

Medium Term Risk Mitigation Plan (MTRM) for Electricity in South Africa - 2010 to 2016

Keeping the Lights on

**This is a National Plan and is an integral part of IRP 2010. The plan deals with the anticipated electricity supply shortfall in the immediate medium term;
2011 to 2016**

Phase 1 Report

Current Situation Diagnostic and Project Scope Assessment

From 2011 to 2016, rolling blackouts are anticipated unless extra-ordinary steps are taken to accelerate the realisation of the non-Eskom generation and energy efficiency projects as identified in Phase 1 of this project and set out in this report

17 September 2010

**Produced by the:
Medium Term Risk Mitigation (MTRM) Project Team**

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1. EXECUTIVE SUMMARY

The current South African Electricity Supply/Demand situation is very tight. The latest forecasts indicate a worsening situation starting in 2011 and proceeding through to 2016. This situation poses a real risk of rolling blackouts, similar to those experienced in 2008, and a serious threat to government's objectives for growth and job creation.

Government is serious about mobilising private sector investment in electricity generation and demand side initiatives. This commitment is supported by the unequivocal message that government is putting in place the necessary enabling framework for private investors in power production (Non-Eskom Generation - NEG) to take up the challenge of competitive electricity production in the country.

The perceived conflict of interest, created through Eskom's scope and mandate as the single buyer and negotiator of contracts, will be mitigated through the establishment of a non-conflicting entity to procure Independent Power. The proposed Independent System and Market Operator (ISMO) provide the signal that NEG's can and will be treated in a non-conflicting manner. While debate around the form and nature of the ISMO is still being engaged, it is clear that a structured and phased approach to the establishment will have to begin in earnest post the publication of the Integrated Resource Plan for Electricity.

IRP 2010 is a long term plan and does not provide sufficient detail to assess short term supply shortages. Consequently, to better understand the risk, and assess options for mitigating the risk, a National Medium Term Risk Mitigation (NMTRM) Project Team was established with the support of government, business, NEDLAC and Eskom. The team comprises various electricity industry stakeholders, including: government, energy intensive users, business, and Eskom.

The Project will consist of two phases:

Phase 1

- Detailed assessment of the shortfalls (the "gap") in supply over demand;
- Identification of potential supply and demand solutions to close the gap such as non-Eskom generation and more efficient use of electricity;
- In the event that the afore-mentioned options fail or do not sufficiently close the gap, a "safety net" energy conservation scheme is recommended; and
- As a last resort the national power reduction protocol will be activated (NRS 048).

Phase 2

- Identification of the binding constraints on the identified solutions;
- Identification of the potential options (Policy/ Legislative/ Resource requirements) to resolve the constraints; and

- Development of an appropriate project plan to manage the implementation of the mitigation actions.

Phase 1 is substantially complete, and the following key conclusions can be drawn¹:

- From 2011 to 2016, rolling blackouts are anticipated unless extra-ordinary steps are taken to accelerate the realisation of the non-Eskom generation and energy efficiency projects as identified in Phase 1 of this project and set out in this report;
- The Energy Availability Factor (EAF) of Eskom's existing generation assets represents the greatest risk in meeting the economic demand for electricity;
- Eskom will be hard-pressed to sustain its existing generator fleet performance above the requisite minimum 85% EAF performance, due to the lack of time available to undertake adequate maintenance and to improve the quality of coal supplied to certain stations (coal quality is a major factor in EAF);
- Any delays in bringing the Medupi or Kusile generating units into operation will prolong and further exacerbate the shortfall in supply over the required economic demand; and
- Whilst opportunities exist to reduce the shortfall in supply, they are constrained by the lack of appropriate "*Carrots and Sticks*". Examples of these include: financial incentives, enabling policy, regulatory instruments, bureaucratic red tape and lack of a dedicated and properly resourced project.

It is important to note that government, labour and business have identified three key issues that need to be addressed, as a matter of priority:

1. Adequate security of supply for the period up to 2016;
2. Affordability of electricity for the poor; and
3. Funding for Eskom's current expansion plan, particularly the Kusile project.

¹ The updated medium term electricity forecast (2010 to 2016) was prepared by Eskom's System Operations and Planning Division, based on a few scenarios and considering realistic assumptions around the future demand curve, Eskom generation fleet availability and other non-Eskom electricity supply sources available between 2010 and 2016.

