*

IRP 2010, page 41

**Figure 6. Comparison of new scenarios**




1. Present value, 8% discount rate; excluding existing fleet fixed costs and committed new builds; including variable costs for full fleet plus all new build costs
Source: Eskom IRP model

Conclusion:

- In IRP 2010, nuclear was not the least-cost option.
- It was a policy decision to include nuclear in the plan to cater for uncertainties around the forecasted cost reduction of renewables, as at the time it was unclear whether they would materialise in the magnitude and as quickly as anticipated in the IRP 2010.
- Annual new-build limits were imposed on solar PV and wind, in order to limit the build-out of these two technologies.
- These adjustments led to the model building nuclear under very specific constraints, where the amount of required CO2-neutral electricity could not be supplied entirely by renewables because of these annual new-build limits.

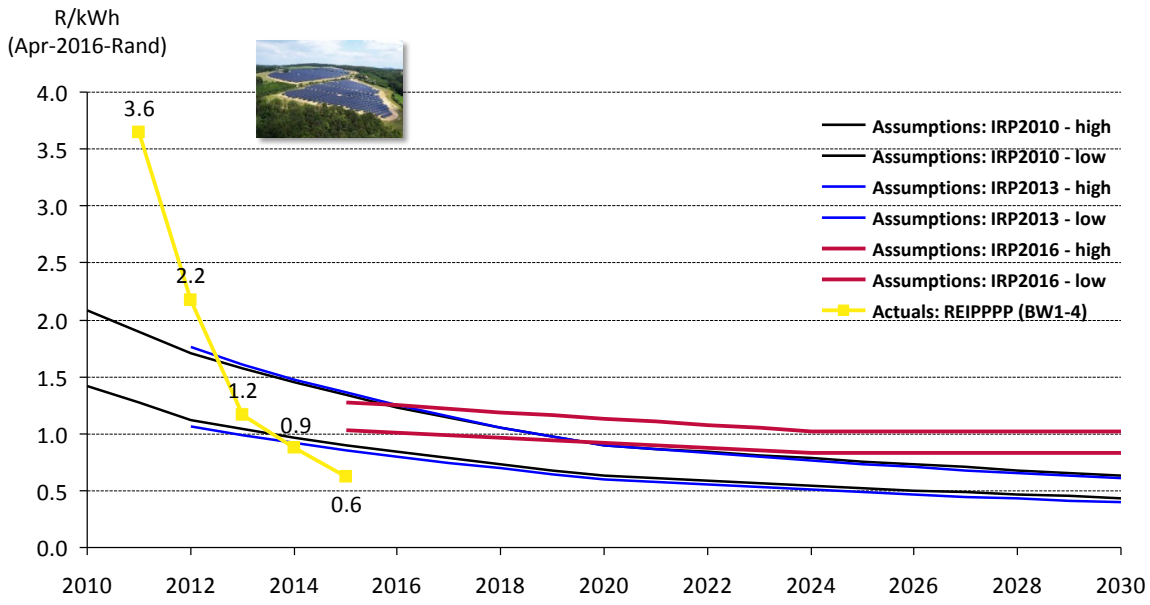
# 2 IRP 2016

Two main areas of concern arose from the presentation of the draft assumptions and results at the MACE meeting on 16 September 2016, and from the subsequent "assumptions meeting" at the DOE on 14 October 2016. These were:

1) Cost assumptions for solar PV and wind; and
2) Annual new-build limits for solar PV and wind.

## 2.1 Cost Assumptions

The figure below shows the cost assumptions path for solar PV in the IRP 2010/2013 as well as the cost-assumptions path for IRP 2016, derived from the assumptions presented to MACE. It furthermore shows the actual results of the REIPPPP for the first four Bid Windows (as well as the Expedited Round).




Assumptions: CPI used for normalisation to Apr-2016-Rand; LCOE calculated for IRP with 8% discount rate (real), 25 yrs lifetime, cost and load factor assumptions as per relevant IRP document; "IRP Tariff" then calculated assuming 90% of total project costs to be EPC costs, i.e. divide the LCOE by 0.9 to derive at the "IRP Tariff"
Sources: IRP 2010; IRP 2013; http://www.ipprenewables.co.za/gong/widget/file/download/id/279; IRP 2016 draft as of September 2016

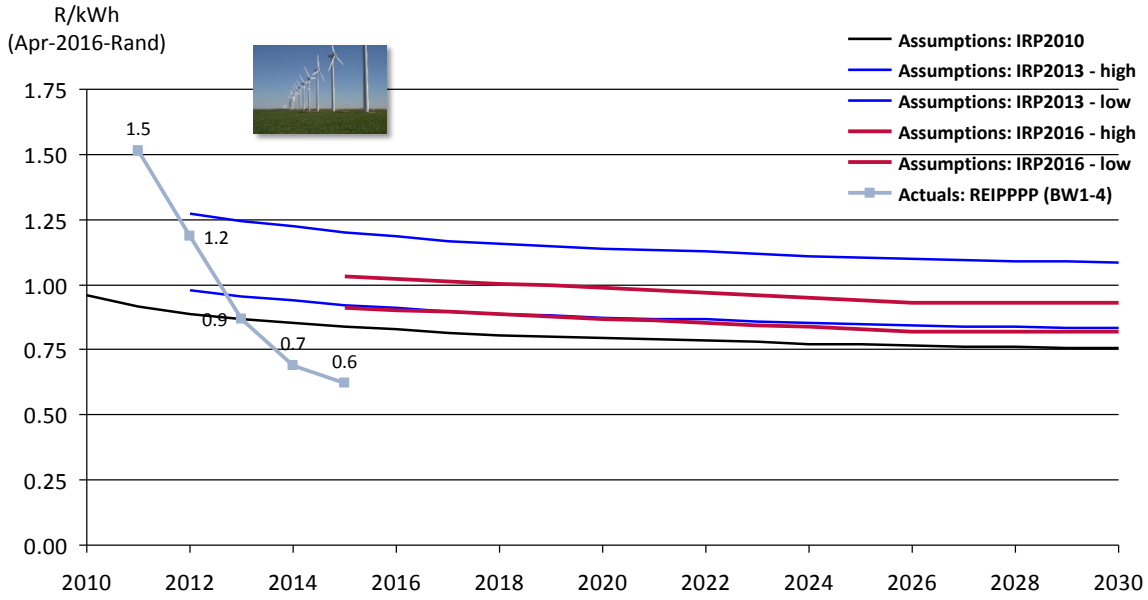
Both IRP 2010 and IRP 2013 forecast a significant cost reduction for solar PV until 2030. Actual costs of solar PV (derived from actual tariffs achieved in the REIPPPP) approached the forecast cost path of IRP 2010/2013 very quickly and are now significantly lower than the cost-assumption funnel for IRP 2010/2013.

The IRP 2016 effectively increases the cost assumptions for solar PV by a) choosing a higher starting point for solar PV costs in 2015 and b) assuming a much lower cost reduction rate from today until 2030 than what IRP2010/2013 had assumed. It is illogical to assume higher prices for PV than the IRP 2010 assumed, while in reality prices have fallen substantially, as shown by the latest REIPPP prices.

**Recommendation:**

**It is advised to keep the solar PV cost assumptions exactly the same as was assumed in IRP 2010 and IRP 2013, with the only difference that the cost funnel should be adjusted downwards for early years such that actual tariffs from BW4 Expedited lie at the lower boundary of the cost funnel in 2015.**

The next figure shows the cost-assumptions path for wind in the IRP 2010/2013 as well as the cost assumptions path for IRP 2016, derived from the assumptions presented to MACE. It furthermore shows the actual results of the REIPPPP for the first four Bid Windows.




Assumptions: CPI used for normalisation to Apr-2016-Rand; LCOE calculated for IRP with 8% discount rate (real), 20 yrs lifetime, cost and load factor assumptions as per relevant IRP document; "IRP Tariff" then calculated assuming 90% of total project costs to be EPC costs, i.e. divide the LCOE by 0.9 to derive at the "IRP Tariff"
Sources: IRP 2010; IRP 2013; http://www.ipprenewables.co.za/gong/widget/file/download/id/279; IRP 2016 draft as of September 2016

Both IRP 2010 and IRP 2013 forecast a relatively moderate cost reduction for wind until 2030. IRP 2013 made a mistake in that it increased the cost assumptions for wind significantly compared to IRP 2010.

Actual costs of wind (derived from actual tariffs in the REIPPPP) approached the forecast cost path of IRP 2010/2013 very quickly and the most latest wind cost (Expedited Round) is already well below the forecast cost assumption of IRP 2010 for the year 2030.

The IRP 2016 more or less reverts back to the IRP 2013 cost assumption path for wind, which was too high.

**Recommendation:**

**It is advised to reduce the cost assumption for wind to the actual achieved average tariff of Bid Window 4 Expedited and to keep it constant at that level until 2030.**

## 2.2 Annual New-build Limits for Solar PV and Wind

Table 1 below shows the current base case of the IRP 2016 as sent to the MACE Working Group. It is similar to the "Base Case A" presented to MACE on 16 September 2016. As can be seen from that table, the model is able to remain generally within the CO2 cap of 275 million tonnes per year until the late 2030s (which is the time when the CO2 cap starts to reduce from its plateau into decline). It even allows new coal to be built. One can also see that the wind and solar PV build-out rates are running into a limitation from 2030 onwards. The exact new-build limit for both technologies per year is unknown to the authors at the time of writing. The annual energy balance as well as the annual total costs are also unknown to the authors.

The experience from the first four rounds of the REIPPPP as well as the global annual deployment of wind and solar PV indicate that it is illogical to impose annual build limits to solar PV and wind, and, more so, to only limit these two technologies and none of the others.

**Table 1**: Output from the IRP Update Base Case

| | Base Case8.2% Dicount rate | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | New Build Options | | | | | | | | | | | |
| | PV | Wind | LandfillGas | DR | Nuclear | OCGT | CCGT | Coal PF w FGD | Inga | CO2 Emissions | Peak Demand (MW) | Firm Reserve Margins (%) |
| 2016 | | | | | | | | | | | | |
| 2017 | | | | | | | | | | | | |
| 2018 | | | | | | | | | | | | |
| 2019 | | | | | | | | | | | | |
| 2020 | | | | | | | | | | 253 | 44916 | 24 |
| 2021 | 160 | | | | | | | | | 264 | 46130 | 28 |
| 2022 | 160 | | | | | | | | | 268 | 47336 | 23 |
| 2023 | 370 | 200 | | | | | | | | 272 | 48547 | 20 |
| 2024 | 440 | 500 | | 1000 | | 396 | | | | 279 | 49656 | 18 |
| 2025 | 650 | 1000 | 15 | 1000 | | 2376 | 732 | | | 278 | 51015 | 19 |
| 2026 | 580 | 1000 | 5 | 1000 | | 264 | 1464 | | | 278 | 52307 | 19 |
| 2027 | 580 | 1000 | 230 | 1000 | | 264 | 2196 | | | 276 | 53561 | 19 |
| 2028 | 580 | 1000 | | 500 | | 396 | 1464 | 1500 | | 277 | 54567 | 20 |
| 2029 | 580 | 1100 | | 1000 | | | 1464 | 1500 | | 273 | 56009 | 18 |
| 2030 | 580 | 1200 | | 1000 | | 1716 | | 2250 | 1000 | 274 | 57274 | 20 |
| 2031 | 580 | 1200 | | 1000 | | 1584 | | 750 | | 274 | 58630 | 20 |
| 2032 | 580 | 1000 | | 500 | | | 732 | 1500 | 1000 | 278 | 59878 | 22 |
| 2033 | 580 | 1200 | | | | | 1464 | 750 | 500 | 276 | 61388 | 23 |
| 2034 | 580 | 1600 | | 1000 | | 1452 | | | | 278 | 62799 | 22 |
| 2035 | 580 | 1600 | | 500 | | | 1464 | 1500 | | 278 | 64169 | 23 |
| 2036 | 580 | 1600 | | 1000 | | | | 1500 | | 278 | 65419 | 21 |
| 2037 | 580 | 1400 | | 500 | 1359 | | 732 | 2250 | | 277 | 66993 | 22 |
| 2038 | 580 | 1600 | | | | 1848 | 1464 | 750 | | 273 | 68375 | 22 |
| 2039 | 650 | 1500 | | | 1359 | | 2928 | | | 267 | 69584 | 22 |
| 2040 | 650 | 1600 | | 1000 | | 1056 | 732 | | | 261 | 70777 | 20 |
| 2041 | 650 | 1600 | | 1000 | 4077 | 792 | | 750 | | 236 | 72343 | 21 |
| 2042 | 650 | 1600 | | 500 | | | 2196 | | | 233 | 73800 | 21 |
| 2043 | 650 | 1600 | | 500 | | | | | | 232 | 75245 | 21 |
| 2044 | 650 | 1800 | | 500 | 1359 | | | | | 228 | 76565 | 21 |
| 2045 | 770 | 1600 | | | 2718 | | 2196 | | | 230 | 78263 | 23 |
| 2046 | 790 | 1600 | | 500 | 1359 | 924 | | | | 225 | 79716 | 20 |
| 2047 | 720 | 1800 | | 1000 | 1359 | | 732 | | | 219 | 81177 | 19 |
| 2048 | 720 | 1600 | | 500 | 2718 | 264 | | | | 211 | 82509 | 20 |
| 2049 | 660 | 1500 | | 500 | 1359 | | | | | 206 | 84213 | 20 |
| 2050 | 720 | 1400 | | 500 | 2718 | | | | | 196 | 85804 | 20 |
| Total (MW | 17600 | 37400 | 250 | 500 | 20385 | 13332 | 21960 | 15000 | 2500 | | | |



Table 2 shows a scenario of the IRP 2016 that was only sent to the MACE Working Group. It was requested by MACE on 16 September 2016 but not presented to the full MACE. This scenario imposes no annual new-build limits (neither for solar PV nor for wind, nor for any other technology for that matter). As can be seen from that table, the model has no problems to remain within the CO2 cap of 275 million tonnes per year. In fact, from 2028 onwards the model is well below the CO2 cap and the annual CO2 emissions even go down to 155 million tonnes per year by 2050, i.e. they are 40 million tonnes per year lower than in the scenario of Table 1. This is achieved without any nuclear new build. The annual energy balance as well as the annual total costs are unknown to the authors.

Neither the annual deployment of solar PV and wind nor the total deployment of solar PV and wind in this scenario are unrealistic in South African or in global terms. The planned solar PV and wind penetration in this scenario by 2050 is in line with actual penetration levels of a number of countries today.



**Table 2:** Scenario with Annual RE limits rremoved

| | New Build Options | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PV | Wind | LandfillGas | DR | OCGT | CCGT | Coal PF w FGD | Inga | CO2 Emissions | Peak Demand (MW) | Firm Reserve Margins (%) | Water Consumption (Mil tonne) |
| 2020 | | | | | | | | | 253 | 44916 | 24 | 276875 |
| 2021 | | | | | | | | | 265 | 46130 | 28 | 266429 |
| 2022 | | | | | | | | | 269 | 47336 | 23 | 263338 |
| 2023 | | | | | | | | | 274 | 48547 | 20 | 266811 |
| 2024 | | 500 | | 1000 | 660 | | | | 283 | 49656 | 19 | 278530 |
| 2025 | 3740 | | | 1000 | 2904 | 1464 | | | 277 | 51015 | 21 | 273170 |
| 2026 | 2190 | | | 1000 | 660 | 732 | | | 277 | 52307 | 20 | 272113 |
| 2027 | 2090 | | 245 | 1000 | | 2928 | | | 273 | 53561 | 20 | 260297 |
| 2028 | 4570 | 200 | 5 | 1000 | | 2928 | | | 264 | 54567 | 20 | 250646 |
| 2029 | | 7300 | | 500 | | 2196 | | | 244 | 56009 | 21 | 219249 |
| 2030 | | 6700 | | 500 | 2112 | | | | 224 | 57274 | 20 | 187839 |
| 2031 | | 3900 | | 1000 | | 732 | | | 211 | 58630 | 19 | 170538 |
| 2032 | 4990 | | | 1000 | | 2928 | | | 215 | 59878 | 20 | 162431 |
| 2033 | | 4700 | | 500 | | 732 | | | 211 | 61388 | 20 | 150679 |
| 2034 | 3570 | | | 1000 | | 2196 | | | 210 | 62799 | 19 | 143892 |
| 2035 | 770 | 3800 | | 1000 | | 1464 | | | 201 | 64169 | 19 | 128021 |
| 2036 | | 3300 | | 1000 | | 1464 | 750 | | 193 | 65419 | 19 | 104663 |
| 2037 | 3390 | 3600 | | 500 | | 2928 | 750 | | 182 | 66993 | 20 | 85768 |
| 2038 | | 1400 | | 500 | | 3660 | | | 169 | 68375 | 20 | 76303 |
| 2039 | 5700 | | | 1000 | 1188 | 1464 | 1500 | | 178 | 69584 | 19 | 71228 |
| 2040 | | 5100 | | 1000 | 396 | 732 | 750 | 2000 | 172 | 70777 | 22 | 56611 |
| 2041 | | 6300 | | 1000 | 3696 | | | | 154 | 72343 | 21 | 56298 |
| 2042 | | 200 | | 1000 | 264 | 2196 | | | 150 | 73800 | 21 | 53166 |
| 2043 | 2020 | | | 1000 | | 732 | | | 150 | 75245 | 22 | 53015 |
| 2044 | 3950 | 4800 | | 1000 | | | | 500 | 146 | 76565 | 22 | 52187 |
| 2045 | 4870 | | | 1000 | | 3660 | | | 156 | 78263 | 22 | 53552 |
| 2046 | 1220 | 3100 | | 1000 | 2112 | 1464 | | | 145 | 79716 | 22 | 49661 |
| 2047 | | 4400 | | | 528 | | | | 140 | 81177 | 21 | 47237 |
| 2048 | 2340 | | | | 132 | 2928 | | | 141 | 82509 | 21 | 44377 |
| 2049 | | | | | | 1464 | 3750 | | 166 | 84213 | 23 | 47602 |
| 2050 | | 7600 | | 1000 | | | | | 155 | 85804 | 19 | 42346 |
| Total (MW) | 45410 | 66900 | 250 | 1000 | 14652 | 40992 | 7500 | 2500 | | | | |



Conclusions:

1) It is clear from the analysis of the two presented scenarios that **the mix of solar PV, wind and natural gas is the cheapest new-build mix** (refer to Table 2), even with incorrectly high cost assumptions for solar PV and wind (see concern number 1)
2) In an "unconstrained" case without annual new-build limits for solar PV and wind (refer to Table 2), the model only builds solar PV, wind and gas-fired power stations. Only small

amounts of new coal (and that only because of the too high cost assumptions for solar PV and wind) are built. **No new nuclear is built**

3) This **unconstrained least-cost mix leads to lower CO2 emissions than the CO2 cap**. The cap is therefore irrelevant and mathematically it's not a constraint anymore
4) Specifics of the constrained model (Table 1):
    a. In the constrained model, the model cannot meet all the demand with wind/PV/gas alone (because of the annual solar PV and wind new-build limits). It therefore builds the second cheapest option: coal
    b. The model can do that up until it runs into the CO2 cap. From there on it then has to build nuclear as the only remaining CO2-neutral option
    c. The timing of the reduction of the CO2 cap, the level of the renewables annual limits and the projected demand post 2030 together determine how much nuclear the model builds and when.

