Comments on Proposed Planning Assumptions in the IRP2

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1. Purpose & Opportunity of IRP2

Very rarely do policymakers have the opportunity to avert disaster. Usually, it is only after some cataclysmic event (such as war or natural disaster) that the decisions proceeding that event are shown to be unwise, ill-considered, and more rational alternatives are made clear. Further, actors are often unaware of how their decisions will reverberate throughout history, acting not in the interest of the species at large but in narrow, short-term self-interest.

The Department of Energy (and, by extension, the South African Government) are not in this position. There is a possible disaster looming (the warming of the global climate causing massive erosion in the quality of this country's ecology) that is widely considered a strong scientific possibility. We know what is coming if we do not act, and we know the solution; the urgent transition to a low-carbon economy.

Beyond this knowledge, we have both the capacity and opportunity to act. Somewhat fortuitously, the South Africa electricity sector is in need of a massive overhaul to replace the fleet of aging coal-fired power stations built in accordance with Apartheid's ruthless minerals-energy complex paradigm. We are looking at an electricity generation bill of over a trillion rand; the question is, ultimately, do we use this trillion rand to solve the problem of climate change or do we stumble along on the same old development path that got us into this situation in the first place?

Or, more simply, do we have the guts to push aside the old ways of thinking, to take on the powerful interest groups, and seek real, substantive change?

The signs on one hand are not good. In advocating recently for a transition to a low carbon economy and the redirection of international funds (through the World Bank, for example) towards this end, South African civil society was declared unpatriotic by certain ministers. This submission on the IRP2 in not made in the spirit of nationalism or economic self-interest, but in a deeper spirit that lies at the base of South African culture, that of ubuntu, of the solidarity between all human beings regardless of culture, race, sex, religion or nationality, of the idea that my neighbour's misfortune is my misfortune and her gain is mine.

Hopefully, the DoE will approach all the submissions in the IRP2 process in this manner.

On the other hand, the IRP2 represents an opportunity, as allude to above. It can be used to avoid the worst effects of climate change by making wise decisions today. It can be used as the vehicle to make those changes, and, hence, the IRP2 needs to well-considered and not rushed. The aim of stakeholder participation surely must be to received well-researched, informed, rational and in-depth contributions that will help to build a better, more efficient & effective, and transparent IRP2; the decisions taken on IRP2 are long-term and highly capital intensive, and mistakes made during this process could have generational impacts. Therefore, we must be cautious (but bold) about decision-making.

Lastly, it is worth pointing out that the DoE is constitutionally mandated to protect the rights of South Africa's citizens to live in a safe and clean environment. We argue that it is this constitutional right must be uppermost in DoE planning processes. This right trumps a coal companies desire to open a new mine, Eskom's desire to build a nuclear plant, or a wind company's wish to build a wind farm.

A South Africa where drought blights the land, where fisheries collapse and malaria spreads, where famine stalks our towns and cities, and where our native species fade into extinction due to climate change can hardly be seen as the actualisation of our common right to a safe and clean environment.

2. List of Recommendations

Recommendation #1: DoE to consult with DWE, DPE and other government departments and then present an integrated approach on the IRP2.

Recommendation #2: That the category of Renewables be split into separate planning assumptions for individual generation options (i.e. wind, solar thermal, hydro, biomass, etc.).

Recommendation #3: Job creation potential must be a weighted criteria in the planning assumptions and each assumption must include its positive (and negative) effects on job creation.

Recommendation #4: The Costs of Inaction on Climate Change be given a separate planning assumption, and, thus, are included in the modelling process.

Recommendation #5: The IRP2 documents should not imply that RE would be sole domain of private generators.

Recommendation #6: D1 Demand. Demand forecasts be brought up to date and be adjusted for changes in industrial policy. Demand forecast be broken down into sectoral demand forecasts

Recommendation #7: D1 Demand. The parameter owner for Demand Forecast be split between the system operator and the CSIR

Recommendation #8: D2 GDP. To reevaluate the parameter in line with rising long-term temperature forecasts

Recommendation #9: D2 GDP. There seems to be no rationale for DoE to assert that natural gas will

be used for electricity generation in D2 GDP. This needs revision.