2. ASSESSMENT OF THE RISK IN SHORTFALL OF ELECTRICITY SUPPLIES 2010 TO 2016

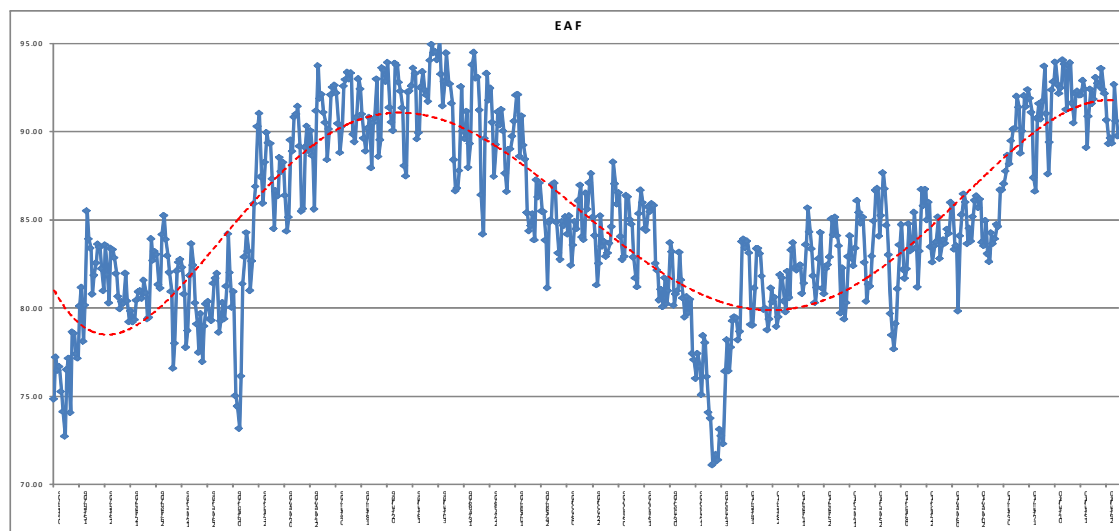
2.1 The key factors that influence the “Supply Outlook”

- The performance of Eskom’s current generation fleet as indicated by their % Energy Availability Factor (EAF); and
- The commissioning schedules for Medupi and Kusile.

Energy Availability Factor

The actual EAF performance for the period January 2009 to July 2010 is illustrated in Figure 1 below:

Figure 1: Actual EAF performance January 2009 to July 2010



EAF values above 85% coincide with the winter months when the maximum available generating plant is put into production to meet the high winter peak demand. EAF values below 85% coincide with the summer months when generating plant must be taken out of service for the requisite major maintenance.

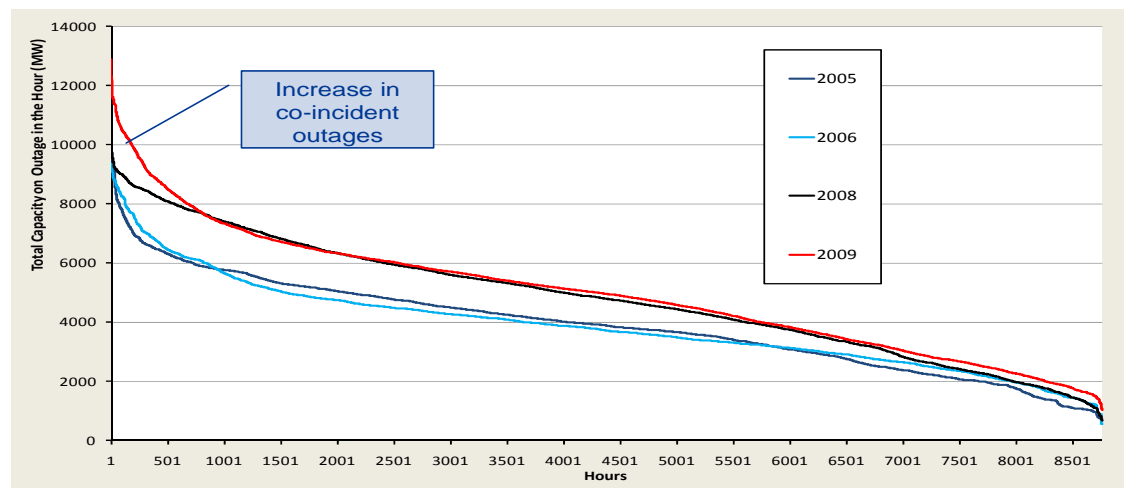
Further analysis of the EAF demonstrates a progressive decline in generation EAF. This is due to lack of "time space" to facilitate maintenance of the plant and the requirement to run the plants harder to meet the demand. If additional time space for maintenance is not created soon, it will become increasingly difficult to sustain an EAF above 85%. This is due to the fact that with increasingly tighter supply constraints the time space in which to do maintenance, which is already restricted to the summer months, is becoming even shorter. Less planned maintenance means more unplanned outages and lower EAF - a vicious downward spiral.

It is common knowledge that the existing fleet is ageing, frequently operating above its recommended continuous rating, and sometimes compromised as a result of coal quality problems. The availability of the existing plant is seen as a major risk, and from an analysis of the recent history, some clear messages are forthcoming:

- The increase in outages from 2005/06 to 2008/09 is evident;
- There has been a dramatic increase in the co-incidence of outages in 2009, and this increases the risk of severe power shortages. While the root causes for the higher co-incidence of outages has not yet been analysed, it must be assumed that the trend will continue, making capacity shortages an even higher risk than energy shortages for the immediate future; and
- Less maintenance time means more unplanned outages, resulting in a reduction in EAF and leading to less maintenance.

The risk of power outages, in particular the increase in co-incidence of outages, is best illustrated by the actual outage duration statistics curve shown in Figure 2 below.

Figure 2: Eskom system outage duration curve - History



The graph illustrates a progressively deteriorating situation (2009 worse than 2008) with ~700 hrs in the year when more than 8000 MW capacity was unavailable.