**Recommendation:**

**It is advised:**

- **The annual new-build limits for solar PV and wind should be removed**
- **This unconstrained scenario (Table 2), re-run with correct solar PV and wind cost assumptions, should form the least-cost Base Case of IRP 2016**
- **The total cost per scenario per year should be calculated**
- **Step by step constraints or policy adjustments scenarios (for example annual new-build limits for solar PV and wind) should also be financially modelled and the total cost per year of such constrained scenarios compared with the revised least-cost Base Case to assess the cost effectiveness of such interventions**

# Critique of:

# Affordability of nuclear power and impact on electricity prices

Professor Steve Thomas

November 2015

There are at least two fundamental flaws in the analysis presented on the 'Affordability of nuclear power and impact on electricity prices' presented as item 37 in the Draft Environmental Impact Assessment Report. As a result, the conclusions drawn are ill-founded.

## 1. Lacking of a basis for cost figures

First, figures are presented from the EIR and from the UK and US governments as authoritative when in practise, they are based on little or no experience. The projected cost of nuclear for South Africa is about R470/MWh or, at exchange rates of Nov 2 2015, £22/MWh or $34.78/MWh. These figures are about 20% of the figure forecast by the UK government (£100/MWh) and about 33% of that forecast by the US government ($108/MWh). Despite these huge discrepancies, no explanation is given as to how this remarkable cost reduction will be achieved. South Africa will be buying any nuclear power plants it purchases from the same world market as UK and US so it is hard to see how South Africa will be able to buy so much more cheaply than the UK and US, countries with far more experience of nuclear power than South Africa. The cost reduction is all the more remarkable given that costs in UK and US are as low as forecast because the plants planned for UK and USA will receive sovereign loan guarantees by the UK and US governments, both of whom have much higher credit rating than South Africa. This will make the cost of borrowing, a major determinant of nuclear costs, in UK and US much lower than is likely to be possible in South Africa.

Forecast costs have seldom been a good indicator of actual costs. Construction of the UK's first nuclear power plant order since 1987 is not expected to start before 2020 so experience of nuclear construction in the UK is now more than 20 years old. In the USA, there are five plants under construction. One of these has been under construction since 1972 so is of little interest in this context. The other four have been under construction since 2013 and are already at least two years late and about 25% over budget with further cost escalation widely expected.[1] This again emphasises how poor an indicator of actual costs forecast nuclear costs are.

In real terms, nuclear costs have continued to rise throughout the 50 year commercial history of the technology and have almost invariably been higher than forecast by governments. In South Africa in 2007, the government expected nuclear plants could be built for $2500/kW of capacity. A year later, bids received in an open tender exceeded $6000/kW. Despite this, the South African government is forecasting costs of less than $5000/kW. In the UK, a government policy 'White' paper of 2008 forecast construction costs of £2bn for a 1600MW reactor. The costs agreed in October 2015 are based on £9bn per reactor.[2] As lessons from Fukushima are incorporated in nuclear designs, there is every reason to expect this trend of rising real costs to continue

[1] http://www.psiru.org/reports/nuclear-construction-problems
[2] http://media.edfenergy.com/r/960/agreements_in_place_for_construction_of_hinkley_point_c

The costs forecast for the coal options appear equally poorly based. A cost for advanced coal with carbon capture and storage (CCS)[3] for USA is given. CCS technology is barely demonstrated, much less being commercially available. Only one small commercial plant, 110MW, is claimed to be in service in Canada. There are strong doubts whether CCS technology will ever be commercially viable.

For UK, forecast costs are given for Advanced Super Critical Coal and Integrated Gasification Combined Cycle. These technologies are not well established anywhere in the world. The last coal-fired plant in UK was ordered in 1985 and was of conventional technology of the type widely deployed in South Africa.

The projected costs for renewables such as onshore wind, solar photovoltaic and solar thermal ought to be much better based given the large amount of recent commercial experience with these technologies in US and UK and increasingly in South Africa. Unlike nuclear, real costs of these technologies are falling sharply as experience accumulates.

## 2. Need for base-load plants

There is frequent reference to dispatchable and non-dispatchable technologies and on base-load. The tacit assumption is that there must be 'base-load' power plants. It is clear there is a 'base-load' demand for electricity, in short the level of demand for electricity below which demand never falls. However, there is no justification for the assumption that there needs to be a set of base-load plants whose job it is to meet this demand. This makes no more sense than assuming that factory that operates seven days a week round the clock must be staffed by one set of workers who also work round the clock seven days a week. What is required is a set of plants that together can, with a high level of confidence, meet this base-load demand. The Chief Executive Officer, Steve Holliday, of UK National Grid Company, the company with the responsibility to dispatch UK power plants and plants in NE USA in such a way as to ensure security of supply, expressed this very clearly.[4] When asked what the future of base-load generation was, he stated: 'That's asking the wrong question, day. "The idea of baseload power is already outdated. From a consumer's point of view, the solar on the rooftop is going to be the baseload. Centralised power stations will be increasingly used to provide peak demand."

## 3. Conclusion

The conclusion drawn in the draft EIA is as follows: 'These figures indicate that coal-fired electricity and nuclear power have comparable costs in South Africa and the USA, but that nuclear is cheaper than coal in the UK and the USA, particularly if modern coal technologies (e.g. Carbon Sequestration and Control or Integrated Gasification Combined Cycle) that reduce greenhouse gas emissions are used.' There is therefore no basis for this conclusion and the omission of any reference to the 3-5-fold discrepancy between the US and UK nuclear costs is glaring.

[3] Incorrectly termed as carbon control and storage and carbon sequestration and control.

[4] http://www.energypost.eu/interview-steve-holliday-ceo-national-grid-idea-large-power-stations-baseload-power-outdated/

Annexure I

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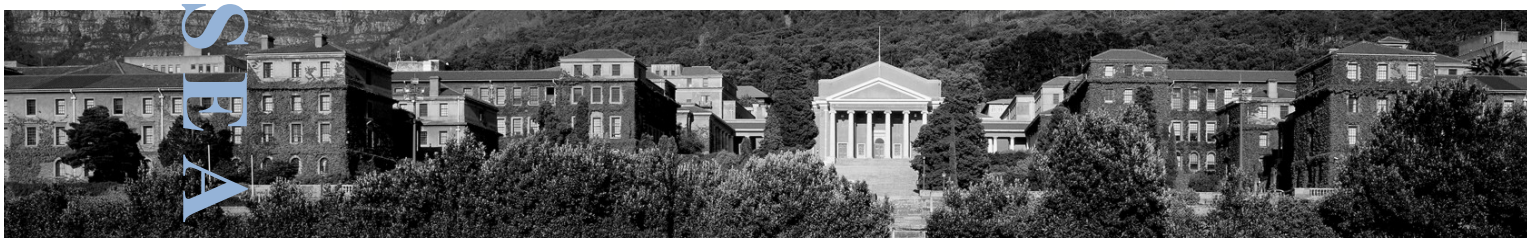

RESEARCH REPORT SERIES

# South Africa's proposed nuclear build plan: an analysis of the potential socioeconomic risks

## Technical Report

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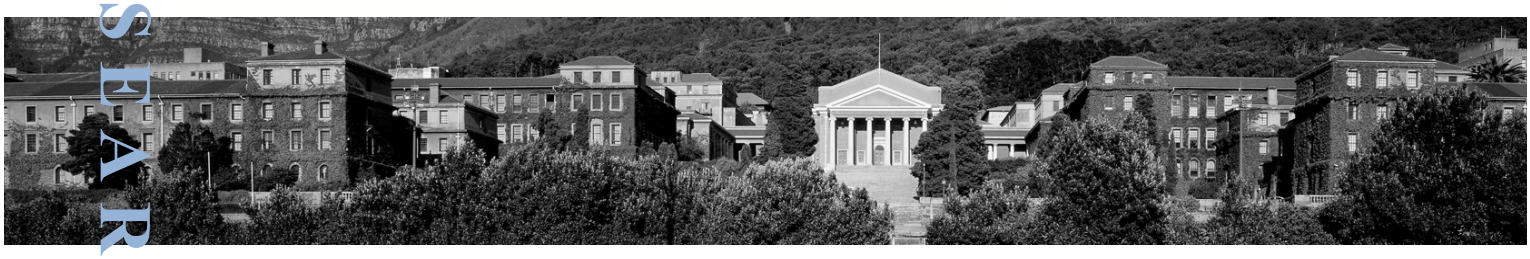

# South Africa's proposed nuclear build plan: an analysis of the potential socioeconomic risks

## Technical Report

**ENERGY RESEARCH CENTRE**

**2015**

**Key points**

- We analyse the South African Government's stated commitment to 9.6GW of nuclear power against other supply options. A flexible planning approach in the electricity sector is preferred to a commitment to the full nuclear fleet.
- In a future with high growth, assuming low costs for nuclear and limited and expensive alternatives, the commitment to nuclear power could have no significant impact on the electricity price and the economy.
- There is, however, a 94% chance that electricity prices will be higher in 2030 as a result of the commitment to nuclear power, which would have negative impacts on growth, employment and welfare in South Africa.
- In a future with lower growth, higher nuclear costs, and availability of other supply options, the commitment to nuclear power could have significant negative implications for growth, employment and welfare in South Africa.
- Consumers are likely to bear the burden of the investment through higher electricity prices and decreased employment.

*Suggested citation for this paper:*

Energy Research Centre, 2015. South Africa's proposed nuclear build plan: an analysis of the potential socioeconomic risks. Technical Report. Energy Research Centre. University of Cape Town. November 2015.

*Acknowledgements:*

The ERC would like to thank Earthlife Africa for funding this study as an independent, technology neutral and comprehensive technical study on the potential socioeconomic implications of South Africa's commitment to nuclear power. This is a first pass at a significant piece of work. It is hoped that this will start an important conversation, bring transparency to the procurement process and make consumers aware of the potential risks involved with such a large-scale investment. Of course, any errors in this report and in the analyses remain the authors' own.

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# 1. Introduction

The Integrated Resource Plan 2010 effectively forced a full fleet of 9.6GW of nuclear power into the final build plan (DoE, 2011) and the South African Department of Energy has since made several statements firmly committing the country to the procurement of a fleet of nuclear power plants. However, the risks and uncertainties specific to a nuclear fleet, as well as those implicit in long term electricity sector planning more generally, have yet to be quantified. This study therefore aims to understand the potential effects on the South African economy of the government's stated commitment to invest in 9.6GW of nuclear power (DoE, 2011) through a technical analysis of the potential risks and uncertainties.

The study reviews this commitment in comparison to a more flexible approach to energy planning that is guided by the imperative of minimising costs. The analysis seeks to answer the following research questions:

1. Given the high level of uncertainty inherent in long-term electricity planning, how does the commitment to 9.6GW of nuclear power by 2030 compare to a more flexible planning approach in meeting government's stated objectives of economic growth, job creation, and welfare?
2. If we do commit to 9.6 GW of nuclear power, what are the risks of an electricity price increase and associated socioeconomic implications?

There are three main tiers of analysis in this study. In order to answer the first research question we first build two illustrative, contrasting futures, to understand the implications of different investment strategies (a commitment to nuclear power versus adopting a flexible planning approach for electricity sector investment). In the second tier, we quantify the socioeconomic implications of the commitment to build a nuclear power fleet versus adopting a flexible planning approach in each of these illustrative futures, examining the effects on economic growth, employment and welfare. Given that these illustrative futures are only two of an infinite number of futures that could unfold for South Africa, we employ a Monte Carlo analysis to analyse 1000 of these possible futures. This increases the robustness of this analysis. It is impossible to illustrate all of these futures and detail the socioeconomic implications of the commitment to nuclear power in each of them. We therefore focus on the impact that the commitment to nuclear power would have on the electricity price in each of these plausible futures. The risk of an electricity price increase with the commitment to nuclear power relates directly to the negative socioeconomic impacts of the commitment. This is quantified in the third tier of analysis and answers the second research question.

Our results highlight the impact of the nuclear decision on South Africa's electricity build plan, economywide and sectoral GDP growth rate, the investment required in the electricity sector, electricity prices, direct and indirect employment for different skilled groups, and household welfare.

# 2. Background

## 2.1 Integrated Resource Plan

There are three main government documents on which the nuclear programme is premised: the Nuclear Energy Act 46 of 1999, the Nuclear Energy Policy of 2008, and the Integrated Resource Plan 2010 (IRP), adopted in 2011.

The policy-adjusted scenario from the Integrated Resource Plan (IRP) is currently South Africa's official electricity build plan to 2030. A comprehensive IRP Update was released in November 2013, but to date has not been promulgated. The policy-adjusted IRP adds 9.6GW of nuclear power to the grid by 2030, which would result in nuclear power accounting for around 12.7% of South Africa's total capacity in 2030[1]. The 9.6GW of new capacity is split into 1.6GW increments of nuclear power coming online annually between 2023 and 2026, in 2028 and in 2029. Nuclear power did not feature in the cost optimal scenarios that were generated in the IRP process, but the proposed nuclear fleet was added as a policy consideration, "to account for the uncertainties associated with the costs of renewables and fuels" (DoE, 2011). Alternative scenarios in the IRP indicated that future electricity capacity requirements could be met without nuclear with the caveat that excluding it presented a risk to South Africa's security of supply.

Three policy options were given in the IRP (DoE, 2011):

> *a) Commit to the nuclear fleet as indicated in the RBS*[2]*,*
>
> *b) Delay the decision on the nuclear fleet indefinitely (and allow alternatives to be considered in the interim),*
>
> *c) Commit to the construction of one or two nuclear units in 2022-4, but delay a decision on the full nuclear fleet until higher certainty is reached on future cost evolution and risk exposure both for nuclear and renewables.*

The Department of Energy opted to commit to the full nuclear fleet as this would provide assurance for security of supply and also ensure sufficient dispatchable base-load capacity to meet system peak demand. The Department further stated that:

*"The Policy-Adjusted IRP continues to indicate a balance between different government objectives, specifically economic growth, job creation, security of supply and sustainable development…also security of supply concerns and affordability." (DoE, 2011)*

The IRP Update (DoE, 2013) was more circumspect regarding nuclear power investment and outlined some of the risks involved – namely the risk that the cost may be uncompetitive and that economic growth may not be high enough to warrant an investment in the full nuclear fleet. The National Development Plan (NDP) was also noncommittal and called for a thorough investigation into the risks and implications of the nuclear build plan (NPC, 2013). The NDP listed three objectives for the energy sector, similar to the key objectives for Integrated Energy Planning put forward in the National Energy Act (Act no. 34 of 2008):

[1] This is based on the official IRP, but is likely to be adjusted with the increases in capacity under the Renewable Energy Independent Power Producers Procurement Program (REIPPPP)

[2] RBS is the revised balanced scenario, the preferred case in the IRP 2010; after stakeholder engagement, the RBS was revised into the policy-adjusted scenario, which became the final electricity build plan for South Africa.

1. Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation.
2. Social equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households.
3. Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change.

These elements and objectives speak not only to security of supply but more broadly to energy security in South Africa. This broader understanding of energy security as including affordability and access to energy (especially for low-income earners) and environmental sustainability is key to the energy policy objectives as outlined above, as well as in the 1998 White Paper on Energy Policy. It is critical that these objectives are considered in energy and electricity planning. For this reason, this study uses the broader definition of energy security to compare planning options recognising that energy security encompasses more complexity than merely security of supply and that the affordability and access to energy are imperatives in the South African context.