Recommendation #10: D2 GDP. The extraction costs of minerals needs to adequately expressed, including but not limited to the costs of infrastructural expansion to extract those minerals. Again, sectoral demand projections would be useful.

Recommendation #11: D5 Price Elasticity of Demand. This parameter is unclear and DoE needs to provide greater clarity, and needs to be broken down into sectors to take in account the differences between sectors in response to price increase; the effect on a household will be different to a company. The one size fits all approach is inadequate.

Recommendation #12: D7 Energy Efficiency. The DoE needs to include financial and legal measure to enforce EE or it else its assumptions will fall foul of Jevrons Paradox.

Recommendation #13: D8 DMP/DR. DoE needs to address the potential for perverse incentives and needs to revise accordingly.

Recommendation #14: D9 Energy Conservation. Coal companies should not be exempt from energy conservation measures; the DoE is proposing a unjust subsidy to certain corporate entities. There also needs to be clarity about step-block tariffs, as NERSA has only made a recommendation on domestic tariffs.

Recommendation #15: D9 Energy Conservation. DoE needs to include all SPAs, international sales, and any other similar supply deals in the SMEC and other power conservation programmes. Further, all the details of these supply details need to be made public so that independent assessment of the IRP2 modelling is possible.

Recommendation #16: D10 Own Generation. If the DoE is going to declare certain coal generation options clean, it must clearly identify those options and then prove their "clean" status.

Recommendation #17: D10 Own Generation. Own generation should be enforced through a combination of punitive tariffs and as a condition of licence.

Recommendation #18: Ex1 Climate Change. In accordance to the LTMS's findings, carbon emissions should have a peak at 470mt CO2-eq by 2020, translating into a peak of 235mt of CO2-eq in 2020 for the electricity sector.

Recommendation #19: Ex1 Climate Change. The IRP2 should include the cost calculation of R spent per million tons of C02-eq saved in its modelling of all generation options.

Recommendation #20: Ex1 Climate Change. Following the Kyoto Protocal, nuclear should be excluded from carbon mitigation measures.

Recommendation #21: Ex2 Carbon Tax. DoE to include carbon taxation on the entire value chain (such as on coal transport costs) not just at the point of electricity generation.

Recommendation #22: Ex3 Water. Water consumption for coal production needs to be included.

Recommendation #23: Ex3 Water. The externalised costs of NOx and SOx emissions be included.

Recommendation #24: Ex3 Water. As CCS is a theoretical technology at present, it should be modelled as such (or excluded). Further, if included, a full financial, energy, and externalised costing needs to be incorporated.

Recommendation #25: Ex3 Water. All generation options need data on water consumption, not just nuclear.

Recommendation #26: Ex4 Distribution Costs. Distribution costs to be included in the IRP2 to avoid significant and negative modelling errors.

Recommendation #27: Output 3 Inflation. Inflation to be modelled in a range (between a bottom and upper level).

Recommendation #28: Output 2 Generation Cost Cone. In order to avoid modelling distortions, tariff structures need to be included.

Recommendation #29: S5 Exchange Rate. A range of exchange rates should be included in this parameter.

Recommendation #30: S7 Nuclear. All the externalised costs need to be calculated including security, waste storage, regulation, decommissioning, labour (training and importation), and construction. The costs of a nuclear accident must be taken into account for an accident(s) is(are) conceivable and presents an omnipresent risk.

Recommendation #31: S7 Nuclear. DoE to make public the results and costings in Eskom's tender process for a new PWR in 2008.

Recommendation #32: S7 Nuclear. DoE removes the bias towards nuclear and places all generation choices on an equal footing.

Recommendation #33: Nuclear power cannot be classified as a low carbon technology

Recommendation #34: S10 Generation Plant Location. DoE must incorporate plant location into the modelling process.

3. Overarching Issues

3.1 Integration with Other Current Policy Processes

Concurrent to the IRP2 process, there are process currently underway (or will be underway this year) in determining industrial policy, climate change policy, and a revision of the Renewable Energy White Paper. All of these will influence and be influenced by the IRP2 process, and, in fact, the IRP2 process may inadvertently preempt policy decisions in other areas and, thus, cause considerable conflict and contradictions within overall government policy.