The often quoted “reserve margin” is a long-term generating capacity planning metric which describes the situation at one point in time in a year at the highest winter peak consumption. Clearly, reserve margin cannot be used as a metric for predicting possible power shortages throughout the year. Eskom has therefore developed four “Adequacy Metrics” (AM 1 to AM4) that more accurately predict possible power shortages. The metrics

indicate the extent to which “Emergency Resources²” may be called on during a year and the modelling³ results are illustrated in Figure 3.

The metrics consist of two Capacity (MW) metrics and two Energy (TWh/annum) metrics as follows:

- Capacity adequacy metrics

AM1 - Unserved Energy per Year: The amount of energy that could not be supplied in a year due to system supply shortages (an indication of consumers having to curtail their demand or experiencing load shedding).

AM2 - Peaking Plant Load Factor (Open Cycle Gas Turbine (OCGT) Load Factor): The extent to which OCGT plant is called upon to supply when there is no base generating capacity available.

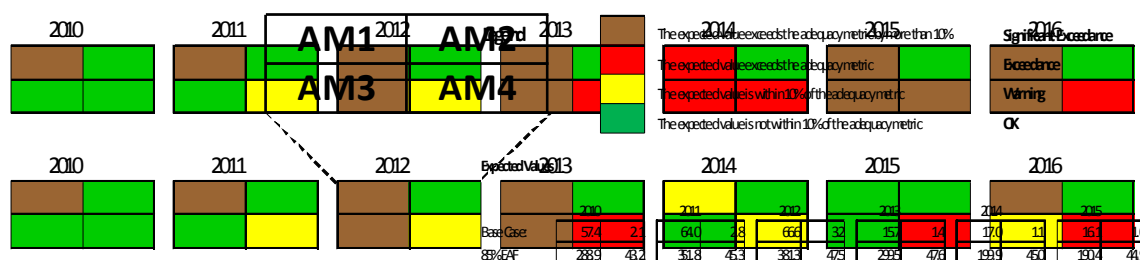
- Energy adequacy metrics

AM3 - Emergency Level 1 Energy: The energy supplied in a year by generators that are committed to operate above their recommended continuous rating (normally done during system emergencies).

AM4 - Old and Expensive Base Load Stations Load Factor: The extent to which older base generating plant such as the old de-mothballed Camden, Grootvlei and Komati are called on to operate above their planned load factor of 50%.

NB: Under normal circumstances the use of such resources should all be in the “Green” status.

Figure 3: Modelling results of Adequacy Metrics



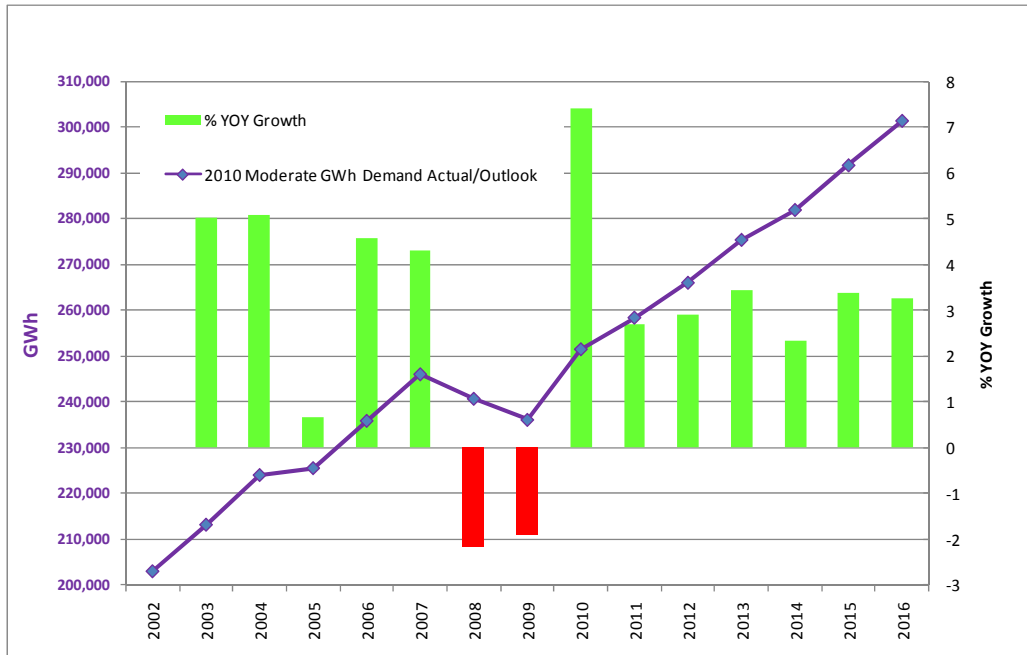
2.2 Energy demand growth assumptions

The electricity demand growth assumptions for 2010 to 2016 (calendar years) are illustrated in Figure 4 below:

² In this regard “Emergency Resources” is analogous to the use of the spare wheel in a car, not something one should use at all if avoidable!

³ The daily generating dispatch is modelled using the PLEXOS® System Modelling Tools. The modelled daily generating dispatch is then measured against these adequacy metrics.