## 2.2 Potential nuclear vendors

South Africa has engaged with a number of prospective nuclear vendor countries over the last few years. Several 'nuclear vendor parade' workshops were held in late 2014 and in parallel the government has entered into negotiations and signed intergovernmental framework agreements with France, Russia and China - all as part of a pre-procurement process. Other agreements have also been signed with vendors in the USA and South Korea. According to President Zuma, "these agreements set out potential frameworks of cooperation that each country foresees where or how they can participate in South Africa's new nuclear build program" (WNA, 2014).

At the time of undertaking this analysis, South Africa's preferred choice of nuclear vendor was not yet clear. Table 1 lists the potential vendors and associated technology options that could be procured. The President has stated that the selection of potential nuclear vendors was based on those that had Pressurized Water Reactor nuclear technology, similar to South Africa's existing nuclear power plant, Koeberg, in the Western Cape (WNA, 2014). For the purpose of this study, the analysis is based on the specifications of Rosatom's VVER-1200 technology[3].

[3] It should be noted that the costs, plant size and financing models are likely to differ according to the choice of vendor and choice of plant. The preferred vendor was not known at the time of writing.

| | Provider | Technology | Generation | Size (MWe) | Notes |
|---|---|---|---|---|---|
| France | AREVA NP, Siemens | EPR | III+ | 1600 | Two units under construction and both with delays.<br>Bidder in the 2008 South African tender. |
| USA | Toshiba, Westing-house | AP-1000 | III | 1110 | Plants under construction in China, USA, Bulgaria, UK.<br>Bidder in the 2008 South African tender. |
| China | CNCC in partnership with CGN | ACP-1000 or 'Hualong One' | III | 1100 | Various designs could be on offer from the three separate Chinese vendors.<br>China has little experience in export markets. |
| | CGNPG | ACPR1000 | III | 1150 | |
| | SNPTC | AP1000/ CAP-1400 | III | | |
| Korea | KEPCO | APR-1400/APR+ | III | 1400<br>/1550 | Plants under construction in Korea and UAE. |
| Russia | ROSATOM | VVER-1200[4] /VVER-TOI[5] | III+ | 1198<br>/<br>1255 | VVER-1200 units under construction in Russia and planned in Turkey, Ukraine and Finland.<br>No VVER-TOIs have been commissioned to date. |

**Table 1: Potential nuclear vendors**

## 2.3 Potential and preferred sites

Eskom undertook an initial Nuclear Site Investigation Program in 1982 and identified five potential sites for nuclear reactors in South Africa, shown below in figure 1. Thyspunt, an area outside of Cape St Francis Bay was declared the preferred site and is the only site where an Environmental Impact Assessment (EIA) has been concluded.

4 http://www.rosatom.ru/en/resources/b6724a80447c36958cfface920d36ab1/brochure_the_vver_today.pdf. Accessed 28-20-2015

5 http://www.rosatom.ru/en/resources/cd8bd100447c26c38cb3ace920d36ab1/buklet_vver_toi_eng.pdf. Accessed 28-10-2015.

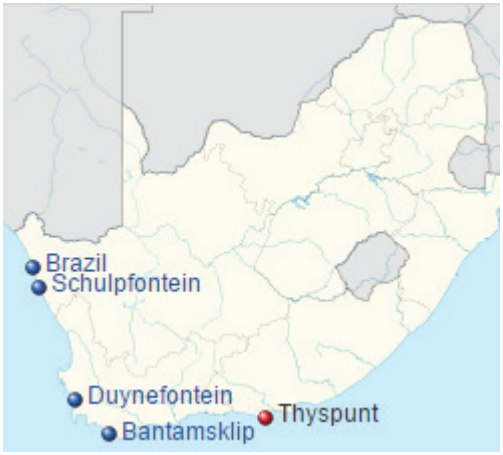



**Figure 2: Potential and preferred nuclear reactor sites**

An investment in nuclear power will have micro (community and provincial level) impacts in these areas through an increase in construction and infrastructure development around the nuclear sites. These impacts are not, however, addressed in this study. It is unlikely, given the high-skills required for the construction and operation of a nuclear power plant that direct employment will increase in these communities. There could be some benefit in terms of indirect job creation and, depending on the localisation component of the procurement contracts, some associated industry development and associated job creation. This study is concerned with understanding the economy-wide impacts of different electricity sector technology choices and does not cover potential localisation and the development of a nuclear industry, however this does present an interesting avenue for further work.

# 3. Methodology

## 3.1 Linked SATIM-E and e-SAGE Models

A linked model approach is used in this study firstly, in order to capture the complexities of the energy sector as well as the impacts of different build plans on the economy. Secondly this approach is employed to capture the feedback of price and investment effects on energy demand. This approach builds on extensive experience with energy models at the Energy Research Centre. The South African Times Model (SATIM), a technology rich energy model and e-SAGE (the energy extension to South Africa's general equilibrium model) are partially linked through the electricity sector and driven by similar assumptions[6].

The linked model approach emulates the planning process of South Africa's IRP 2010, in which a generation build plan is proposed based on forecasts for future electricity demand and revised every few years according to new information and updated assumptions. It was noted in the IRP 2010 that there is a need for potential socioeconomic effects of the electricity build plans to be assessed, the linked model allows for this analysis to be done. By using the linked model approach, this report goes further by providing a comprehensive socioeconomic analysis of the scenarios from the IRP planning process. The benefit of using a linked model approach is that it captures the price effects of the electricity build plan on the entire economy (with sectoral and household responses to

[6] Work on linking other sectors of the energy model and the economic model is ongoing.

changing electricity prices); this means that the demand forecast, and subsequent final build plan, more accurately represents that of industry and consumer electricity demand through to 2040.

Our approach is illustrated below, along with the drivers that are passed between the energy and economic model through the linking process.

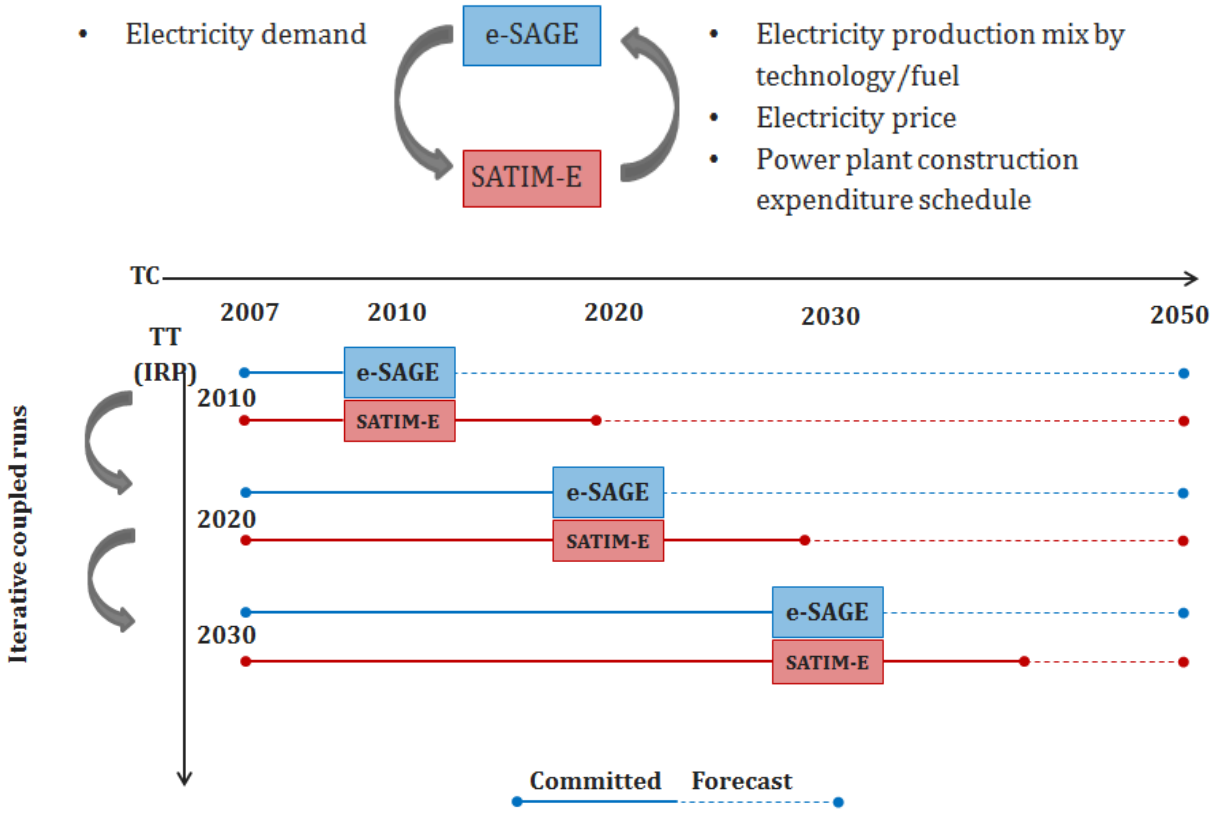



**Figure 3: The link between the economic model and the energy model**

Alternate runs of SATIM-E[7] and e-SAGE are performed from 2006 to 2050, each time exchanging information about fuel prices, electricity demand, investment and capital growth in the power sector, electricity production by technology group, and electricity price. Similar to the process of the IRP, SATIM-E computes an investment plan and an electricity price projection based on an initial electricity demand from e-SAGE. These are passed onto e-SAGE to determine the impact, if any, that the new price projection has on the demand, which then goes back to SATIM-E in the next iteration. After a few iterations convergence between the two models is reached, i.e. the models contain the same prices and demand paths. An iterative approach is beneficial as it allows stakeholders to follow the data exchange from model to model and understand the relationship between the electricity sector and the economy.

[7] SATIM can be run as a full energy sector model or as an electricity sector model (SATIM-E); we have used the latter in this analysis, since the study is an assessment of alternative electricity planning options.

## 3.2 Economic model (e-SAGE)

The e-SAGE model is a dynamic recursive computable general equilibrium (CGE) model developed by UNU-WIDER (Arndt et al., 2011). The main input is the 2007 South African Social Accounting Matrix (SAM). The SAM is a set of accounts that represents all of the productive sectors and commodities in South Africa, as well as factor markets, enterprises, households, and the 'rest of the world.' The 2007 SAM has 61 productive sectors (industries) and 49 commodities. The seven factors of production include land, four labour groups disaggregated according to level of education[8], energy and non-energy capital (Arndt et al., 2011). The government, enterprises, 14 household groups based on their per capita expenditure, and the external account[9] are all represented (Thurlow, 2004). The behaviour of industries and households is governed by rational expectations (Thurlow, 2008). Industries and producers are thus assumed to aim to maximize profits while households aim to maximize their utility subject to their budget constraints. Product and factor market equilibrium are maintained.

The e-SAGE model is a dynamic recursive model, and as such has two periods, the "within-period" and the "between period". The static run of the CGE model makes up the within-period in which the economy adjusts to an annual shock. Some variables and parameters are updated based on the new equilibrium during the between period, for instance, capital accumulation and re-allocation are determined endogenously, whereas population growth, factor productivity and technical change in the energy sector are forecast exogenously (Alton et al., 2014).

An average population growth rate of 0.7% per annum to 2040 was assumed in this study. This is aligned with the United Nations' median estimates for population growth. The expected growth rate is quite low because, according to current trends, migration rates are likely to decrease and the rate of growth in the population of South Africa will decline between now and 2040[10]. The population in 2040 is forecast to be approximately 63 million people.

There are also several pertinent assumptions about labour supply growth to 2040. The study assumes a more optimistic view on the future of education and skills development than current skills/education levels would suggest. Labour supply for semi-skilled workers grows at 1.5% per annum, significantly faster than population growth, and the supply of skilled workers by 1% per annum. The result is an increase of semi-skilled and skilled labour to about 40% of the total labour force by 2040. There is a high demand for semi-skilled and skilled workers in South Africa, therefore full employment is assumed for these labour categories.

A key feature of the e-SAGE model is that non-energy industries can react to energy price changes during the between-period by shifting their investments to less energy intensive capital and technologies, how easy it is for these industries to switch is specified exogenously (Alton et al., 2014)[11].

---

[8] Labour is disaggregated into four groups according to level of education and mapped to level of skill: individuals that have attained primary and middle-school education are considered unskilled, completed secondary school are semi-skilled, and tertiary education are skilled.

[9] External Account includes: global commodity prices, foreign financial flows, payments for imports and revenues from exports, and trade elasticities.

[10] Estimates for the population in 2050 range between 56 and 75 million people for various scenarios explored by the International Institute for Applied Systems Analysis (IIASA) and World Population Program (WPP) (2015 Revision) – the medium variant is slightly higher than 65.54 million. The IIASA estimates are too low for the initial years (between 54 and 55 million in 2020), therefore these were revised to a more reasonable estimate of 54.5 million in 2015.

[11] Energy is considered an intermediate input and the interaction between intermediates and factors is governed by a Leontief production function. To decrease the rigidity of using a Leontief

CGE models are governed by a set of closure rules that allow the model to reach equilibrium. The following closures are applied for all of the e-SAGE model runs:

- **Savings and investment:** Previous studies have found that the savings-driven investment closure is most appropriate for South Africa.[12]
- **Government:** Uniform sales tax rate point changes are allowed for selected commodities, while government savings remain fixed.
- **Foreign:** South Africa has a flexible exchange rate, therefore a fixed trade balance is assumed and the exchange rate is able to adjust and maintain equilibrium between the payments to and from other countries[13].
- **Factor market:** A large portion of the low-skilled workforce in South Africa is unemployed, and some of this unemployment is structural. Therefore, it is assumed that low-skilled labour is not fully employed and that there are rigidities in the labour market.[14] Labour supply is flexible and allowed to adjust to meet the demand for labour in the economy. Skilled labour and semi-skilled labour on the other hand are assumed to be fully employed and mobile. Factor prices (i.e., rent or wages) are allowed to adjust to ensure equilibrium is reached and demand equals supply. Capital is assumed to be fully employed and activity- or sector-specific. Land is fully employed and mobile, that is, it can be used for different purposes.

## 3.3 Energy model (SATIM)

The South African TIMES Model (SATIM) is an inter-temporal bottom-up optimisation energy model of South Africa built around the Markal-TIMES platform. SATIM uses linear or mixed integer programming to solve the least-cost planning problem of meeting projected future energy demand, given assumptions such as the retirement schedule of existing infrastructure, future fuel costs, future technology costs, learning rates, and efficiency improvements, as well as any given constraints such as the availability of resources. The model is structured into five demand sectors and two supply sectors that can be analysed individually or together. The demand sectors are industry, agriculture, residential, commercial and transport, and the supply sectors are electricity and liquid fuels. The technical, economic and demand projection data for each sector is contained in

production function, there is 'response elasticity' that governs the amount sectors are able to change in their energy inputs per unit of output based on energy prices.

[12] The relationship between savings and investment continues to be a highly debated and controversial topic in macroeconomics (Nell, 2003). Neo-classical, and new endogenous growth theory maintains the view that it is former savings that decide an economy's investment and output (Thurlow, 2004). Conversely, from a Keynesian perspective, it is investment that is exogenous and savings that adjust accordingly (Thurlow, 2004). Although, according to Nell (2003), analysis has established that in the case of South Africa, the long-run savings and investment relationship is associated with exogenous savings and no feedback from investment. In light of this, the SAGE model assumes a savings-driven closure (Arndt at al., 2011). This implies, amongst other things that the deficit (foreign debt) is kept constant.

[13] The IMF projections show South Africa maintaining a current account deficit similar to the current deficit to 2020 – this is in-line with the assumptions made in the model.

[14] To simulate unemployment, an upward sloping supply curve was assumed for low-skilled labour. Low real wage supply elasticities were also assumed to indicate that their unemployment is structural.

a set of databases.[15] This data is detailed in the 'inputs and assumptions' subsection. Demand is specified as useful energy demand (e.g., demand for energy services such as cooking, lighting, and process heat), and final energy demand is calculated endogenously based on the optimal mix of demand technologies. The model allows for trade-offs between supply and demand sectors, it explicitly captures structural changes (i.e., different sectors growing at different rates), process changes, fuel and mode switching, and technical improvements related to efficiency gains. The result of the optimization is both the supply and demand technology mix (e.g., capacity, new investment, production, and consumption) that would result in the lowest discounted system cost for meeting energy demand over the time horizon, subject to all other imposed constraints (Altieri et al, 2015).

The SATIM model can be run as an electricity sector only version (SATIM-E) or a full energy sector model. Currently, there is a partial link with only the SATIM-E model linked to the economic model.

### 3.3.1 Overall assumptions and exclusions

The results of a model are entirely dependent on the design of the model and its underlying assumptions. In order to provide transparency and some context for the results, the key assumptions used in the model and model exclusions are listed below:

General assumptions:

- The energy model runs to 2050 but the linked model runs to 2040.
- A discount rate of 8% is assumed.[16]
- The model solves every 5 years and the results are interpolated for the years in-between.
- A reserve margin of at least 15% must be maintained by the system. This constraint falls within the range of 14% to 19% recommended in the Electricity Master Plan (DME, 2007).
- Reliability of supply - The firm capacity assumptions of all thermal, pump storage and hydro units are assumed to be 1; a conservative estimate for wind of 0.15 is assumed and we assume zero for solar thermal without storage and solar PV (ERC, 2013).
- No new coal power plants are built after Medupi and Kusile. This assumption is based on past work on modeling national climate targets (Altieri et al, 2015), that shows that when national climate policy targets are imposed, sectors do not reduce their emissions pro-rata (based on the base-year inventory) as is assumed in the IRP, but given that the electricity sector offers lower cost opportunities for emissions reduction this is where most of the mitigation happens, and coal power is almost completely phased out by 2050 as shown in figure 3.[17]

[15] The databases that support the SATIM model are continuously updated according to any new information and therefore may be slightly different to those used in this report. The latest versions of these can be found on the ERC website, www.erc.uct.ac.za.