It is not clear how the IRP2 process interacts with these processes or how they interact with it, and this is a cause for considerable concern.

Recommendation #1: DoE to consult with DWE, DPE and other government departments and then present an integrated approach on the IRP2.

3.2 Generalisation of Renewable Energy

Throughout the Planning Assumptions a variety of disparate generation options are lumped together under the generic banner of Renewables. This does not make logical sense. The underlying division is between finite and infinite fuel sources, but, beyond this, there are a huge variety of different renewable options each with specific advantages, disadvantages, cost structures, capacities, system requirements, land requirements, etc.

The Planning Assumptions are significantly compromised by this generalisation. For example, landfill gas is cheaper than solar and, most likely, quicker to bring onto the line but more limited in its total production possibilities. Equating these two under one banner makes for a significant loss in planning potentials. There is also a mixing of renewable options suited to baseload and/or dispatchable power with ones not.

This also makes comparisons with other generating choices (such as nuclear) difficult. Further, there seems to be no rational reason as to why nuclear power should be given its own distinct set of assumptions while its direct competitor (solar thermal with storage) is subsumed and, to a large degree, lost under the banner of Renewables.

Recommendation #2: That the category of Renewables be split into separate planning assumptions for individual generation options (i.e. wind, solar thermal, hydro, biomass, etc.).

3.3 Employment and other related economic impacts

Given that the state will, one way or another, be underwriting a good deal of the economic costs of the IPR2 outputs (generation CAPEX) and given not only the government's but also society's deep desire to reduce our unemployment rate, that employment outputs need to be considered for each and every planning assumption. Further, employment projections must look at the types of jobs created and at what skill level.

Put another way, DoE cannot pass up the opportunity to eradicate high unemployment in our communities in what will be this country's largest infrastructure build. In many ways, this is more important than GDP projections, as the phenomena of jobless growth has been our operating paradigm since liberation and is at the root of many of our social ills. Further, the supply of electricity does not always equate into increased jobs (for example, the mechanisation of factory lines or mines from greater electricity supply may actually equate to reduced employment) and, thus, the assumption that increased electricity supply will necessarily reduce unemployment needs to be vigorously interrogated or, at least, defended in DoE IRP2 documentation.

Recommendation #3: Job creation potential must be a weighted criteria in the planning assumptions and each assumption must include its positive (and negative) effects on job creation.

3.4 Costs of Inaction on Climate Change

This should be its own separate planning assumption but also has an overarching nature as negative climatic phenomena affect the entire domestic economy. The costs of inaction on climate change (exceeding the global limit of 2 degrees centigrade) are calculable (i.e Stern Review) and should be included in the planning assumption. Just as there will be a cost to the economy of lack of supply (Cost of Unserved Energy), there will be a similar cost to the economy if the climate warms to above 2 degrees centigrade and this can be calculated. This criteria would "kick in" if South Africa's total emissions exceed the LTMS's Required by Science peak of 470mt CO2-eq in 2020, as beyond this point the probability of keeping to two degrees decreases rapidly and the costs of climate change mitigation and adaptation escalate.

Recommendation #4: The Costs of Inaction on Climate Change be given a separate planning assumption, and, thus, are included in the modelling process.

3.5 Private Sector and "Renewables"

There seems to be an assumption running through the documents that "Renewables" would be implemented by the private sector under a REFIT. This assumption is unwarranted as nothing precludes Eskom from building solar, wind or wave plants instead of coal or nuclear plants; in fact, Eskom currently has limited plans for solar and wind technologies.

Recommendation #5: The IRP2 documents should not imply that RE would be sole domain of private generators.

4. Specific Comments on Planning Assumptions

4.1 D1 Demand (Energy & Maximum Demand) Forecast

4.1.1 In Figure 1, there is no analysis of previous forecasts in comparison to the historical data (i.e. rigour in previous models), as it is vital to avoid overcapacity. Further, the Figure 1 is dated Nov. 2008, and we have had 18 months of historical data that could be added; the forecast could be out of date. Further, this assumes that industrial policy remains the same as before (energy intensive industry) in modelling based upon historical averages; i.e. the system operator methodology.