Figure 4: Electricity demand growth assumptions - 2010 to 2016



The supply/demand outlook for 2010 to 2016 was derived by considering the key supply and demand profiles, and factors from four scenarios modelled by Eskom's System Operations and Planning Division. These scenarios are:

- **Base Scenario:** Essentially the MYPD2 2009 assumptions.
- **Scenario 1:** Energy Availability Factor of 85%. The first Medupi unit is delayed by one year, and the second unit is commissioned two months later. The rest of the Medupi units remain the same as Base Case dates and Kusile is delayed by two years as shown in Table 1.
- **Scenario 2:** Energy Availability Factor of 85%. The Medupi project is delayed by one year, the second Medupi unit is commissioned two months after the first unit, and the rest of units are eight months apart. Kusile is delayed by two years.
- **Scenario 3:** Energy Availability Factor of 84.5%. Medupi units are commissioned as shown in Table 1.

Table 1: New Build Commission Dates

Unit	Base Case: Medupi Units	Scenario 1: Medupi Units	Scenario 2: Medupi Units	Scenario 3: Medupi Units	Base Case: Kusile Units	Scenario 1, 2 & 3: Kusile Units
1	7 May 2012	6 May 2013	6 May 2013	6 May 2013	7 Jul. 2014	4 Jul. 2016
2	7 Jan. 2013	8 Jul. 2013	8 Jul. 2013	5 Aug. 2013	2 Mar. 2015	6 Mar. 2017
3	2 Sep. 2013	2 Sep. 2013	3 Mar. 2014	4 Nov. 2013	2 Nov. 2015	6 Nov. 2017
4	5 May 2014	5 May 2014	3 Nov. 2014	5 May 2014	4 Jul. 2016	2 Jul. 2018
5	5 Jan. 2015	5 Jan. 2015	6 Jul. 2015	5 Jan. 2015	28 Feb. 2017	25 Feb. 2019
6	7 Sep. 2015	7 Sep. 2015	7 Mar. 2016	7 Sep. 2015	31 Oct. 2017	28 Oct. 2019

Considering the need for a responsible risk mitigation plan, and based on the consensus view of the team, it was decided to use Scenario 3 as the basis for the Medium Term Risk Mitigation (MTRM) Plan.

The results of the modelling indicate a severe risk of power shortages caused mainly by:

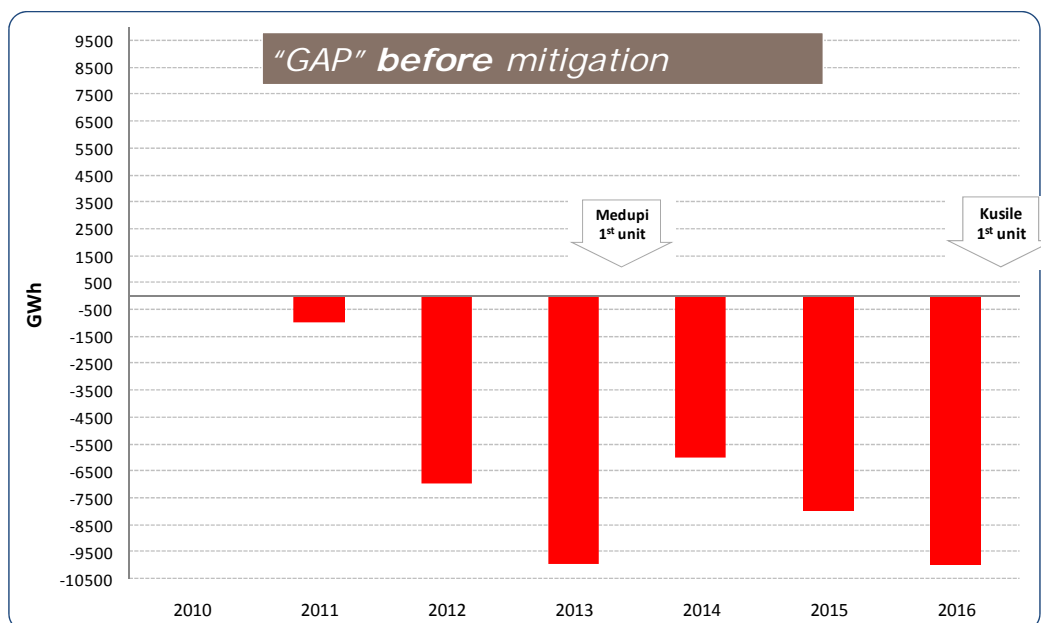
- The threat to maintain the current Eskom Generation fleet performance due to the lack of time space to do adequate maintenance and the poor quality of coal supplied to certain stations; and
- Extended delays in the commissioning of Medupi and Kusile Power Stations due to uncertainty regarding funding solutions.

NB: The scenarios clearly illustrate the urgent need to take immediate action and the necessity to put in place risk mitigation until at least 2016.

2.3 The anticipated supply shortages 2010 to 2016 in scenario 3

The consequence of a “business as usual” approach is clearly illustrated in Figure 5 below which shows an ongoing shortfall in supply capacity to meet the anticipated demand starting 2011 through 2016.