[16] A discount rate of 8% is used as it was equivalent to the yield on a 10Y Government bond at the time of writing - the benchmark was suggested by National Treasury.

[17] Altieri et al (2015) ran a full energy sector model that captures the trade-offs, costs and benefits of decarbonisation in the energy sector as a whole, whereas the IRP is an electricity-only model

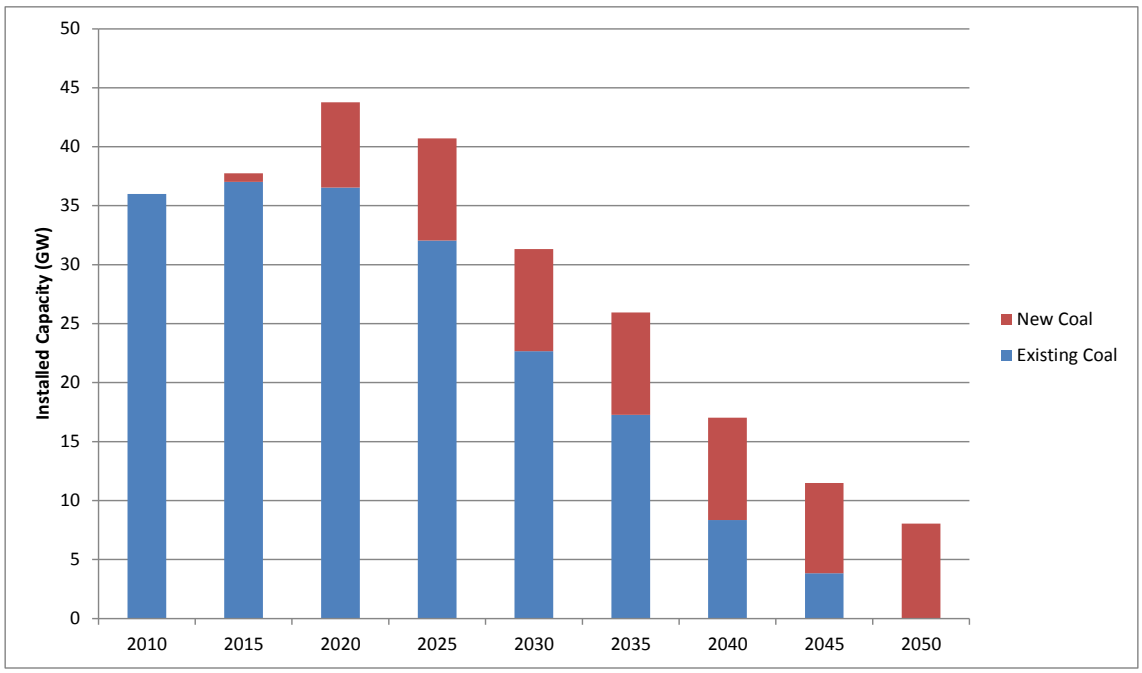



**Figure 4: Installed coal capacity in all scenarios**

Excluded from the modeling scope:

- The model does not include high resolution plant ramping limits or account for the efficiency/emission changes that would result from this
- Transmission costs are included in the technology cost estimates, but are not spatially disaggregated based on the geographic location of the plant or source of demand
- Life extensions of existing coal-fired plants are not considered, however Koeberg is assumed to run for its extended 60 year life
- Short term electricity system reliability analysis is not included in this analysis[18]
- Carbon Capture and Storage (CCS) is not included in this analysis
- A full analysis of the waste, decommissioning and implications on water-use.

# 4. Scenarios

We started with two potential and illustrative futures for South Africa (Future 1 and Future 2), each with specific conditions. The differences in each future related to parameters such as economic growth assumptions (because higher economic growth typically leads to increased electricity demand), technology costs (nuclear power versus renewable energy technologies) and the costs and availability of other sources of power such as domestic gas and regional hydropower.

In each of these futures, we then modelled the commitment to the nuclear fleet and compared this against a flexible planning scenario. In short, we model the policy

and assumes that other sectors will 'do more' in terms of decarbonisation, despite decarbonisation in the electricity sector being the cheapest option.

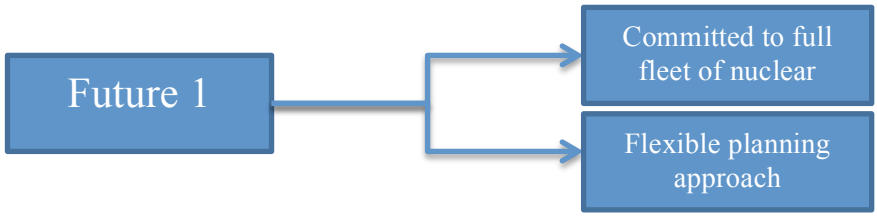
[18] An important next step would be to run the scenarios through a dispatch model to ensure reliability. This has been noted as an essential piece of future work.

decision to commit to nuclear against a counterfactual where South Africa adopts a flexible planning approach in two possible futures.

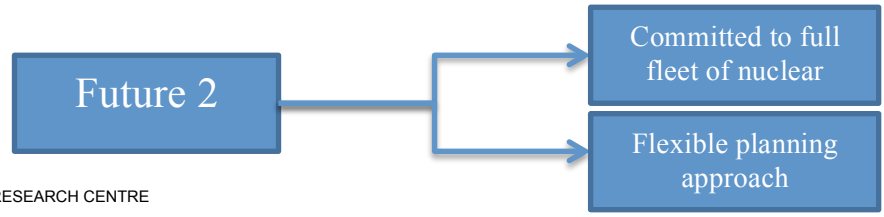
By flexible planning, we mean that we run scenarios that aim to build an electricity capacity expansion plan – as in the integrated resource plan – that minimises overall costs while meeting demand. The flexible scenarios are thus 'least-cost' and can be compared against scenarios with the nuclear commitment in each potential future. Given the uncertainties around economic growth, electricity demand, and costs, investment in large-scale, expensive electricity generation technology is always accompanied by some degree of risk and uncertainty. Steyn (2001: 31) outlines the literature on investing under conditions of uncertainty; he defines inflexible technologies as technologies characterised by: long construction lead times, large unit sizes, high capital intensity, dependence on dedicated infrastructure, non-incremental development strategies, and limited substitutability. These characteristics limit learning, responsiveness to changes in external conditions, and increase the costliness of errors. A flexible approach thus aims to ensure 'least-cost' planning and to reduce the risks inherent in inflexible decision-making.

In essence, there are an infinite number of futures that could materialise and it would be impossible to describe the socioeconomic implications of all of these. In order to narrow this down, we define two illustrative futures based on plausible and contrasting assumptions. This allowed us to compare the effects of the nuclear fleet under conditions of future uncertainty – because we do not know which future will materialise, it was important to understand the potential supply options and the impacts of those supply choices for different, uncertain futures. Whichever future materialises, we can compare the socioeconomic impacts of the committed nuclear build against a build plan that includes a diversity of supply options. In the third tier of analysis, the Monte Carlo simulations, we are able to analyse 1000 of these plausible futures. Given that it would be impossible to expand on all of these futures, Future 1 and Future 2 were chosen as they fall near the two extreme ends of the range of these 1000 futures.

Each future is described in more detail below.




Future 1 can be understood as the "best case" for nuclear power: it is a future world in which conditions are optimal for nuclear. In this future, South Africa experiences higher levels of growth between 2015 and 2040, averaging 3.6% per year. The assumed costs of nuclear power are lower, the decline in costs of renewable energy is assumed to be slower (i.e. renewable energy options are comparatively more expensive), and there are limited alternative options to nuclear power such as domestic gas resources and regional hydropower. Future 2, on the other hand, can be understood as a "worst case" for nuclear power. South Africa's economic growth rate is lower (2.7% per year on average) and electricity demand is therefore lower; nuclear power costs are higher, renewable energy technologies are cheaper, and there are domestic gas and regional hydro options that are viable and competitive technology options.



The detailed parameters used as inputs into the modelling can be seen in Table 2:

| **Uncertainty parameter compared in each future** | **Future 1 (Best case for nuclear)** | **Future 2 (Worst case for nuclear)** |
|---|---|---|
| Average Economic growth 2015-2040 | ~3,6% | ~2,7% |
| *Nuclear parameters:*<br>Overnight Cost (2014 $/kW$_{net}$)<br>Lead/construction time (years)<br>Availability | *Optimistic*<br>Lower (~5100)<br>Shorter (6)<br>Higher (90%) | *Pessimistic*<br>Higher (~7000)<br>Longer (12)<br>Lower (75%) |
| *Renewable energy parameters:*<br>(overnight cost reduction 2040:2015)<br>PV (incl. rooftop and centralised)<br>CSP (all storage levels)<br>Wind | *Pessimistic*<br><br>-26%<br>*-25%*<br>*-1%* | *Optimistic*<br><br>-37%<br>*-34%*<br>*-10%* |
| Cost and source of natural gas | Liquefied Natural Gas at $12/MBtu | Domestic gas at $9.5/MBtu |
| New Hydro Imports from the region incl. 2 phases of Inga | no | yes |

**Table 2: Summary of uncertain parameters for Future 1 and Future 2**

A comprehensive explanation of these assumptions is given in section 4.1.

## 4.1 Key uncertainties and drivers

Each of the parameters used to define each future is described below in more detail.

### 4.1.1 Economic growth and electricity demand

Economic growth is a key driver of energy demand and given that many factors influence growth in the South African economy, it is particularly difficult to forecast. Higher economic growth forecasts are usually coupled with higher electricity demand forecasts. The magnitude of electricity demand growth being dependent on assumptions related to electricity intensity. Given the uncertainties around economic growth and ultimately electricity demand, investment in large-scale, expensive electricity generation technology is risky. A lower-than-expected realised electricity demand could result in lock-in and excess supply, as was the case in South Africa in the late 1980's and early 1990's (Steyn, 2001). On the other hand, a situation where electricity supply capacity is not sufficient to meet electricity demand could have a significant impact on the economy. As is currently the case in South Africa, where shortages in electricity supply continue to threaten the country's productivity, economic performance and competitiveness.

Given the uncertainty in economic growth projections, future 1 assumes a higher average annual GDP growth rate of 3.7% to 2050 and for future 2 an average annual GDP growth

rate of 2.7%[19]. These average annual growth rates are lower than those in the IRP update, between 5.4% and 2.9%, to 2050. There are two main reasons for this. Firstly, the electricity intensity in the linked model is slightly higher than those assumed in the IRP update, and so a lower growth rate means that the electricity demand projections are comparable to those in the IRP update (DoE, 2013). Secondly, there is no evidence that South Africa's growth rate will increase to the National Development Plan's aspirational economic growth rate of 5.4% per annum to 2030[20] (NPC, 2011) and, as stated in the IRP update, assuming this growth rate will be achieved raises the risk of overbuilding capacity to meet the target.

The electricity demand (energy in TWh) trajectories that result from the economic growth assumed in future 1 and future 2 described above are shown in Figure 5. This is the expected electricity consumed downstream of transmission. The figure also shows how those two trajectories compare to some of the demand projections used in the IRP update.

The electricity demand is a result of the assumptions in e-SAGE (the economic model) about the electricity needs of each sector (as a coefficient of intermediate input per unit of output, i.e. the amount of electricity required to produce goods in each sector) and household income in the economy. Electricity exports are kept constant at historical values. The current version of the linked model does not allow for substitution away/towards electricity from/to other fuels, but sectors are given some flexibility to reduce their electricity intensity in response to price increases as documented in Arndt et al. (2011), i.e. sectors have some flexibility in adjust their electricity use per unit of output as prices fluctuate.

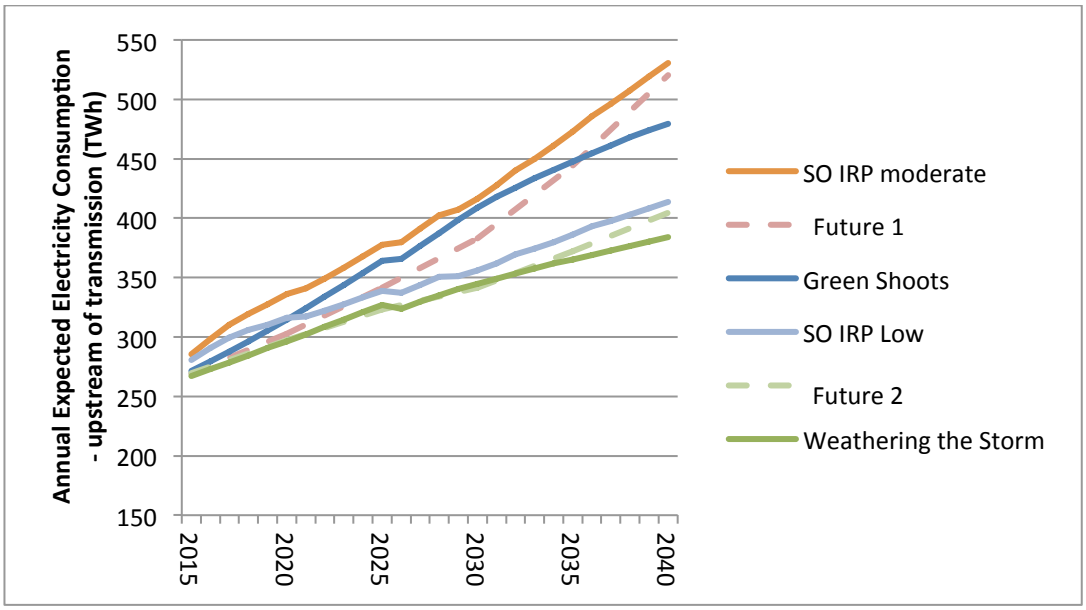



**Figure 5: Electricity demand trajectory**

[19] In the CGE model, the total factor productivity (TFP) rates were adjusted as well as the investment portion of absorption. In the lower demand scenario, TFP's grow at a declining rate of around 3% and assumed that there would be no change in South Africa's investment portion of absorption (~ 20.4%). The higher growth scenario assumed a slightly higher TFP growth rate (declining growth at 1% per annum) and a more optimistic view, aligned with the NDP, on the level of investment in South Africa (increasing to 25% by 2025).

[20] The World Bank estimates that in order for South Africa to reach its goal of at least 5.4% economic growth to 2030, economic growth would have to average at about 7.2% per annum to 2030.

As can be seen, the demand trajectories in our modelling are between the 'SO IRP moderate' and 'weathering the storm' demand forecasts in the IRP 2010 update[21]. This means that the electricity capacity requirements in two scenarios presented in this report are comparable to the capacity requirements modelled in the IRP update.

### 4.1.2 Nuclear cost parameters

Several parameters impact the costs of nuclear power. These include the overnight capital cost (the cost of building a plant excluding interest payments; the construction or lead time to build the plant; the capacity schedule (when plants come online); and the nuclear availability factor (how much of the time the plant is running once online). Each of these factors is discussed in detail below.

#### *4.1.2.1 Overnight Investment Cost*

The estimated overnight investment cost is one of the more important parameters when it comes to accessing the economic competitiveness of nuclear power. The fixed costs for construction make up the largest component of levelised or life-cycle costs of a nuclear power plant, around 70% of the total investment cost (Thomas, 2010). There is a large range in possible overnight costs for South Africa (Merven & Durbach, 2015), driven by the different costs of each technology, costs proposed by different vendors, varying material costs, labour costs and regulatory setup costs.

As previously mentioned, we assume that the preferred vendor is Rosatom and draw from the most recently quoted figures from Rosatom of $ 40-50bn to build 8 units of their VVER-1200 (TASS, 2014) in South Africa.

The model requires overnight costs in R/kW. This is calculated by dividing the cost per unit by the net[22] capacity per unit. The cost per unit quoted by Rosatom most likely does not include the owner's costs. Owner's costs cover expenses that fall outside of the engineering, procurement and construction (EPC) costs such as site preparation, Environmental Impact Assessments, decommissioning costs, and the costs of setting up/augmenting regulatory frameworks. For nuclear this could make up between 10% and 20% of the total overnight costs (Black & Veach, 2012), a reasonable assumption given that Eskom estimates owner's cost to be about 15% of the total overnight cost[23]. By adding 10% to the lower end and 20% to the upper end this puts the range between $44 billion and $60 billion. The net capacity of the VVER-1200 is 1082 MW (IAEA, 2013). The range in cost per kW is therefore $5,100 to $7,000 per kW (shown in Table 2), which is consistent with the range used in the IRP update report (DoE, 2013).

To convert from $/kW to R/kW we use the historical exchange rate for 2014-2015 of 11.45 R/$ (Oanda, 2015), which gives a range of: ~2015 R 58,000/kW to 79,000/kW[24].

[21] The growth rates on which the IRP 2010 are considered to be out of date and for this reason the comparison is made against the IRP 2010 update.

[22] Net generation capacity is equal to the gross generation of a power plant less the electricity used to operate the power plant (the power plants own use on pumps and fans, etc). The IRP uses gross generation capacity in the calculation of overnight costs, although it is generally accepted that the net capacity should be used in this calculation.

[23] Based on a personal communication with an Eskom employee.