4.1.2 More importantly, this parameter only looks at overall demand and not sectoral demand. This is vital in determining costs, who pays, and where DSM and EE measures should be concentrated. ELA Jhb's own research indicates that future demand is located primarily in the industrial sector (not the domestic sector), and, thus, energy planning is primarily to meet industrial demand, which begs questions of industrial policy and pricing agreements. Further, if future demand is largely located in the industrial sector, future power plants could achieve energy savings by being located nearer to industrial growth zones.

Recommendation #6: D1 Demand. Demand forecasts be brought up to date and be adjusted for changes in industrial policy. Demand forecast be broken down into sectoral demand forecasts.

4.1.3 The parameter owner is identified as the SO but should be split between the SO and the CSIR

to maintain independence of CSIR's independent analysis.

Recommendation #7: D1 Demand. The parameter owner for Demand Forecast be split between the system operator and the CSIR

4.2 D2 GDP

4.2.1 The parameter includes a temperature component that is assumed to be stable. This is a rather big assumption as the scientific evidence clearly points to a deteriorating weather circumstance (in particular, rising temperatures) due to climate change. This is closely associated to costs on inaction on climate change, which are normally expressed as reduction in GDP. This shows the dynamic nature of this parameter; failure to reduce emissions to the Required by Science scenario will result in declining GDP figures, thus having an impact on other parameters.

Recommendation #8: D2 GDP. To reevaluate the parameter in line with rising long-term temperature forecasts

4.2.2 The parameter states that, "gas resources are assumed to be employed for electricity generation." There seems to be little ground for this assumption; for example, PetroSA is currently in supply crunch for its GTL plant and is seeking to import LNG to service its plant. Sasol currently imports vast quantities of natural gas for GTL and direct sales to consumers. Further, this is an example of IRP2 pre-empting another policy (IEP in this case), which might consider that burning limited supplies of natural gas for electricity may be something of a waste and would be better employed in running municipal buses or home heating. In fact, natural gas may have limited uses in displacing electricity generation in certain sectors (thus reducing demand and supply requirements).

Recommendation #9: D2 GDP. There seems to be no rationale for DoE to assert that natural gas will be used for electricity generation in D2 GDP. This needs revision.

4.2.3 Extraction Costs of Minerals: In particular coal (but also applying to gold), as the best reserves are or have been already exhausted, the remaining reserves become increasingly expensive to mine and, more importantly, require greater energy intensity. Simply stating reserves exist is inadequate, rather the quality of those reserves and the energy impact of extraction must also be included. As a general rule of thumb, a doubling of minerals of production would require the doubling of electricity supply, hence the need for a sectoral approach to demand. Further, any increase in minerals production will require other infrastructural expansion (such as ports, railways, roads, etc.) that are outside of the IRP2. This strongly suggests that the demand factors in mineral production and supply of electricity thereto need to be included in this IRP2. Essentially, minerals policy needs to be aligned to infrastructure (non-electricity) development so that electricity generation can be aligned correctly.

Recommendation #10: D2 GDP. The extraction costs of minerals needs to adequately expressed, including but not limited to the costs of infrastructural expansion to extract those minerals. Again, sectoral demand projections would be useful.

4.3 D5 Price Elasticity of Demand

4.3.1 Generally speaking, the presentation is somewhat confusing and if more time were available

ELA Jhb would seek clarity from DoE on this parameter. This needs clarity.

4.3.2 That said, this parameter seems to suffer from a one size fits all approach. Price elasticity is different for different sectors. Poor communities are less able to deal with price increases (as price increases rise, so does the likelihood of illegal connections, which are evident in Eskom's residential sale figures) than rich communities. Sasol is able to mitigate price increases through own generation while a small auto parts manufacture is not. This parameter needs to be broken down into sectors.