Figure 5: Gap before mitigation



Total shortfall ~ 42,000 GWh. The “business as usual” assumptions are; Medupi 1st unit 12 months late (rapid roll-out), Kusile 1st Unit 24 months late, no new non-Eskom generation, no new demand side savings and an EAF <84,5% (Note: Eskom may require ~82,5% to do major maintenance).

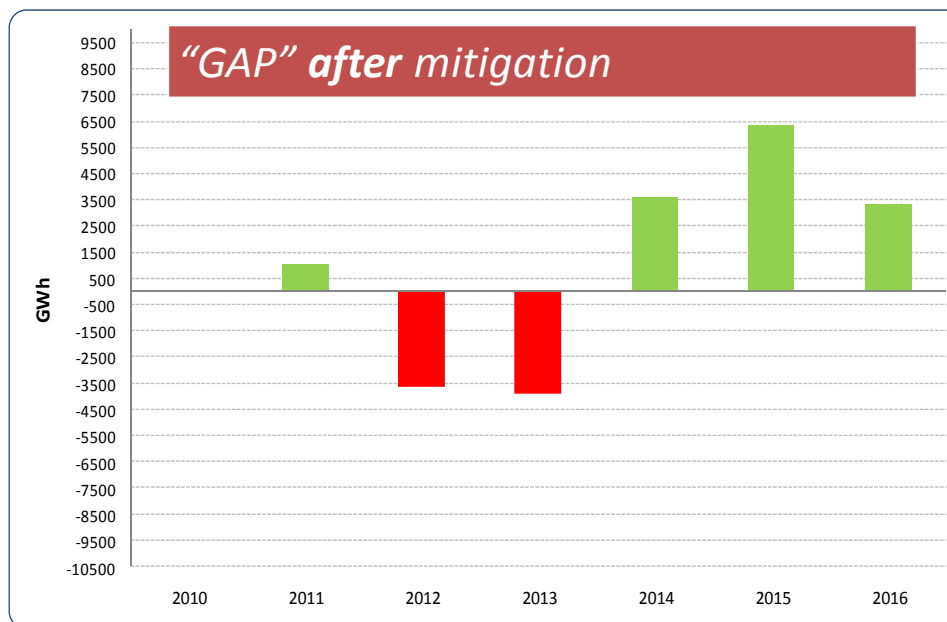
The above shortfall can be reduced or risk mitigated with new non-Eskom generation and demand side initiatives which can be put into operation over the period 2011 to 2016 but this requires extraordinary action, in the main by government, Eskom, business and large metropolitan councils.

The Phase 1 study undertook an assessment of the realisable potential risk mitigation options and the findings are summarised below:

<u>Supply Options</u>	<u>GWh</u> (2011 – 2016)
• Renewables	302
• Co-generation	7,300
• Own Generation	22,500
• IPP	14, 000
<u>Demand Options</u>	
• Efficiency Projects "Price Driven"	7,000
• Efficient Technology "Carrot/Stick"	12,000
• Changed behaviour "Carrot/Stick"	400

The extent to which risk will be reduced by the above options was modelled and the results are illustrated in Figure 6 below.

Figure 6: *Gap after mitigation*



Figures 5 and 6 clearly illustrate that “business as usual” is not an option and that solutions must and can be introduced. This requires urgent action and a co-ordinated effort to remove the constraints that currently prevent the solutions from being realised.

The remaining “gap” in the years 2012 and 2013, shown in Figure 6, can be addressed through an Energy Conservation Scheme (ECS).

<u>“Safety Net” Options</u>	<u>GWh</u> (2011 – 2016)
• Energy Conservation	5,000

ECS⁴ entails limiting the amount of energy a consumer may use in a month. Any energy consumed above the set limit will be charged at above normal rates (a “penalty” rate).

ECS will be mandatory, but activated only when required and as the last stage before forced power cuts become necessary. Consequently, the scheme has to be designed and put in place ready to be activated at short notice if and when required.

NB: It is a “Safety Net” to be used only if the non-Eskom generation and energy efficiency options fail or do not sufficiently close the gap. Notwithstanding, and as a last resort, the national power reduction protocol (NRS 048) will be activated as the final measure.

⁴ The energy conservation scheme requires users to maintain their monthly energy consumption below their individually determined allocation (Energy CAP) which is equal to the individual's prearranged “normalised reference energy consumption level” less a publicised saving. The energy conservation scheme requires appropriate technology and systems which at this time are only in place with large users. Consequently, the scheme envisages a progressive roll out starting with large users and extending to smaller users as and when the required technology and systems are put in place.

3. AN ASSESSMENT OF AVAILABLE RISK MITIGATION SOLUTIONS

3.1 The Potential Sources for Risk Mitigation Solutions

Five potential sources exist for risk mitigating solutions as follows:

3.1.1 Eskom existing Generator Fleet Performance

Improving the performance of Eskom's existing generator fleet is arguably the most significant contributor to mitigating the shortfall in supply. An EAF of 82,5% might be realised if the existing fleet were to be given the requisite time to do much needed, major maintenance. This is substantially less than the minimum Energy Availability Factor (EAF) required of 85%. Eskom have committed significant resources towards resolving a range of problems that are causing unplanned generator outages and constraining output.