[24] In 2012 Rands this gives us a range of R49 000/kW to R67 600/kW, which is consistent with the IRP update 2012 rand figures adjusted by the same 10% and 20% owner's costs.

#### *4.1.2.2 Lead/Construction time*

Lead times for nuclear power plant builds vary significantly depending on a number of factors, which include technology type, skills and component availability, safety and licencing approval, funding availability and state, public and private sector interventions. Data from the Power Reactor Information Systems (PRIS) database (IAEA, 2015), shows that for reactors connected to the grid after 1990 lead times varied between 26 years and 9 months (ROSTOV-3, a VVER V-320 reactor in Russia) and 4 years and 2 months (SHIN-KORI-1, an OR-1000 reactor in Japan)[25]. The lead times used in this study were based on the assumptions in the IRP 2010 for future 1 (6 years) and based on the 75th percentile value from the IAEA data for future 2 (12 years). It could be argued that using the 75$^{th}$ percentile is optimistic, given some of the lead times shown in Figure 6. However, lead times of over 20 years are likely to be attributed to specific country experiences and delays that may not necessarily be relevant for the South African context. A lead time of over 12 years would amplify the negative impact of the forced nuclear scenario on the energy sector as well as on the economy.

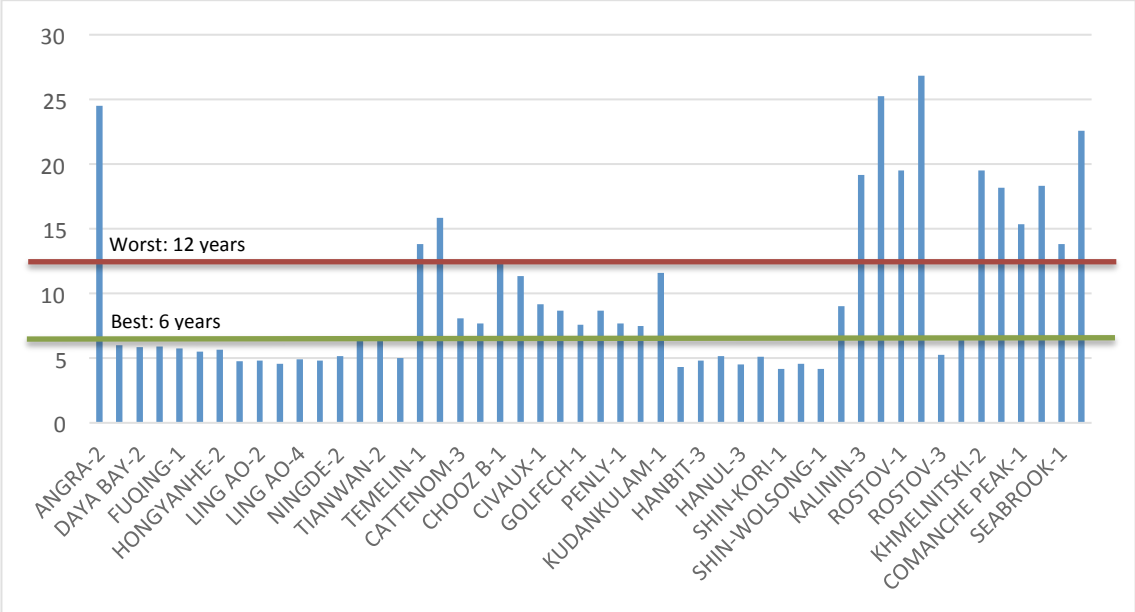



**Figure 6: Nuclear reactor lead times (IAEA, 2015)**

#### *4.1.2.3 Nuclear capacity schedule*

The IRP Update states that the earliest date that the first unit of nuclear power could be commissioned is in 2025. This assumption was carried forward to our analysis and the date of commissioning the first unit, as shown below in table 3, is 2025. In order to have the full 9.6GW online before 2030, one unit is added to the grid every year until 2030. In future 2, with a lead time of 12 years and therefore a delay of 6 years for each unit, the schedule is pushed back and the first unit comes online in 2031[26].

[25] These figures are taken from a reasonable sample of the data - only units connected after 1990 and larger than 900MW gross were used in the sample. Outliers were omitted as well as older technologies that are unlikely to be considered by South Africa as possible generation types.

[26] In a recent statement, Rosatom was quoted as saying that once the deal is finalised they would need at least three years of preparation before construction would commence (Business Day 2015). It would then take at least 60 months (5 years) to construct the first nuclear reactor, and subsequent units come online every 40 months (3 years and 4 months) (Business Day 2015). A more relaxed investment schedule such as this one would put less financial pressure on South Africa and dampen the negative short-term economic impacts of a large-scale

| | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 | 2041 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nuclear IRP 2010 (Updated) | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | | | | | | | | | | | |
| Nuclear Delayed | | | | | | | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | | | | |
| *Nuclear (Rosatom)* | *1.6* | | | *1.6* | | | *1.6* | | | | *1.6* | | | *1.6* | | | *1.6* |

**Table 3: Nuclear capacity schedule**

#### *4.1.2.4 Nuclear Availability Factor*

The availability factor is another important parameter in determining the levelised or life-cycle costs of power plant technologies. The PRIS data (IAEA, 2015) was used to determine the upper and lower bounds for the availability factors used in future 1 and future 2 respectively[27]. The assumed availability factors used in this study were a more optimistic 90% for future 1 and a less optimistic 75% for future 2, as shown below in figure 6.

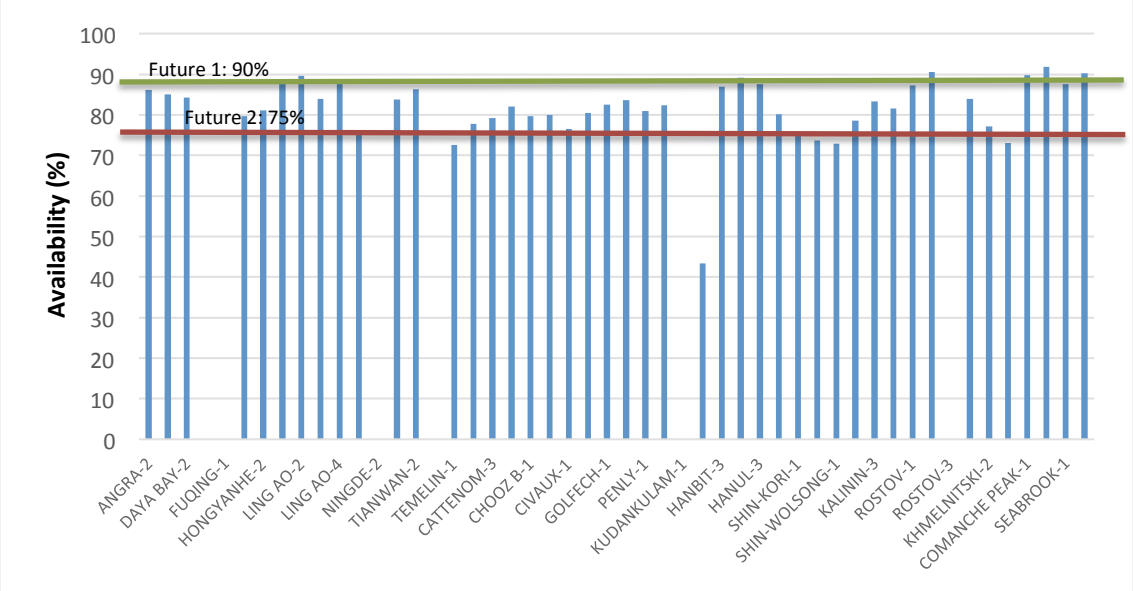



**Figure 7: The availability factors of nuclear reactors currently online**

### 4.1.3 Renewable energy parameters

#### *4.1.3.1 Centralised Photovoltaic*

The cost of Photovoltaic (PV) has reduced significantly in recent years, sustaining high learning rates of 20%-23% over the period 1976-2014 (IEA-ETP, 2014; 2015). Global installed capacity has steadily been increasing and is expected to continue to increase

electricity sector investment. This scenario was out of the scope of this study, but presents an interesting piece of future work.

[27] At roughly an 80% confidence interval.

over time. It is expected that as installed capacity increases further, there will be even more cost reductions, however, there is uncertainty around whether the high learning rate will be sustained and whether installed global capacity continue to expand at the current rate. The recent ERC-UNEP study looks at this in some detail (Merven & Durbach, 2015), by assuming probability distributions for the learning and future total global installed capacity. The 5th (UNEP-Optimistic used in Future 2) and 95th (UNEP-Pessimistic used in Future 1) percentile trajectories, as shown in Figure 8, are used in the analysis. It also shows how the projections compare to the assumptions in the IRP Update (DoE, 2013) and to the average overnight cost observed in the latest round (round 4) of the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP).

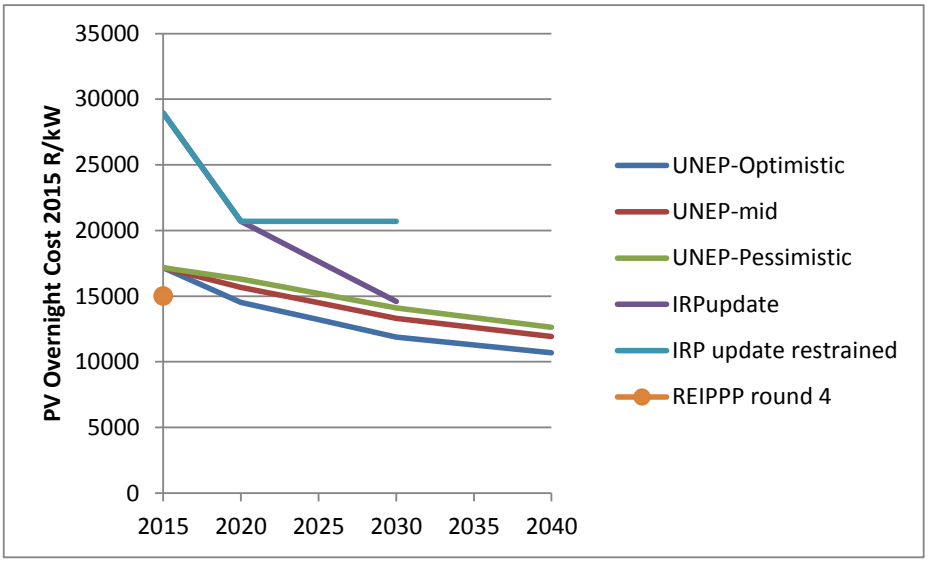
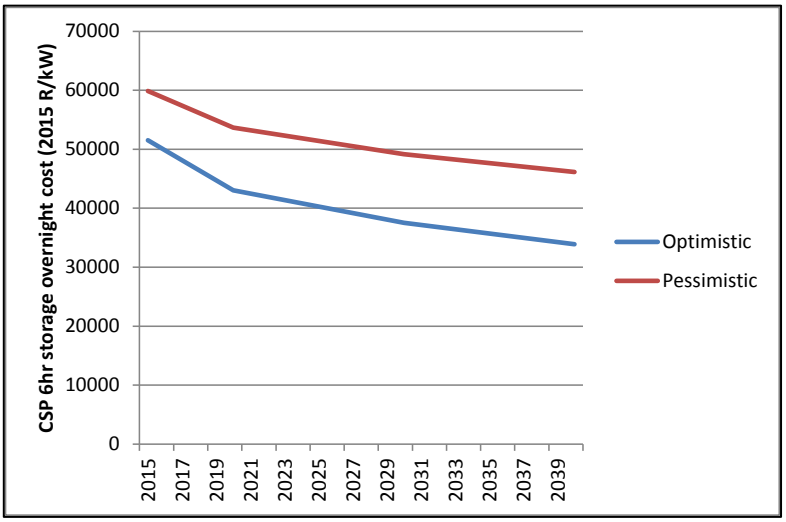



**Figure 8: Overnight cost for Centralised PV**

#### *4.1.3.2 Concentrating Solar Power (CSP)*

A similar approach was used for Concentrating Solar Power (CSP). The ERC-UNEP study takes a range of learning rates and future global installed capacity to get a range of projections for the overnight cost of CSP. The 95% and 5% percentile trajectories for the plant with 6 hours of storage for Future 1 (optimistic) and Future 2 (pessimistic) respectively are shown in Figure 9. Plants with up to 14 hours of storage are considered. The costs of the different storage options are scaled from the 6-hour storage plant using constant scaling factors shown in Figure 9.




| Storage Hrs | Cost Ratio |
|---|---|
| 3 | 0.84 |
| 6 | 1.00 |
| 9 | 1.15 |
| 12 | 1.31 |
| 14 | 1.41 |

**Figure 9 Overnight Cost for CSP with 6hr storage and ratio of costs for different storage options**

#### *4.1.3.3 Wind*

The cost of wind has reduced significantly over the first four rounds of the REIPPPP. As with PV and CSP, there are uncertainties in the learning rate of wind in the future. To capture this uncertainty, two trajectories are considered for future 1 (optimistic trajectory) and future 2 (pessimistic trajectory), shown below in relation to the cost from round four of the REIPPPP in Figure 9[28].

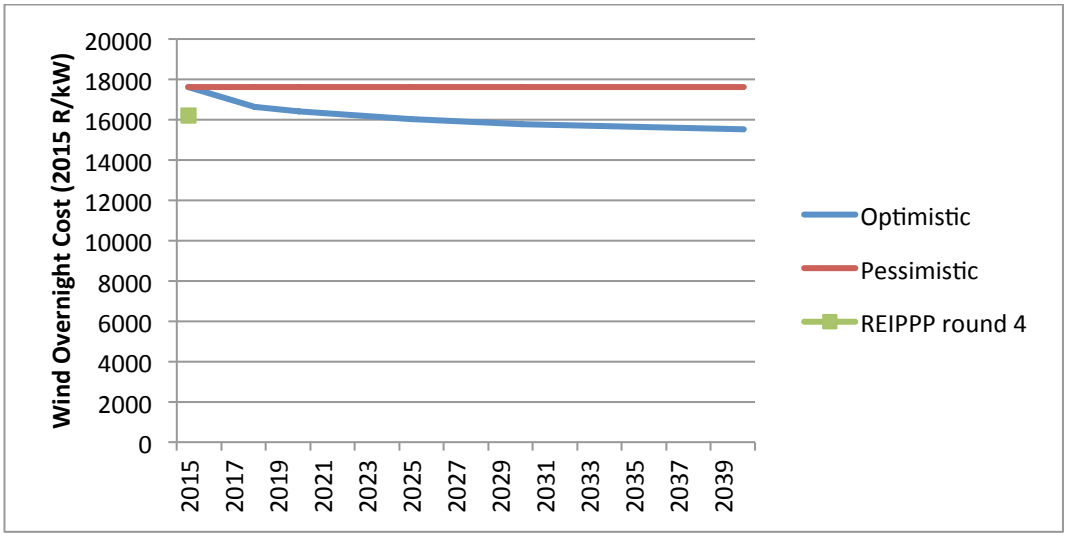



**Figure 9: Overnight cost for Wind**

### 4.1.4 Natural gas

South Africa could benefit from the availability of affordable natural gas via its shale resource. However, the size, quality, and extraction costs of the resource remain highly uncertain. In Future 2, it is assumed that up to 40 Tcf is available at $9.5/MBtu to power plants located in the vicinity of the resource.

In Future 1, shale gas is not available to the power sector and natural gas is imported in the form of liquefied natural gas (LNG)[29]. The price of LNG (after regasification) is

[28] The cost assumed in this study is slightly higher than that of the REIPPPP, therefore it is likely that wind is more cost competitive than we assume and the take up of wind could be higher than the resultant electricity build plans, presented in the results section.

[29] It is assumed that the Sasol Southern Mozambique pipeline continues to operate to supply the existing Sasol gas power plants.

assumed to be $12/MBtu, and is available to power plants in the vicinity of the LNG terminals.

#### 4.1.5 Regional hydro imports

The Southern African Power Pool distributes electricity throughout the region via major infrastructure corridors. In Future 1, import options are limited and there are no new imported hydro options available. In Future 2, all the import options that are listed in the IRP (DoE, 2011) and IRP Update (DoE, 2013) are allowed, as well as two phases of Grand Inga.

During Phase 1 of Inga, up to 2.6 GW can be imported via the western corridor. The Phase 1 tariff is set at $64.7/MWh on the basis of a levelised generation cost of $35/MWh and a levelised transmission cost (including losses) of $29.7/MWh (SNEL et al., 2011). The date of operation for Phase 1 is consistent with the updated version of the IRP (DOE, 2013) and is an import option from 2022.

Phases 2 of Inga plans for additional imports of up to 3.6 GW via other corridors (e.g. the Eastern Corridor and other routes). Imports are permitted from 2027 at a phase 2 tariff set at $72.8/MWh on the basis of a levelised generation cost of $35/MWh and a levelised transmission cost of $37.8/MWh.

# 5. Results

The results of the electricity sector and socioeconomic implications for each future as well as the results of the Monte Carlo analysis are detailed in this section.

## 5.1 Electricity sector and socioeconomic implications

This section presents some of the key results from the linked energy and economy-wide modelling, bearing in mind the elements that, according to the NDP, should be promoted by the energy sector.

The results are reported for each future as a comparison of the case where South Africa commits to 9.6 GW of nuclear power versus the counterfactual where a flexible planning approach is adopted for the electricity sector. Given different underlying assumptions of the two futures a direct comparison between them is not analytically useful. The point of this analysis is to understand the possible macro- and socioeconomic implications of following through with the nuclear build plan versus adopting a flexible planning approach in two illustrative and extreme futures, knowing that the future that could unfold will fall somewhere between the two.