Recommendation #11: D5 Price Elasticity of Demand. This parameter is unclear and DoE needs to provide greater clarity, and needs to be broken down into sectors to take in account the differences between sectors in response to price increase; the effect on a household will be different to a company. The one size fits all approach is inadequate.

4.4 D7 Energy Efficiency

4.4.1 While ELA Jhb supports EE and suggests that it should be maximised in energy planning, the IRP2 documentation doesn't seem to address Jevrons Paradox. As the document stands, there are no regulatory or legal process to back up EE measures nor is it clear that the tariff price will be used to promote EE measures, although this is assumed that a carbon tax will be used to this effect. The basic problem is that the EE measures seem to technological instead of conservation based, and, thus, fall foul of Jevrons Paradox. This seems to be only avoided if the EE measures in the IRP2 are backed by financial & legal mechanisms, which seem to be absent.

Recommendation #12: D7 Energy Efficiency. The DoE needs to include financial and legal measure to enforce EE or it else its assumptions will fall foul of Jevrons Paradox.

4.5 D8 DMP/DR

4.5.1 While DMP/DR is a wise idea, the documentation makes no mention of perverse incentives. Instead of using less electricity in total, certain participants seek a greater electricity allocation (thus the higher required CAPEX for electricity build) in order to obtain excess electricity supply in order to sell back to the SO. If this were to happen, we pay twice; once to build the capacity to supply and then again under the DR.

Recommendation #13: D8 DMP/DR. DoE needs to address the potential for perverse incentives and needs to revise accordingly.

4.6 D9 Energy Conservation

4.6.1 Under the Parameter Value, two things immediately stand out. The first is the exclusion of coal mines; if the rest of the country is being asked to reduce demand, why should coal companies be exempt? If we are to mine coal, there is no reason as to why it can't be done in an energy efficient manner. This represents state subsidy to corporate entities, and is unjust. The second is NERSA and step-block tariffs. In the recent MYPD2 ruling (referred to in the document), NERSA only made a recommendation on domestic step-block tariffs. No mention was made about industrial tariffs (i.e. megaflex) and thus this needs to be clarified before moving forwards.

Recommendation #14: D9 Energy Conservation. Coal companies should not be exempt from energy

conservation measures; the DoE is proposing a unjust subsidy to certain corporate entities. There also needs to be clarity about step-block tariffs, as NERSA has only made a recommendation on domestic tariffs.

4.6.2 There are certain long-term supply contracts in existance that are outside of NERSA's current remit (i.e. SPAs to BHP Billiton and Anglo-American), and there is no indication that these will be included in the SMEC (or any other power conservation programme). Again, this is unjust and impractical given these companies high rates of consumption. DoE needs to include all SPAs, international sales, and any other similar supply deals in the SMEC and other power conservation programmes.

Recommendation #15: D9 Energy Conservation. DoE needs to include all SPAs, international sales, and any other similar supply deals in the SMEC and other power conservation programmes. Further, all the details of these supply details need to be made public so that independent assessment of the IRP2 modelling is possible.

4.7 D10 Own Generation

4.7.1 In the purpose section, the DoE mentions clean coal. Earthlife Africa Jhb is bemused to note that coal can be clean and is at a loss to understand what is meant by clean coal. If the DoE is going to declare certain coal generation options clean, it must clearly identify those options and then prove their "clean" status.

Recommendation #16: D10 Own Generation. If the DoE is going to declare certain coal generation options clean, it must clearly identify those options and then prove their "clean" status.

4.7.2 Earthlife Africa Jhb is again worried that own generation may become a subsidy for large corporation instead of being a requirement/cost. For corporations with identifiable own generation potentials, the tariff price should be used as a forcing mechanism; i.e. companies that decline the potentials of own generation from existing operations, should be charged a punitive tariff. New operations (i.e. news mines or industrial plant) that have own generation potential should have own generation as a condition of licence.

Recommendation #17: D10 Own Generation. Own generation should be enforced through a combination of punitive tariffs and as a condition of licence.

4.7.3 Under the Impact on the IRP, DoE notes that possibility of decrease in transmission expenditure. While true, it is also bizarre as Ex4 seems to exclude these costs (see below). There seems to be a lack of internal consistency in the DoE documentation.