3.1.2 Demand Market Participation – DMP

DMP is when customers reduce their demand for a prearranged fee (Price for Interruption) in response to requests from the system operator. DMP is a cost effective alternative to expensive peaking generation plant and can be introduced fairly quickly dependent on the price paid for being interrupted.

3.1.3 Demand side management - DSM

DSM refers to capital incentive schemes the aim of which is to promote investments in more effective utilisation of energy.

Details of the demand side management initiatives and potential currently under consideration or being implemented is an integral part of Phase 2 of the Medium Term Risk Mitigation Project.

3.1.4 Non Eskom Generation and Emergency Power Purchase Agreements

Non Eskom Generation represents a significant and cost effective untapped source of new generating capacity for South Africa. Investment in industrial co-generation and own generation, as well as renewable generation options typically have shorter lead times than full blown conventional supply options. These options, however, have been severely constrained by a generally unfriendly environment for independent investors, the main constraints being bureaucratic red tape, unacceptable risk and uncertainty on policy, prices and contracts in general for prospective investors.

3.1.5 Energy Conservation

An Energy Conservation Scheme which has been in planning for the past two years can be made ready for implementation as the last planned response before forced power outages are introduced.

3.2 Summary of Possible Solutions before 2016

Note: These solutions demand extraordinary action to break the binding constraints

Based on the past two years experience in demand side initiatives and non-Eskom generation and the phase 1 study conclusions it is clear that risk mitigation solutions that could be put into operation to alleviate short term constraints could release an effective 3500 MW by 2016 as follows:

3.2.1 NERSA MYPD2 approved DSM Funds

Before 2013 **1100 MW** could be released using the NERSA MYPD2 approved DSM funds currently under management by Eskom. Unfortunately, this programme is being put at risk by the recently announced NERSA Standard Offer (policy pending public comments) which will be competing for the same funds. This must be resolved urgently.

3.2.2 Additional DSM Funds and Co- and Own Generation

After 2013 but before 2016 an additional **1800 MW** could be released with an additional allocation of DSM funding in the Mid Year Price Determination 3 funding approval. In addition advanced projects for Co- and Own Generation potential can contribute between **1000 to 1500 MW**.

3.2.3 Tax Incentives

Assuming the remaining binding constraints of policy and funding are speedily removed **an additional ~2000 MW** from demand side initiatives and non-Eskom generation could be released. The Tax Incentive for energy efficiency projects proposed by National Treasury in 2009 is required to incentivise these investments in improved energy efficiency.

3.2.4 IPP investments

In addition IPP investments flowing from the IRP 2010 process could contribute to the supply before 2018.

Note: The Project considers Electricity Conservation Measures essential but as a “Safety Net”. This scheme envisages a phased roll out and ultimate implementation across all the electricity consumer segments.

Recently Eskom established a new Integrated Demand Management (IDM) Division, responsible for integrating all energy efficiency, demand response and conservation programmes across Eskom in order to streamline and optimise the effective roll-out of all Demand Side Management, Energy Efficiency and Demand Response initiatives.

4. ASSESSMENT OF THE RISKS, SOLUTIONS AND SOLUTION CONSTRAINTS

4.1 Capacity Shortfalls – Inability to meet instantaneous demand, requiring load shedding

Risk: An immediate threat of capacity shortfalls during periods of co-incident failures on the supply side exists. This is most likely to happen during the maintenance season (i.e. outside of the winter) when Eskom has generation equipment down for planned maintenance or mid-life refurbishment, and concurrently experiences several other unplanned outages and partial load losses. Capacity shortfalls will present immediate and urgent emergency conditions, and if a reduction in demand cannot be achieved to bring the supply and demand back in balance, the power system stability will be at risk leading to forced load shedding.

Solution: Demand Market Participation (DMP). Eskom presently has 2000 MW of interruptible supply and 570 MW of DMP capacity on its books. A more realistic capacity is 980 MW for 4 times per week since the book value includes capacity that can contractually only be used four times per week.

Significantly more DMP can be released with better prices and the introduction of aggregators and smart metering system technologies such as *Utility Load Manager and Advanced Metering Technologies*, especially if rolled out in the smaller industrial, commercial and residential sectors.

Some constraints will have to be resolved before an aggressive roll out of DMP is possible, including:

- Concept to be proven in pilot programmes (in progress but not fast enough);
- Funding, with various options and funding models to be evaluated; and
- Resolving municipal distributor fears of “loss of revenue”.

Solution: Demand Side Management (DSM). DSM programmes mostly reduce demand during peak and high periods, and are therefore alleviating both capacity and energy shortages. NERSA, in the MYPD2, approved funding for R5,3 billion towards incentives for consumers to invest in more effective utilisation of energy. DSM, according to Eskom’s latest estimates, can in effect deliver ~1000 MW savings over the next three years.

The Eskom DSM delivery pipeline must be streamlined to ensure delivery of these savings. The Standard Offer Programme (SOP) in its current proposed form will jeopardise the current DSM delivery pipeline. It is therefore proposed that Eskom retains its DSM responsibilities until such time as a seamless transition can be achieved to the SOP, having addressed all the concerns submitted to NERSA.