Key results include the mix of generation capacity in response to the assumptions for economic growth and imposed nuclear share, the resultant electricity price, electricity investment paths and the socioeconomic implications of these outcomes.

#### 5.1.1 Future 1 results: Best case for nuclear

Here we compare the results of committed nuclear investment versus flexible planning in Future 1.

##### *5.1.1.1 Electricity build plan*

In Future 1, peak demand is similar for both the case where a flexible planning approach is adopted and when there is a firm commitment to 9.6 GW of nuclear power: at 57 GW

in 2030 and 77 GW in 2040, as shown in Figure 10.[30] The installed capacity is higher for the scenario where a flexible planning approach is adopted, because of higher uptake of renewable energy technologies.

When a flexible planning approach is adopted, nuclear capacity does come online but only approximately 4GW of new capacity by 2030, whereas other new capacity is from wind, natural gas-fired plants (using imported liquefied natural gas) and Solar PV generation. This is in contrast to a fixed commitment to 9.6GW of nuclear, which replaces wind and gas capacity in particular by 2030. By 2040, however, we observe similar levels of new capacity for nuclear even in the flexible plan. The flexible planning scenario has 17.8GW of installed nuclear capacity by 2040, and the forced nuclear scenario has 20.6GW.

It is important to note the difference in 2030 between these scenarios, both of which assume more favourable conditions for nuclear power. In the scenario where flexible planning is adopted (i.e. a plan that aims to minimise costs) significantly less nuclear capacity is built by 2030 than in the scenario where nuclear power is forced onto the system. By 2040, the large nuclear capacity being built is a result of the assumptions about higher electricity demand, limitations on new coal capacity, and the relative prices of different supply options (lower nuclear costs and higher renewable energy and gas). This replicates the findings in the *Toward a New Power Plan* (ERC, 2013) report that found that there was no urgent need for nuclear power in South Africa[31].

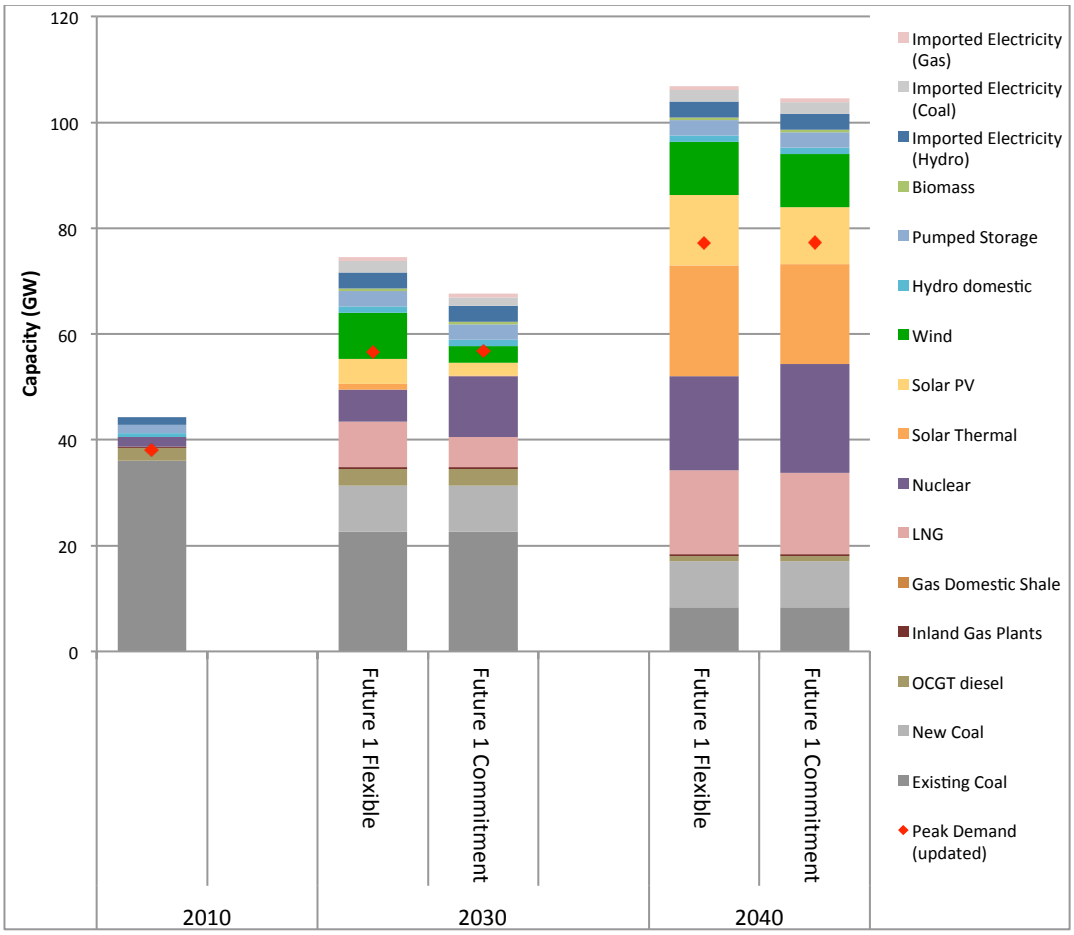



**Figure 10: Electricity sector installed capacity in 2010, 2030 and 2040 for Future 1**

[30] Future one has substantially higher installed capacity by 2040 than Future 2 does – this is in response to a higher demand forecast driven by an assumption of higher economic growth over the period 2015-2040.

[31] The NPP report found that even with low costs for the nuclear build programme and high electricity demand the earliest nuclear power might be required is 2029.

### *5.1.1.2 Investment levels and electricity prices*

Figure 11 illustrates the annual investment required for a flexible plan versus the forced nuclear scenario, and the resultant electricity price increases. The high growth in electricity demand in Future 1 leads to new installed capacity of 25.2GW and 24.2GW (between 2015 and 2040) for the flexible planning approach and the committed nuclear build cases respectively. Given the low capital cost of nuclear assumed in Future 1, there is no significant difference between the total investment required by the electricity sector in either scenario. A total investment of approximately R4.4 trillion for the electricity sector from 2015 to 2040 is required for both the flexible scenario and the nuclear commitment. The lack of a significant difference in the cost of the electricity build plan translates into a similar electricity price path for both scenarios: R1.34 per kWh (2015 Rands) in 2040 as indicated by the horizontal lines in Figure 11 below.

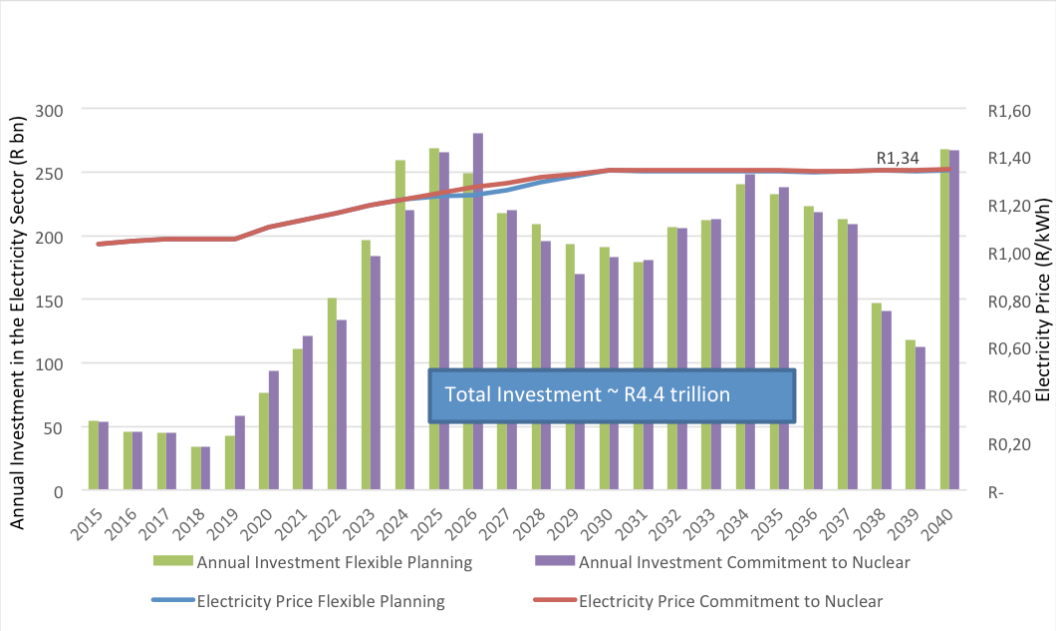



**Figure 11: Comparison of investment and electricity price for committed nuclear versus flexible planning in Future 1**

### *5.1.1.3 Growth and employment*

The deviation in GDP growth and employment between the committed nuclear scenario and a flexible plan is shown in Figure 12. There is a slight decrease in GDP between 2020 and 2024 and then a slight increase in GDP between 2024 and 2035 in the case of the committed nuclear fleet. The deviation has two main causes: firstly, the commitment to nuclear power would require construction of the plants between 2019 and 2030 (factoring in a 6 year lead time), leads to a reduction in the investment available to other sectors of the economy between these years. This has a small negative impact on GDP between 2020 and 2025, after which the nuclear power plants come online and there are returns on these investments. Secondly, there is also a marginal price impact as can be seen in Figure 11 and Figure 12 between 2024 and 2030 when sectors react to slightly higher electricity prices.

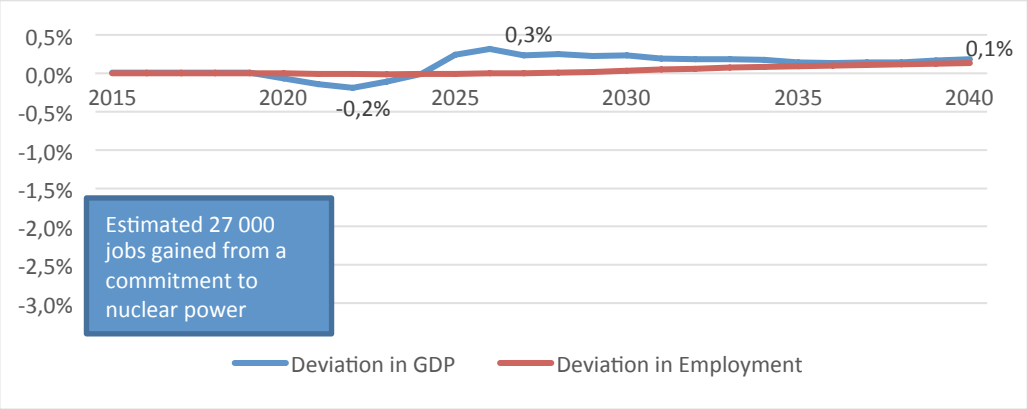



**Figure 12: Impact on GDP and employment of the nuclear commitment versus flexible planning approach in Future 1**

The result is an oversupply of affordable electricity, incentivising growth from 2025 onwards. It is essential to understand that this is not a technology specific outcome[32], but rather the outcome of an overinvestment in electricity supply capacity in an economy with high enough GDP growth to absorb the excess electricity supply. This would not be the case with lower levels of GDP growth and the result would be a larger negative impact on GDP (see Figure 16 on GDP in the results for Future 2).

#### *5.1.1.4 Employment effects by labour category*

With an estimated unemployment rate of 25% in South Africa, any potential negative impact on employment is a cause for concern. Table 4 shows total employment (disaggregated by educational attainment) and the potential impact on jobs of the commitment to nuclear power compared to the case where South Africa follows a flexible planning approach. In Future 1, because of the higher growth rate assumed, the effect on employment is marginally positive for all sectors and labour categories for both the flexible and forced nuclear cases.

| | Number of employed workers (thousands) | | | Number of jobs created/(lost) with nuclear commitment | Number of jobs created/(lost) with nuclear commitment as a percentage of employed workers |
|---|---|---|---|---|---|
| | 2010 | Flexible policy in 2040 | Nuclear commitment in 2040 | | |
| **LABOUR** | **12 369** | **20 813** | **20 840** | **27 298** | **0.1%** |
| **Unskilled labour** | **5 731** | **11 081** | **11 108** | **27 298** | **0.2%** |
| Primary | 1 942 | 3 712 | 3 721 | 9 030 | 0.2% |
| Middle | 3 789 | 7 368 | 7 387 | 18 269 | 0.2% |
| **Skilled labour** | **6 639** | **9 732** | **9 732** | **-** | **-** |
| Secondary | 3 645 | 5 697 | 5 697 | - | - |
| Tertiary | 2 994 | 4 036 | 4 036 | - | - |
| ***Electricity sector*** | ***37*** | ***81*** | ***79*** | ***-1 460*** | ***-1.8%*** |

**Table 4: Employment effects of committed nuclear versus flexible planning in Future 1**

[32] Interestingly, when a similar capacity commitment was made with investment in solar CSP the socioeconomic implications were better than the case with forced nuclear.

#### *5.1.1.5 Welfare*

The potential impact of the scenarios on welfare in South Africa is also of concern, given South Africa's development imperatives. Households in South Africa are affected either directly through the price of electricity or indirectly through job losses and changing wage rates. The results have shown that by committing to the nuclear build plan, there is less investment available for other sectors, which leads to a slight contraction of the economy in the early 2020s. Some of the sectors that are the main 'losers' of investment are also employment intensive sectors, not only for unskilled, but also for semi-skilled and skilled workers. This is shown below in Figure 13 as household consumption[33] drops for both high and lower income earners before 2024.

In Future 1, once the electricity supply is available from 2023 onwards, there is a small positive impact on all households, (low, middle and high income) (Figure 13). This is an intuitive result because of the higher growth that is assumed in this case and the slight increase in employment caused by the higher growth.

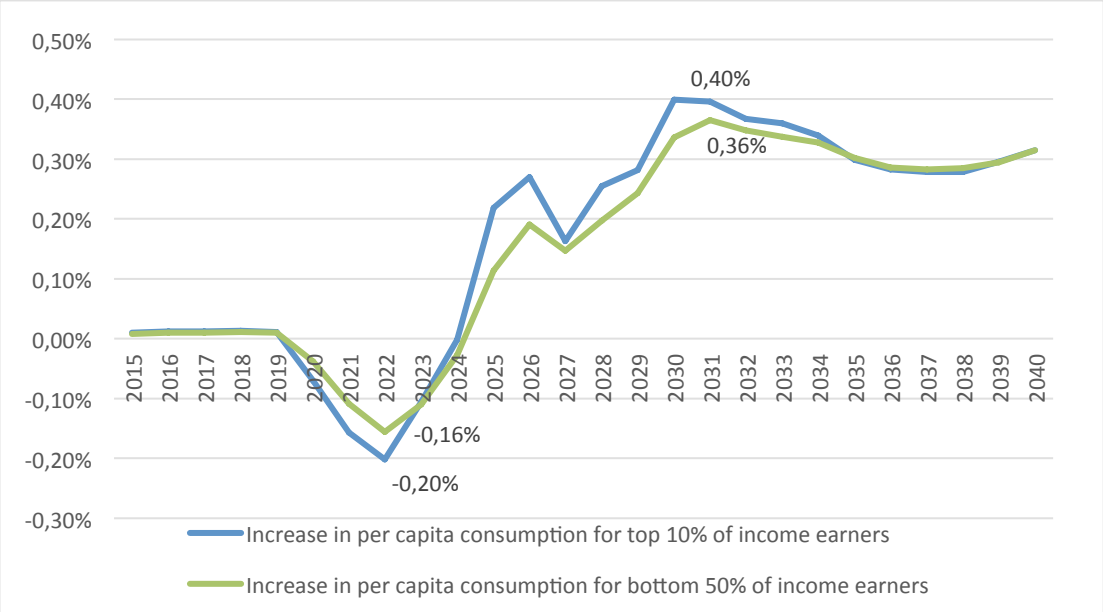



**Figure 13: Impacts on household consumption of committed nuclear versus flexible scenario in Future 1**

### 5.1.2 Future 2 results: Worst case for nuclear

#### *5.1.2.1 Electricity build plan*

In Future 2, the demand under the flexible planning scenario peaks in 2030 at 51 GW and grows to 61 GW in 2040, shown in Figure 14. In the scenario where there is a commitment to 9.6 GW of nuclear power, peak demand in 2030 is 50 GW and increases to 58 GW in 2040. The slightly lower demand in the forced nuclear scenario is in response to the higher electricity price in this scenario (see Figure 15 for the electricity price in Future 2). As a result of this price response, peak demand and installed capacity is slightly higher in the flexible planning scenario in both 2030 and 2040 versus the committed nuclear scenario.

[33] Consumption and income are used synonymously because the e-SAGE model is a neo-classical model with fixed savings rates, therefore any increase or decrease in consumption is equal to the increase or decrease in income. Income is used as a proxy for welfare, although there are wider implications on income inequality and poverty that are important and should be explored further.

In Future 2, we see no new nuclear by 2030 and the first committed unit is commissioned in 2031 (a result of an assumed lead time of 12 years). By 2040, we see no new nuclear when the flexible planning approach is adopted, with alternatives such as shale gas, concentrated solar thermal, PV, wind and imported hydro coming online as least cost generation options.