4.8 Ex1 Climate Change

4.8.1 Climate Change mitigation is only effective in scientific terms if the absolute amounts of CO2-eq released into the atmosphere peak and then decline in absolute terms (the use of percentages from projections is significantly vague enough to be problematic in planning processes). These are, based upon the best international and domestic modelling to date, unavoidable limits. The LTMS clearly states what is required by science in this matter (i.e. a peak at 470mt CO2-eq by 2020 in order not to exceed the critical 2 degrees global warming level) and these absolute amounts should

be used in the climate change parameter; this would translate into a peak of 235mt of CO2-eq for the electricity sector, given a 50-50 split. Emissions above these amounts will result in significant economic and social costs (including declining GDP) and these have to be included (see 3.4). Increases in this will have an opportunity loss for other sectors of the economy as electricity generation takes a larger chunk of their carbon budget. Further, the likelihood of water shortages will increase if this limit is not met (less rainfall from climate change), making other costs within the IRP2 parameters (water, coal) increase substantially. It appears that DoE is ignoring the Government's own approved scientific analysis on what is required to mitigate in terms of climate change.

Recommendation #18: Ex1 Climate Change. In accordance to the LTMS's findings, carbon emissions should have a peak at 470mt CO2-eq by 2020, translating into a peak of 235mt of CO2-eq in 2020 for the electricity sector.

4.8.2 As the IRP2 is essentially a costing exercise, the omission of cost factors under this parameter is unusual. In particular, the well-known and easily identifiable cost calculation of R spent for CO2-eq savings (R per CO2-eq million tons reduced). Essentially, this is a financial efficiency indicator. The greater the emissions reduced for the less spent, the better. This financial costing should be applied to all the generation/savings parameters in the IRP2 and should be a part of the modelling.

Recommendation #19: Ex1 Climate Change. The IRP2 should include the cost calculation of R spent per million tons of C02-eq saved in its modelling of all generation options.

4.8.3 In this parameter and in others, DoE has included nuclear as a carbon mitigation instrument. Following the Kyoto Protocol, Earthlife Africa Jhb rejects this (due to the carbon emissions from the entire nuclear process, not the actual nuclear reaction process) and requests that nuclear be excluded.

Recommendation #20: Ex1 Climate Change. Following the Kyoto Protocal, nuclear should be excluded from carbon mitigation measures.

4.9 Ex2 Carbon Tax

4.9.1 It appears that DoE is considering carbon taxation at the point of electricity generation and is not factoring in the cost of carbon taxation on those points in the value chain (such as mining or cement manufacture). Clarity is required.

Recommendation #21: Ex2 Carbon Tax. DoE to include carbon taxation on the entire value chain (such as on coal transport costs) not just at the point of electricity generation.

4.10 Ex3 Water

4.10.1 This parameter states, "...and excludes water consumption for the production of coal." This is rather strange as the production of coal is a necessary component of any coal-fired power station, and the consumption of water by coal mines has a direct effect on the available supply of water and the costs of supplying water to power plants, especially as coal mines and power plants often compete for the same fixed water supply. As new and current coal-fired power stations will require new coal mines (mines would not be built in the absence of Eskom power stations) this will place

additional stress on water supplies, and this needs to be factored into this parameter .

Recommendation #22: Ex3 Water. Water consumption for coal production needs to be included.

4.10.2 In the parameter values, it must be assumed that FGD will be install on all new coal-fired power stations and provision made for retrofitting of existing power stations. Our constitution mandates a clean and safe environment for its citizens, the scrubbing of sulphur dioxide emissions is clearly a case where the electricity sector can meet this constitutional mandate, not to mention the Air Quality Act. In fact, the costs of NOx and SOx emissions are identifiable externalised costs and thus, in terms of the Energy White Paper, should be included as externalised costs in this IRP2 process; it is illogical to exclude NOx and SOx costs but include water costs.

Recommendation #23: Ex3 Water. The externalised costs of NOx and SOx emissions be included.