Other initiatives, such as DSM investments by municipalities using the Division of Revenue Act funds, and the proposed Tax Incentives from National Treasury for improvement in energy efficiency must be urgently revitalised, implemented and monitored.

4.2 Energy Shortfalls – Inability to meet demand over an extended period, forcing Eskom to maximise generation, dispatch more expensive reserves and postpone or reduce required maintenance

Risk: The shortfall in current capacity means there is insufficient time available to do the requisite planned maintenance on Eskom's existing fleet of power stations and this in turn increases unplanned outages. Variations in coal quality are also a source of poor generator reliability, more especially in capacity constrained circumstances where the fleet requires tighter coal quality control.

Solution: Non-Eskom Generation. Investment in non-Eskom generation opportunities such as co-generation, own generation and renewable generation is urgently required to make up for the shortfall in supply today and as an additional source of new generation capacity for South Africa. In addition non-Eskom generation alleviates the current shortfall in new generation funding.

Well advanced co-generation and own generation projects can produce between 1000 MW and 1500 MW by 2014. In addition, renewable generation of 1025 MW, utilising MYPD2 approved funds to buy this capacity at REFIT tariffs, could be brought into operation from 2012 onwards.

This assumes the following binding constraints are resolved as soon as possible:

- Equitable rules and costs of energy transport over the grid;
- Ring fencing and making transparent energy transport tariffs;
- Single buyer appointed and commercial evaluation criteria agreed;
- Standardised PPA and fair contractual risk allocation;
- Grid code requirements for small generators simplified;
- It is crucial that recently announced government decisions on a few critically important issues regarding non-Eskom generation and demand side incentives be formally confirmed. Failure to do so creates doubt, speculation and high uncertainty and consequently no action; and
- Assist municipalities to put into operation existing idle generating plant.

NB: There are different types of non-Eskom generation, and the requirements, constraints and remedies differ between the types. The classes of non-Eskom generation are illustrated in Appendix C.

Interim solution: Energy Conservation Scheme (ECS). It will take at least three years to add additional non-Eskom generation and for this reason it is important to put in place an interim risk mitigating solution. The ECS is such a solution which can be implemented in a

phased manner where large power users (>25 GWh per annum) could be made operational in less than 12 months. The scheme, when activated, requires users to reduce their consumption to a level below an individually agreed allocation (Energy CAP).

Users who consume <25 GWh per annum could be incorporated over a period of three years.

Note: The NERSA approved MYPD2 included “stepped tariffs” where different tariffs apply based on the consumer’s level of consumption. This provision means all domestic consumers are now induced to conserve energy using tariffs.

The **ECS is a refinement** and simplification of the work done previously under NERT. It will cap electricity energy available per large power user. The main aspects are the following:

- A “Normalised Reference Consumption” per customer must be agreed;
- Equitable and realistic savings targets to close the remaining energy gap must be determined;
- Scheme rules must be refined and agreed, including decisions on the enabling legislation (Electricity Regulation Act or Energy Act), exemptions, allocation management, excess charges payable, what happens to the excess charges payable, etc.;
- An allocation management system, allowing inter-company allocation balancing and bilateral trading needs to be put in place; and
- Preparation must be completed to enable the scheme to be “switched on” at short notice should it be required.

The primary aim of the Contingency Plan is to avoid forced load-shedding.

Notwithstanding, a National Standard (NRS 048) was developed that serves as the protocol that will be applied in the event of forced load-shedding.

5. THE MEDIUM TERM RISK MITIGATION (MTRM) PROJECT PLAN

The required risk mitigation solutions are only possible with the total commitment and involvement of all key stakeholders and with a dedicated project team.

It is essential that we overcome the “*Tragedy of the Commons*” which demands cooperation, even if this is achieved at slight detriment to individual interests. Our failure to achieve this will lead to greater negative consequences for all. This problem is not unique and was highlighted by the UK’s Stern Report on climate change, which summarises the paradox we face – “nations will only cooperate if they see some direct, short-term economic benefit to themselves”.

By far the biggest challenge facing this project is to get active stakeholders commitment, and active participation.

Project Purpose

“To ensure there is sufficient planned reduction in demand and additional non-Eskom generation to avoid any form of power supply rationing or curtailment in the constrained period from 2010 to 2016.”

Scope

*To plan and implement the requisite, “Emergency Response and business Continuity Measures”, with a duly established Project Team which is mandated by government, business, NEDLAC and Eskom. **NB: This a National Project***

Leadership and Governance

- Business Sponsor – Jayendra Naidoo
- Government Sponsor – Neli Magubane
- Eskom Sponsor - Brian Dames

Project Phases

Phase 1 is complete and consisted of:

- A realistic assessment of the medium term supply and demand outlook;
- Risk assessing the expected capacity and/or energy shortfalls, so that appropriate mitigation measures can be developed;
- Assessing the state of supply and demand mitigation measures⁵ inclusive of any binding constraints and “remedies” to resolve such constraints; and
- Developing a Project Plan for the implementation.