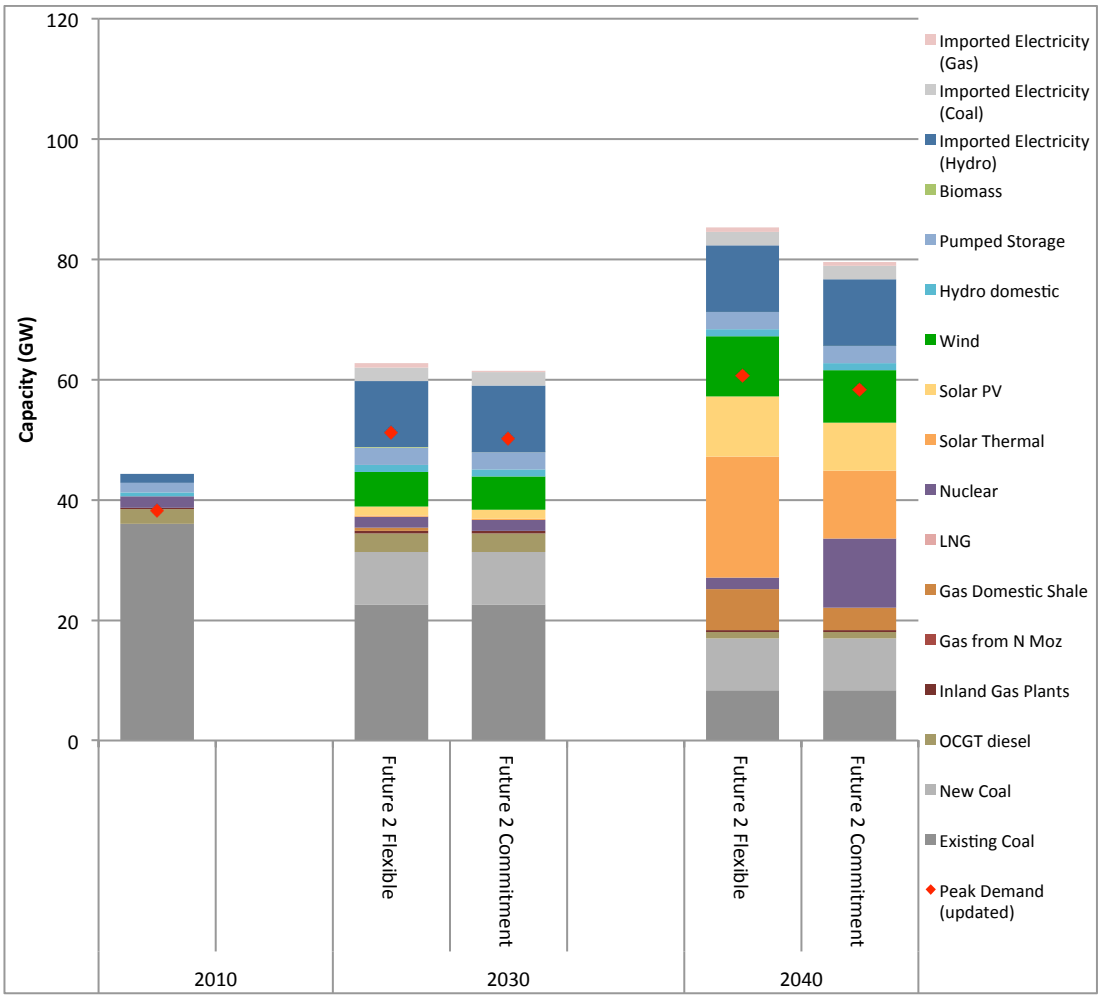



**Figure 14: Electricity sector installed capacity in 2010, 2030 and 2040 for Future 2**

### *5.1.2.2 Investment levels and electricity prices*

In Future 2, the scenario with lower growth, the commitment to nuclear power produces a significantly higher electricity price than that of a flexible planning approach, which produces the lowest electricity system cost (shown in Figure 15). Despite a lower generation capacity requirement due to lower electricity demand in this scenario, the electricity price increases to R1.38 when nuclear power is forced into the build plan. Since the cost of nuclear is higher ($7000/kW) this commitment leads to a significant price difference of 23 cents/kWh by 2040. Taken together with the longer lead times required, the nuclear build does not compare favourably with alternative options. Indeed, the commitment to nuclear results in investment costs of R0.4trillion more than the investment required under the flexible planning approach. To put this investment into perspective, in 2027 the additional investment requirement for nuclear power is R102 billion more than the already high investment requirement of R121 billion (when annual electricity investment peaks).

In Future 1, where more favourable conditions for nuclear power are assumed, there is no price difference between the commitment to the fleet and flexible planning. In contrast,

where demand is lower and prices are higher, as in Future 2, the difference in the electricity price would be substantial, with a sustained difference between 2030-2040, leading to 20% higher prices by 2040. Table 5 shows this in more detail with the absolute and percentage divergence in the electricity price under the committed nuclear scenario for Future 2.

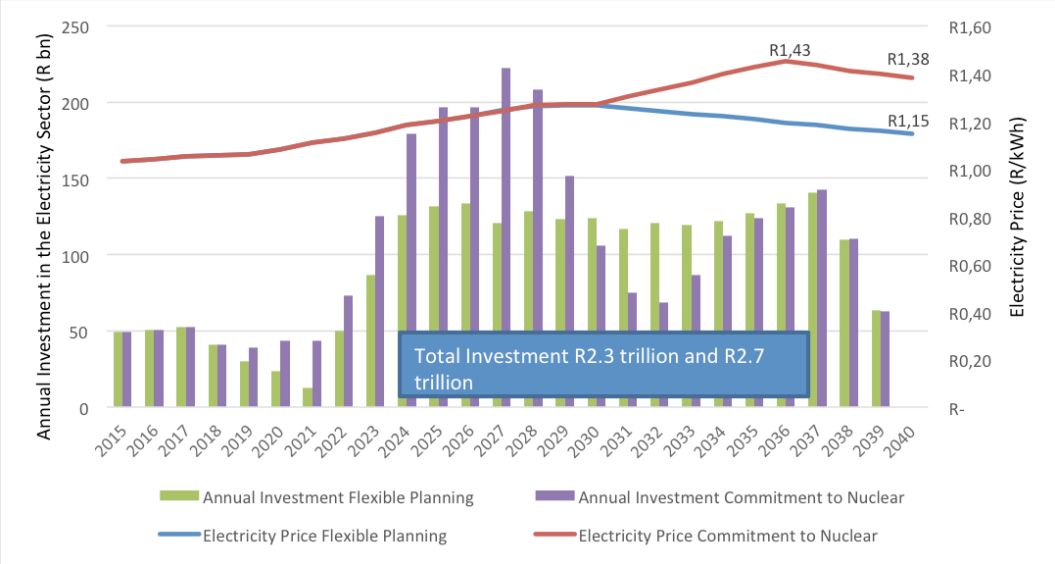



**Figure 15: Comparison of investment and electricity price for committed nuclear versus flexible planning in Future 2**

| | Electricity price with flexible planning approach (R 2015) | Electricity price with committed nuclear (R 2015) | % Increase in electricity price with the commitment to nuclear power |
|---|---|---|---|
| 2030 | 1.27 | 1.27 | 0% |
| 2031 | 1.26 | 1.30 | 4% |
| 2032 | 1.24 | 1.33 | 7% |
| 2033 | 1.23 | 1.36 | 11% |
| 2034 | 1.22 | 1.40 | 14% |
| 2035 | 1.21 | 1.43 | 18% |
| 2036 | 1.19 | 1.45 | 22% |
| 2037 | 1.18 | 1.44 | 21% |
| 2038 | 1.17 | 1.41 | 21% |
| 2039 | 1.16 | 1.40 | 20% |
| 2040 | 1.15 | 1.38 | 20% |

**Table 5: Comparison of electricity price divergence between committed nuclear and flexible planning in Future 2**

### *5.1.2.3 Growth and employment*

The deviation in GDP and employment between the committed nuclear and the flexible planning scenario is substantial as shown in Figure 16. The large effect on GDP is caused by the demand for investment from the electricity sector causing a crowding out effect on

investment available for other sectors between 2020 and 2030. By assuming a lead time of 12 years, there is an investment requirement during the period of construction, so even though the first unit is only commissioned in 2031 the CAPEX payments are made for 12 years before this date. The full impact on the electricity price is reflected once each unit has been commissioned[34].

Put simply, if South Africa follows a low growth path (average of 2.7% per annum to 2040), nuclear power is expensive and has a long lead time, whereas renewable energy is cheap and shale gas and hydro options are available and competitive. The impact of an increased electricity price has a sustained negative impact on GDP, peaking at 2.1% decrease in 2030 and easing slightly to an annual loss of approximately 1.3% per annum after the units are commissioned. Several sectors are unable to absorb the electricity price hikes and begin to contract due to decreased competitiveness. In this case, the sectors that are the biggest 'losers' are non-ferrous metals (-0.44% per annum), iron and steel (-0.21% per annum) and metals (-0.17% per annum) – all electricity intensive sectors. The electricity sector is also negatively affected (-0.48% per annum) as a result of decreased electricity demand.

The price impact as well as the impact of less available investment for other more profitable sectors has a significant negative impact on employment, with approximately 75 000 jobs lost if South Africa remains committed to an investment in nuclear power. The next section unpacks this result and provides more detail on labour market repercussions.

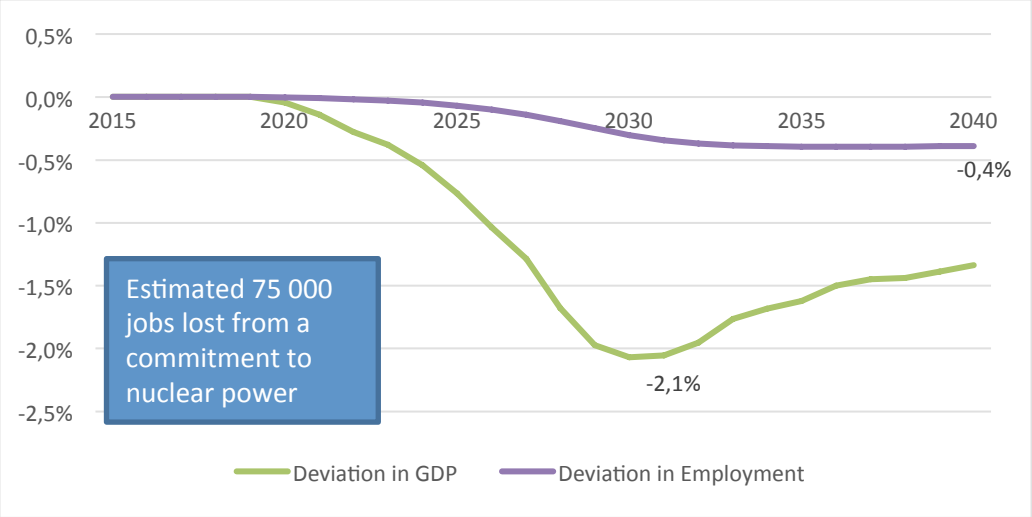



**Figure 16: Impact on GDP and employment of the nuclear commitment versus flexible planning approach in Future 2**

### *5.1.2.4 Employment effects by labour category*

Table 6 below shows the impact of the commitment to nuclear power against a flexible approach in Future 2. The employment effects on unskilled labour are significant. Since high-skilled workers are assumed to be fully employed and able to move between sectors

[34] It is unclear how the nuclear build plan will reflect on Eskom's RAB. If a turnkey model is used where Eskom is allowed to include the nuclear build plan as a capital works in progress (CWIP) as part of their Regulatory Asset Base (RAB), then consumers will bear the construction costs and risk of delays. The impact on the electricity tariff will happen much sooner than is the case in this analysis and is likely to have even more negative socioeconomic implications.

there is no decrease in employment, although the wage rates for skilled labour do decrease. The highest impact is felt on workers who have not completed Matric, with 50 000 jobs potentially at risk due to the slow GDP growth rate.

| | Number of employed workers (thousands) | | | Number of jobs created/(lost) with nuclear commitment | Number of jobs created/(lost) with nuclear commitment as a percentage of employed workers |
|---|---|---|---|---|---|
| | 2010 | Flexible policy in 2040 | Nuclear commitment in 2040 | | |
| **LABOUR** | **12 369** | **19 282** | **19 207** | **(74 663)** | **(0.4%)** |
| **Unskilled labour** | **5 731** | **9 549** | **9 475** | **(74 663)** | **(0.8%)** |
| Primary | 1 942 | 3 204 | 3 180 | (24 393) | (0.8%) |
| No matric | 3 789 | 6 345 | 6 295 | (50 270) | (0.8%) |
| **Skilled labour** | **6 639** | **9 732** | **9 732** | **-** | **-** |
| Secondary | 3 645 | 5 697 | 5 697 | - | - |
| Tertiary | 2 994 | 4 036 | 4 036 | - | - |
| ***Electricity sector*** | ***37*** | ***66*** | ***59*** | ***(7 066)*** | ***(10.7%)*** |

**Table 6: Employment effects of committed nuclear versus flexible planning in 2040 for Future 2**

#### *5.1.2.5 Welfare*

The combination of lower economic growth rates and a commitment to the nuclear fleet results in a significant increase in the electricity price which in turn results in the contraction of a number of key sectors in South Africa and decreases employment as discussed above. The net result is therefore a negative impact on welfare.

Household income is lower for households of all income levels. Figure 17 shows the impact on household consumption of the nuclear commitment scenario against the flexible planning approach. Consumption of the richest 10% of households falls by up to 2.24% against the consumption in the flexible scenario. Consumption for the poorest 50% of households falls by up to 1.92%.

In essence, a key message from this result is that all consumers are likely to be burdened by the commitment to nuclear power. If consumers are unable to substitute electricity for more affordable energy options, they are likely to have to spend more on electricity and will therefore be forced to forgo the consumption of other goods or decrease their rates of saving. This is of particular concern for low income earners. Although the percentage impact is smaller than for wealthier consumers, poorer households already spend a significant portion of their income on basic energy services, and forgoing other consumption will have serious impacts on their overall welfare.

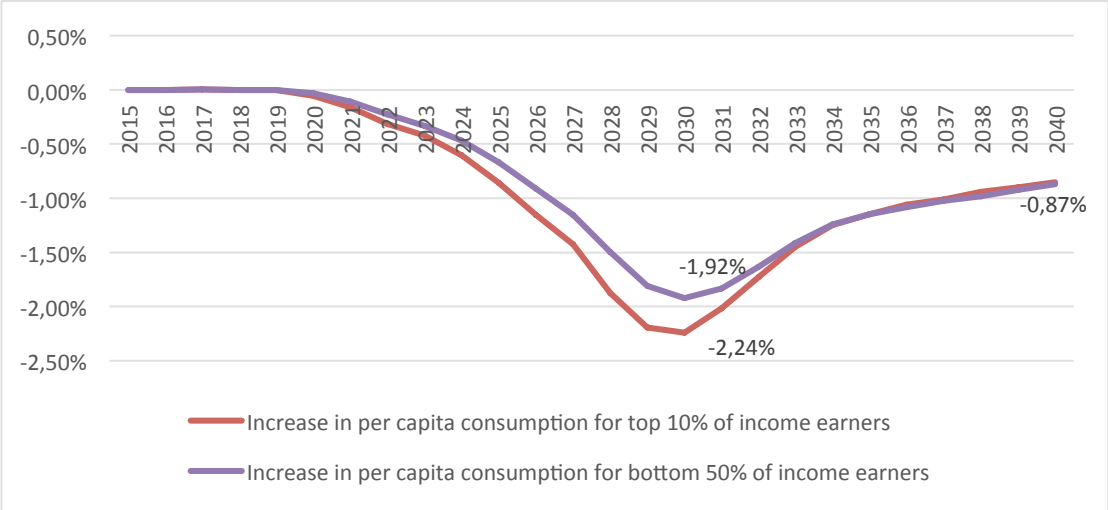



**Figure 17: Impacts on household consumption of committed nuclear versus flexible scenario in Future 2**

## 5.2 Quantifying the risks of a higher electricity price using Monte Carlo Analysis

As stated above, the actual future is likely to fall somewhere in between the two extreme, illustrative futures considered above. In this third tier of analysis we move away from these illustrative futures and use a Monte Carlo simulation to model a thousand different 'futures' or scenarios, each with an internally consistent set of assumptions from a distribution for each of the uncertain parameters. To relate back to the potential socioeconomic implications explained in the previous section, Future 1 would be closer to the lower bound of the price differences and Future 2 closer to the upper bound shown in Figure 18. Each line represents a possible 'future'; too many to detail individually. The Monte Carlo simulations enable the estimation of the probability of a future closer to that of Future 1 or Future 2.

The 1000 different combinations are tested with and without the forced nuclear build plan. In each case the electricity price is compared over the modelling horizon. Figure 18 shows the difference in electricity price for all 1000 scenarios in absolute (R/kWh) and in percentage terms. The "green" line shows the median line, starting off at around 10c/kWh in 2030 (10%) and dropping over time as the "committed build" gets absorbed in the system. The blue lines show the 80% confidence interval, which stays above the zero line until 2040. The red line shows the 95% confidence interval.