4.10.3 The inclusion of CCS (here and in other places) is both inappropriate and incomplete. CCS remains a theoretical possibility as it A) has not been developed in South Africa and B) research is only beginning to assess its viability in South Africa. The soonest large-scale CCS can be expected in somewhere between 2035 and 2045. If CCS becomes scientifically, technologically and economically viable, it can be added to subsequent IRPs. Further, the DoE does not seem to include the energy penalty of CCS (it takes energy to sequester carbon) in its supply calculations, which would mean a overall reduction in electricity generation and the creating a supply/demand mismatch; estimates of energy penalties of CCS range from 10% to 40%. An energy penalty of 20% would required 5 power stations with CCS to achieve the same output of 4 power plants without CCS, thus requiring additional CAPEX, cement production, mine production, etc.. The costs of CCS also need to calculated (if CCS is not to be excluded), 35 to 60% greater than without plus the increased costs of coal (more coal is burnt), limestone, ammonia, and the externalised costs of ash/slag, FGD residues, and spent CCS sorbent. Essentially, if DoE is going to include a technology which does not exist, it must do a full financial, energy, and externalised costing

Recommendation #24: Ex3 Water. As CCS is a theoretical technology at present, it should be modelled as such (or excluded). Further, if included, a full financial, energy, and externalised costing needs to be incorporated.

4.10.4 No data is included in the water consumption of CSP, and thus is highly incomplete.

Recommendation #25: Ex3 Water. All generation options need data on water consumption, not just nuclear.

4.11 Ex4 Distribution Costs

4.11.1 In the Purpose section, it states "NB: Due to time constraints Distribution Costs will not be an input consideration to this IRP 2010 plan". This is massive exclusion. The generation of electricity only has meaning if it can be distributed to users. By excluding the distribution costs an inaccurate modelling exercise will occur and grave mistakes could be made; for example, picking generation options that would appear economic but become uneconomic when distribution costs are factored in. This is a clear example of rushing the IRP2 process could have significant and negative consequences, and how the time factor is undermining the purpose of IRP2.

Recommendation #26: Ex4 Distribution Costs. Distribution costs to be included in the IRP2 to avoid significant and negative modelling errors.

4.12 Output 3 Inflation

4.12.1 It is unclear if inflation is to be factored in. Clarity is required.

Recommendation #27: Output 3 Inflation. Inflation to be modelled in a range (between a bottom and upper level).

4.13 Output 2 Generation Cost Cone

4.13.1 As mention above (4.11), the exclusion of Distribution Costs is ill-advised.

4.13.2 Under the Range of Parameter Values section, it states, "The parameter does not address the tariff structures". This should be reversed as it is a vital consideration. In particular, the provision of Free Basic Electricity and Special Purchasing Agreements have a demonstrated costs to Eskom and these have been significant historically and will have a measurable output to the IRP2 process. Not including these will create distortions in the modelling exercise.

Recommendation #28: Output 2 Generation Cost Cone. In order to avoid modelling distortions, tariff structures need to be included.

4.14 S5 Exchange Rate

4.14.1 ELA Jhb is unsure why the exchange rate is assumed to be constant, especially given the Rand's historical volatility. Exchange rate fluctuations will have significant impacts on loan repayments, imports of fuel, skills, CAPEX requirements, etc. It is suggested that a range of exchange rates (with projected probabilities) be included in this parameter.

Recommendation #29: S5 Exchange Rate. A range of exchange rates should be included in this parameter.

4.15 S7 Nuclear

4.15.1 While Earthlife Africa is well-known for considering nuclear to be an inherently inappropriate technology, it is worth pointing out that the nuclear parameter seems to exclude certain external costs specific to nuclear power. These include the high costs of security (power stations and nuclear fuel and waste supply chains need to secured), regulation (the NNR is currently understaffed and under-resourced and requires additional state investment), short and long-term waste storage, and decommissioning. Further, any expansion for current nuclear capabilities would require an expansion of a specialised and expensive labour force, which would have to be trained and/or imported, and these costs are not presented.

More importantly, the risks of a nuclear accident are not calculated but need to be included. If such a calamity would occur, the costs would be significant to say the least. This needs to be incorporated.