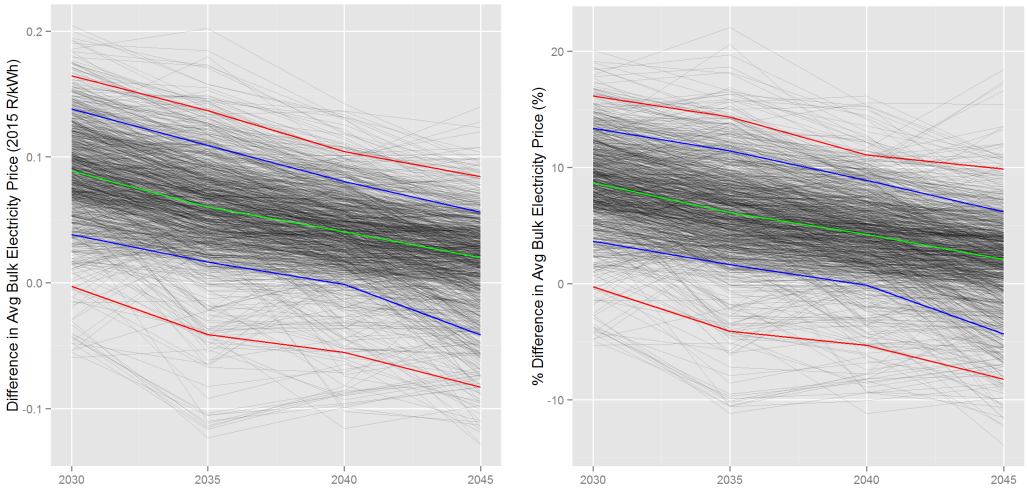



**Figure 18: Difference in Electricity price between "forced" and "free" in absolute and percentage terms**

The cumulative distribution plots for the difference in percentage terms for 2030, 2035 and 2040 are shown in Figure 19. The x-axis shows the percentage change in electricity price when South Africa is committed to the full fleet of nuclear power. The y-axis shows the probability of the price impact being less than the corresponding x-axis value. Consistent with the charts in Figure 18, the electricity price difference drops over time, however, with a significant risk of sustained higher electricity prices, which would have adverse effects on the economy along the lines of those explained in the results for Future 2, although by varying degrees depending on the magnitude of the electricity price increase.

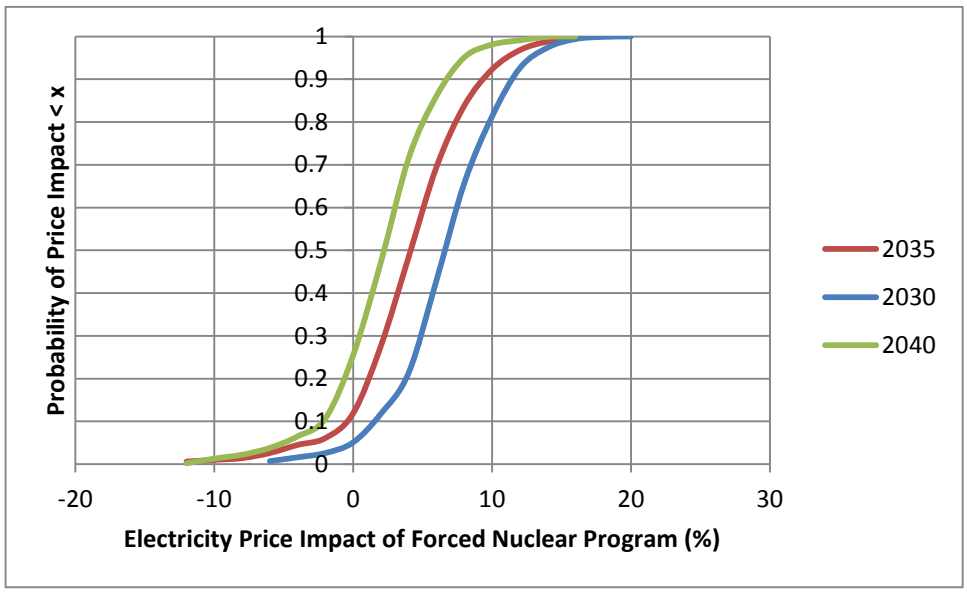



**Figure 19: Cumulative probability distribution for the price impact of the nuclear program**

Figure 19 shows that in 2030 there is approximately a 94% chance of the electricity tariff being higher with the committed build. In addition there is a 20% chance of the tariff arising from the commitment to nuclear power being 10% greater than that from a flexible planning approach.

The two extreme cases analysed in the previous section fall within the range of results shown here. In the economic analysis of the two extreme cases, the impact of higher electricity prices and the opportunity cost of the capital allocation of the nuclear program

on the economy has been quantified. Monte Carlo simulations using the linked model would have been preferable, but not possible within the time frame and budget available for this project. However, by combining the knowledge gained in the first part of the analysis and the distribution for the electricity price obtained here, one can infer fairly robustly that the risks of a negative impact on the economy of the large commitment being contemplated are very high indeed.

# 6. Discussion

This study was limited to a technical analysis of the risks and potential implications of a commitment to 9.6 GW of nuclear power by 2030. There are a number of interesting and important areas for future work, however, and these areas are briefly outlined after this discussion of the key findings from this study.

If economic growth is high and the costs of nuclear are low, then the negative impact of building nuclear versus other capacity is negligible. In this future, higher demand requires higher installed capacity, and if we are optimistic about nuclear and pessimistic about alternatives, then committing to nuclear power will not impact on the electricity price or investment required compared to a flexible approach (since the capacity will be required and the forced nuclear is relatively cheap). In addition, if this future were to transpire, an overinvestment in electricity capacity before 2030 could lead to favourable outcomes for the economy and facilitate higher growth in later years. When there is higher growth there are marginal positive benefits from the commitment to nuclear power, although these effects are driven directly by the supply of affordable electricity and not by the decision to invest in nuclear power explicitly. In this case, job creation and incomes are driven by higher GDP growth and not directly by the investment in nuclear power.

If South Africa follows a path of lower economic growth, and nuclear costs are high while cheaper alternatives exist, a commitment to a fleet of nuclear power plants will have negative socioeconomic implications. Electricity prices will be higher over the period 2030-2040 and could be 20% higher in 2040 when compared to a flexible planning approach; similarly, there will be negative effects on key sectors as well as on GDP. The investment required for electricity generation infrastructure will be significant, crowding out investment in other sectors and increasing the electricity price. This could lead to a significant number of jobs at risk as the economy contracts in response to higher electricity prices. Given high levels of unemployment amongst unskilled workers and the potential negative impacts on relatively employment intensive industries, unskilled workers are most likely to face the worst impacts of growing unemployment. In turn, household consumption will drop for all consumer groups, with potentially serious ramifications on welfare of all.

The results discussed above are for two illustrative futures, when in reality an infinite number of futures could unfold. The Monte Carlo analysis was used to analyse 1000 of these futures combining different assumptions for the uncertain parameters, drawing from probability distributions for each one of them. This probabilistic approach was used to gain an understanding of the risks associated with committing to 9.6 GW of nuclear by 2030, by comparing in each of the 1000 scenarios the electricity price trajectory when a more flexible approach is taken. The results show that in 2030 there is a 94% chance that electricity prices will be higher if South Africa commits to a full fleet of nuclear instead of adopting a flexible planning approach. They also show that the risks of sustained higher electricity prices are very high. A commitment to 9.6 GW before 2030, when demand is low and more affordable alternatives exist would therefore not be prudent. The investment could have significant socioeconomic implications and the lock-in associated with the investment will result in South Africa foregoing investment in other small scale and more cost effective electricity generation technology options.

However, this does not mean that nuclear power should be completely discarded as an option for South Africa in the longer term, as it may indeed play a role in the SA power system under certain circumstances, some which may not have been considered by the

analysis[35]. Given uncertainty it is preferable to keep all options open, but there is no rush in terms of making this decision, and there is no justification for making a commitment of this scale at this time. These findings are consistent with the New Power Plan (ERC, 2015)

Key areas for future research:

This study is a first pass at a significant piece of work and a number of key areas for future research have been identified.

Macroeconomic, aggregate models such as e-SAGE capture linkages and interactions between all agents and markets in the economy. There are however a number of microeconomic (community and provincial level) impacts that are not adequately captured in these types of models. The impact of localisation, direct job creation at the community level (for instance the potential socioeconomic and environmental impact of a nuclear plant constructed in Thyspunt) should be analysed as the localisation component could be tailored to develop areas such as these. There is potential for skills development at a more micro-level, however an analysis of the potential is heavily reliant on the full disclosure of the localisation plan by the government.

The specifics of how South Africa will finance an investment is another topic that needs to be explored. The high capital cost and risks associated with nuclear power mean that it is likely that government will have to guarantee the build plan, which would put huge pressure on an already constrained fiscus. The lock-in of investing in the full fleet under this funding model will result in South Africa forgoing investment in other electricity generation technologies as well as investment in other sectors of the economy. Our results show that this could have significant negative impacts on the economy and if the procurement should go ahead, a comprehensive financing plan would need to be in place to mitigate these impacts. An alternative could be the procuremnt of nuclear power under a build, own and operate (BOO) model, which could mitigate some of the risk to the consumer, but it is unclear whether any of the nuclear vendors would be able to supply finance.

An important next step is to run these scenarios through a dispatch model to ensure that there is no threat to the security of supply. However, given that there is evidence that CSP could be capable of providing a stable baseload supply in South Africa, it is unlikely that there would be any threat to security of supply in the least cost scenarios (Pfenninger & Keirstead, 2015).

Lastly, the findings in this report have important implications for the political economy of South Africa, especially for sectors and consumers that are most vulnerable to electricity price increases. While in the modeling framework, the adjustment to a new equilibrium happens without any cost, it is likely that in the real world these sectors will lobby and exert pressure on the government. The impacts of this, along with other elements of the political economy of nuclear power, warrant a separate study and could be an interesting piece of future work.

[35] It is not possible to describe all the future uncertainty using probability distributions.

# 7. Conclusion

In conclusion, the results of this study show that the commitment to a large and inflexible nuclear build plan will result in higher electricity prices and furthermore that the socioeconomic impacts of this could be significant.

There is a small chance that a future with low costs for nuclear, high costs for renewable energy, no gas or hydro import alternatives and high electricity demand could arise, but even under these conditions the socioeconomic implications of an investment in nuclear power are similar to that of alternative electricity investment paths. In this future there would be no significant difference between the electricity price from a flexible planning approach or from a commitment to the full nuclear fleet.

It is more likely that the future that will arise is one in which these favourable conditions do not materialize and that the electricity price will be higher with the commitment to nuclear power than they would be were a flexible planning approach adopted instead. In this case the socioeconomic implications would look more like those shown in the illustrative future two scenario. With sustained increases in the electricity prices, economic growth will decrease, jobs are at stake and household welfare could decrease across all income classes.

This study goes further and quantifies the risk of a future with negative socioeconic implications from the commitment to nuclear power similar to that of future 2 unfolding. We find that there is a 94% chance that electricity prices will be higher in 2030 with the commitment to nuclear power. In addition there is 20% chance of the tariff arising from the commitment to nuclear power being 10% greater than that from a flexible planning approach. From this we can infer, fairly robustly, that the risks of a negative impact on the economy of such a large scale are high.

However, if South Africa's economic growth does pick up in the coming years, then an overinvestment in electricity capacity could lead to more favourable outcomes for the economy in the future, as consumers will be able to take advantage of the over-supply of electricity in later years. This is not driven directly from an investment in nuclear power, however, but is essentially based on the availability of affordable electricity.

There is a balance that must be found between investing in electricity generation capacity and investing in other key areas of the economy. This study clearly shows the trade offs of investment and the potential crowding out effects that could transpire with an overinvestment in the electricity sector, especially in instances of lower growth.

Finally the electricity build plan must reflect and balance the expected electricity demand, consider least-cost alternatives and ensure the provision of affordable electricity to consumers.. Therefore given the risks inherent in long-term electricity planning, government must, if it chooses to procure nuclear power, do so in a way that minimizes the likely risks and negative effects on the economy and consumers in South Africa. Our results show that there is no economic case to be made for a firm commitment to commissioning a full fleet of 9.6GW of nuclear power by 2030. The findings of this study show that in all futures a flexible planning approach is preferred.

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**Minister approves WesCape development**[1]

POSTED BY WEBWOLLY, ON JANUARY 13TH, 2014

**Media Statement – 13 January 2014**

**STATEMENT BY ANTON BREDELL, MINISTER OF LOCAL GOVERNMENT, ENVIRONMENTAL AFFAIRS AND DEVELOPMENT PLANNING REGARDING THE CITY OF CAPE TOWN'S PROPOSED AMENDMENT OF THE CAPE TOWN SPATIAL DEVELOPMENT FRAMEWORK IN THE BLAAUWBERG DISTRICT, FOR THE PROPOSED DEVELOPMENT PROJECT KNOWN AS WESCAPE**

As the competent authority in terms of the Land Use Planning Ordinance, 1985 (LUPO) I have decided **to approve** the amendment of the City of Cape Town's Spatial Development Framework (CTSDF) in terms of section 4(7) of LUPO, to amend the City's Urban Edge to include the land earmarked for the proposed development known as **WesCape** within the Urban Edge. The applicable land units are as follows: Remainder Portion 1 (Klipvalley) of Cape Farm No. 41, Remainder Cape Farm (Lange Rug) No. 36, Cape Farm (Lange Rug) No. 37, Cape Farm (Brakkekuyl) No. 38, Cape Farm (Brakkekuyl) No. 39, Cape Farm No. 1244, Cape Farm No. 1509, Cape Farm No. 80, Portion 1 of Cape Farm (Klein Zoute Rivier) No. 84 and Cape Farm No. 78.

The site falls within the West Coast development corrider, which the City of Cape Town has earmarked for future development. It should also be emphasized that the approval does not give the applicants development rights, but rather provides them with an opportunity to submit rezoning, environmental authorization and subdivision applications, all of which will include the full statutory public participation processes required by legislation.

The development site covers approximately 3 100 ha and is located in the City of Cape Town's Blaauwberg Planning District, just north of the M19 (Melkbosstrand Road), and falls between the Atlantis railway line and old Mamre Road to the west and the N7 to the east, and extends to the north of the R304 (Philadelphia Road) just to the south of the Dassenberg Smallholdings.

The development proposal is for a large scale urban development on the site, over the next 20 years. The development concept includes the provision of approximately 200 000 dwelling units, in approximately equal proportions (± 25% each) for subsidised housing for incomes less than R3 500/month; lower "gap" housing for incomes less than R7 500/month; upper "gap" housing for incomes less than R15 000/month; and semi-detached and free standing housing for incomes of more than R15 000/month. There is to be a range of unit types, ranging from seven storey apartment blocks to two or three storey walk ups and some single storey buildings, resulting in a range of housing opportunities. A light manufacturing zone,

[1] http://gctca.org.za/minister-approves-wescape-development/;

business and retail nodes are proposed to provide residents with employment opportunities that are close to home. Approximately 200 000 employment opportunities are envisaged.

My decision was informed by considering the inputs by various stakeholders. It should be emphasized and noted that this application was pitched at a level of decision making for the purpose of amending the CTSDF's urban edge in the identified area. The applicants will now have to submit rezoning, environmental authorization and subdivision applications.

Many of the stakeholders that have participated in the process thusfar, including the City of Cape Town's Economic, Environmental and Spatial Planning Committee, its Mayoral Committee and its officials, have justifiably raised various concerns, which will be addressed during the rezoning, environmental authorization and subdivision applications that will be submitted in future. Some of the key issues to be addressed in these future applications, which will also include the full statutory public participation processes applicable in terms of the relevant legislative prescripts, will be:

- Bulk infrastructure capacity and provision;
- Transport planning and traffic impacts;
- Ability to implement the Koeberg Nuclear Emergency Plan;
- Alignment with the City of Cape Town's Densification Policy;
- Loss of agricultural land;
- Loss of critically endangered ecosystems in terms of the City of Cape Town's Biodiversity Network;
- Social Impacts; and
- Impact on the Blaauwberg cultural landscape.

My Department will be involved as a commenting and decision making stakeholder during the further application processes to follow and will therefore have the opportunity to influence those processes and decisions at that stage.

It is important to accept that the proposed development falls within a long term (20-30 years) category of land use planning. There is therefore a timing issue (phasing) which will be addressed in the LUPO rezoning and subdivision (and EIA) applications. The application for the amendment of the CTSDF should be viewed through this longer term lens.

The City's "Cape Town Growth Options" Planning Report (2012), amongst others, state: "Spatial growth modelling undertaken by the City's Spatial Planning and Urban Design Department reflects that developable land inside the urban edge has the capacity to accommodate housing development up to 2021."

The **WesCape** development applicant has indicated that even if all the approvals were to be obtained, the first phase will only likely commence in about seven years' time i.e. in 2020/21.

This is when, according to the City's own CTSDF calculations, enough land will not be available within the City's current urban edge to accommodate the actual demand. It must also be noted that some of the last land inside the current urban edge in the West Coast development corridor is private land and might not be available for development by 2021. This will require other "available" land to be included in the urban edge to cater for the projected demand up to 2021.

In the face of a changing planning legal regime, where Local Government has the obligation to manage its own planning affairs, and where Provincial Government has the obligation to support Local Government in managing these affairs and to coordinate alignment between Municipal and Provincial decision making, the focus should be to combine capacity and efforts to serve the long and short term interests of the citizens affected by planning decisions.

We have attempted to do this in the consideration and approval of this CTSDF urban edge amendment application and which is why I conveyed my support for the conditions of approval as set out in the Municipality's Economic, Environmental and Spatial Planning Portfolio Committee's report to the Executive Mayor and that these conditions and requests for more information be addressed during future environmental and planning applications for development rights for the proposed **WesCape** development.

**Anton Bredell**

**Minister of Local Government,**

**Environmental Affairs and Development Planning**