Recommendation #30: S7 Nuclear. All the externalised costs need to be calculated including security, waste storage, regulation, decommissioning, labour (training and importation), and construction risk. The costs of a nuclear accident must be taken into account for an accident(s) is conceivable and presents an omnipresent risk.

4.15.2 There is a lack of data on the costs. This is inexcusable as Eskom tendered for a new PWR in 2008, and those tender bids provide a base for CAPEX costs on nuclear.

Recommendation #31: S7 Nuclear. DoE to make public the results and costings in Eskom's tender process for a new PWR in 2008.

4.15.3 Running throughout the IRP2 documents there seems to be an inherent bias towards nuclear. This is disconcerting as it does not imply a level playing field for all generation option.

Recommendation #32: S7 Nuclear. DoE removes the bias towards nuclear and places all generation choices on an equal footing.

4.15.4 Nuclear Carbon Emissions

This is a matter of considerable debate. On full life cycle terms, nuclear power is not a carbon neutral technology and seems to do worse than all the renewable technologies. It simply cannot be assumed to be a low-carbon or zero carbon technology. In fact, the scientific literature has not provided a majority view on this subject to date. In a recent article, B.K. Sovacool examined the different studies, which varied widely on the figures from improbable low of 1.4gCO2e/kWh to a high 288gCO2e/kWh, and arrived at a mean value of 66gCO2e/kWh. This, he compared with life cycle analysis of other generation options, see below:

Table 8
Lifecycle estimates for electricity generators[a]

Technology	Capacity/configuration/fuel	Estimate (gCO_2e/kWh)
Wind	2.5 MW, offshore	9
Hydroelectric	3.1 MW, reservoir	10
Wind	1.5 MW, onshore	10
Biogas	Anaerobic digestion	11
Hydroelectric	300 kW, run-of-river	13
Solar thermal	80 MW, parabolic trough	13
Biomass	Forest wood Co-combustion with hard coal	14
Biomass	Forest wood steam turbine	22
Biomass	Short rotation forestry Co-combustion with hard coal	23
Biomass	FOREST WOOD reciprocating engine	27
Biomass	Waste wood steam turbine	31
Solar PV	Polycrystalline silicone	32
Biomass	Short rotation forestry steam turbine	35
Geothermal	80 MW, hot dry rock	38
Biomass	Short rotation forestry reciprocating engine	41
Nuclear	Various reactor types	66
Natural gas	Various combined cycle turbines	443
Fuel cell	Hydrogen from gas reforming	664
Diesel	Various generator and turbine types	778
Heavy oil	Various generator and turbine types	778
Coal	Various generator types with scrubbing	960
Coal	Various generator types without scrubbing	1050

Source: B.K. Sovacool, *Energy Policy 36 (2008) 2940-2953*

The above illustrates the difficulties in determining the carbon emissions of a nuclear plant, and, as the DoE has not proven its statements in this regard, they can only be considered conjecture.

Recommendation #33: Nuclear power cannot be classified as a low carbon technology

4.16 S10 Generating Plant Location

4.16.1 This is deeply troubling parameter as the location of a plant has implications across the board from fuel supply to transmission costs and supply to local air quality limits to water supply to job creation and so on. The IRP2 modelling cannot proceed without taking location into account for it would create a distorted model, divorced from physical realities. If decision-makers then used this distorted model in their deliberations, DoE would be at fault for improperly representing reality. Time constraints cannot be used as an excuse.

Recommendation #34: S10 Generation Plant Location. DoE must incorporate plant location into the modelling process.

5. Concluding Remarks

Broadly speaking, DoE needs to revise the parameters and the modelling process. The climate change targets need to be revised, the bias for nuclear power removed, generation choices disaggregated and plant location included.

Furthermore, DoE needs to present a range of financial parameters that express an upper and lower limit of inputs such as inflation, exchange rates, cost of capital, etc. Then, when modelling, generation choices need to fall within that range. For example, if wind is viable at a lower exchange rate of R7:USD1 and at an upper rate of R10:USD1 then it is viable. If nuclear power is not viable at a inflation rate of 7% but is at 3%, then it is not viable