Phase 2 (9 to 12 months) consists of the following: (See milestone plan below)

⁵ Note: This paper defines a “remedy” as an appropriate policy/regulatory change or allocation of the requisite resources the lack of which presents the constraint. For more details see Appendix C.

- Establish the Project;
- For each of the demand-side and supply-side mitigation measures a “fact sheet” must be developed that describes the measure, its impact, the assumptions, the constraints and remedies to address those constraints;
- Commence implementation;
- Provide specialist advice on legal, regulatory and policy issues;
- Launch Stakeholder Management and alignment meetings; and
- Provide regular monitoring and feedback to Stakeholders.

The project requires sufficient time from a few unique identified individuals in business and Eskom and it is assumed their cost will be borne by their employers.

Over and above this, a full time project management function must be appointed and the services of pre-identified specialist consultants must be procured, for which funds will be required.

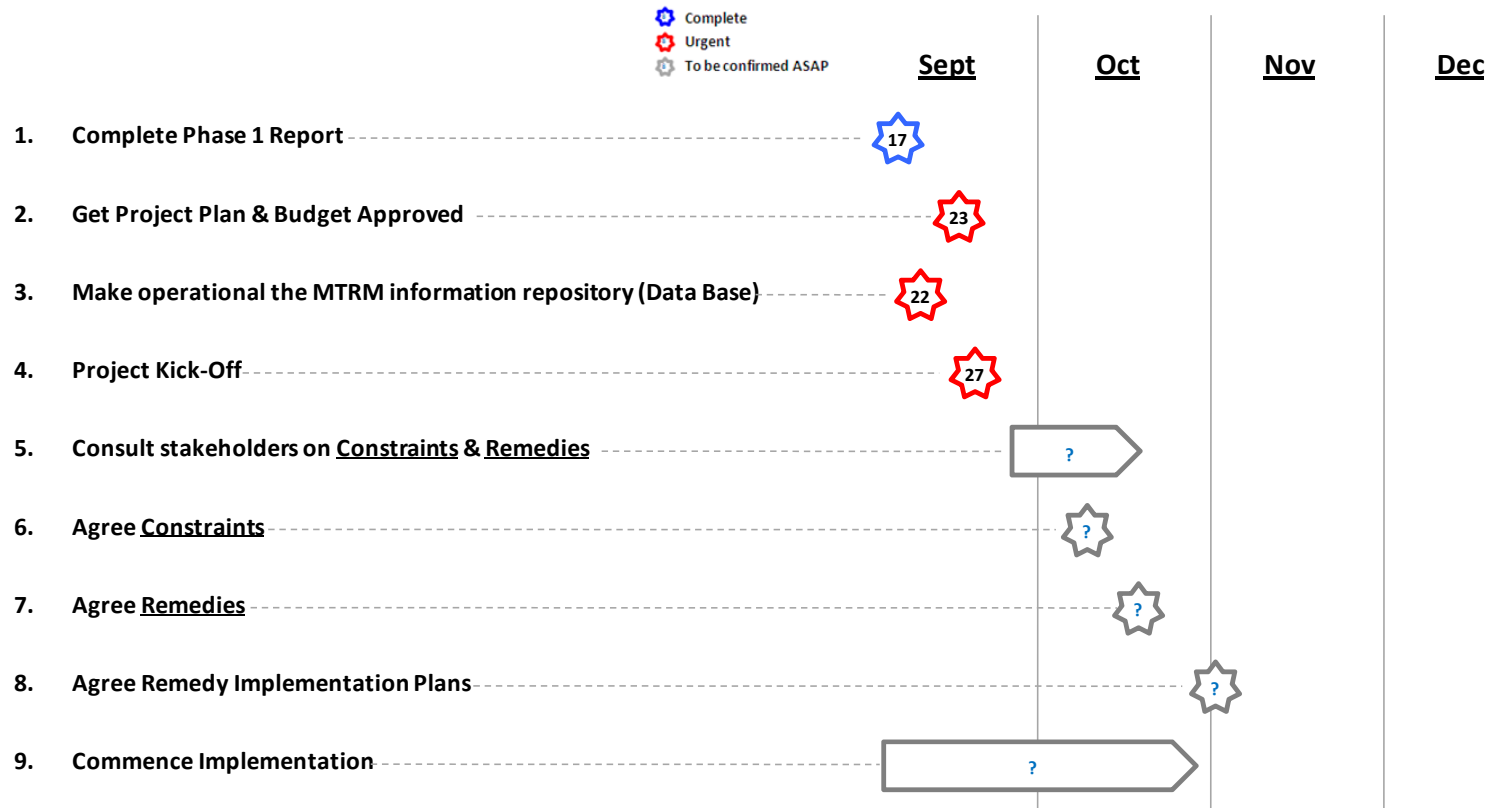
An order of magnitude estimated budget for Project Phase 2 is: R15 million. A detailed project budget must still be prepared.

A summary milestone plan is shown in Appendix A.

NB: It is imperative to gain stakeholder support and considering the diverse stakeholder interests, fears and expectations it is imperative that Phase 2 follows a rigorous and systematic approach. Details of the recommended approach are illustrated in Appendix B *“Project Phase 2 Key Steps and processes to be followed”*.

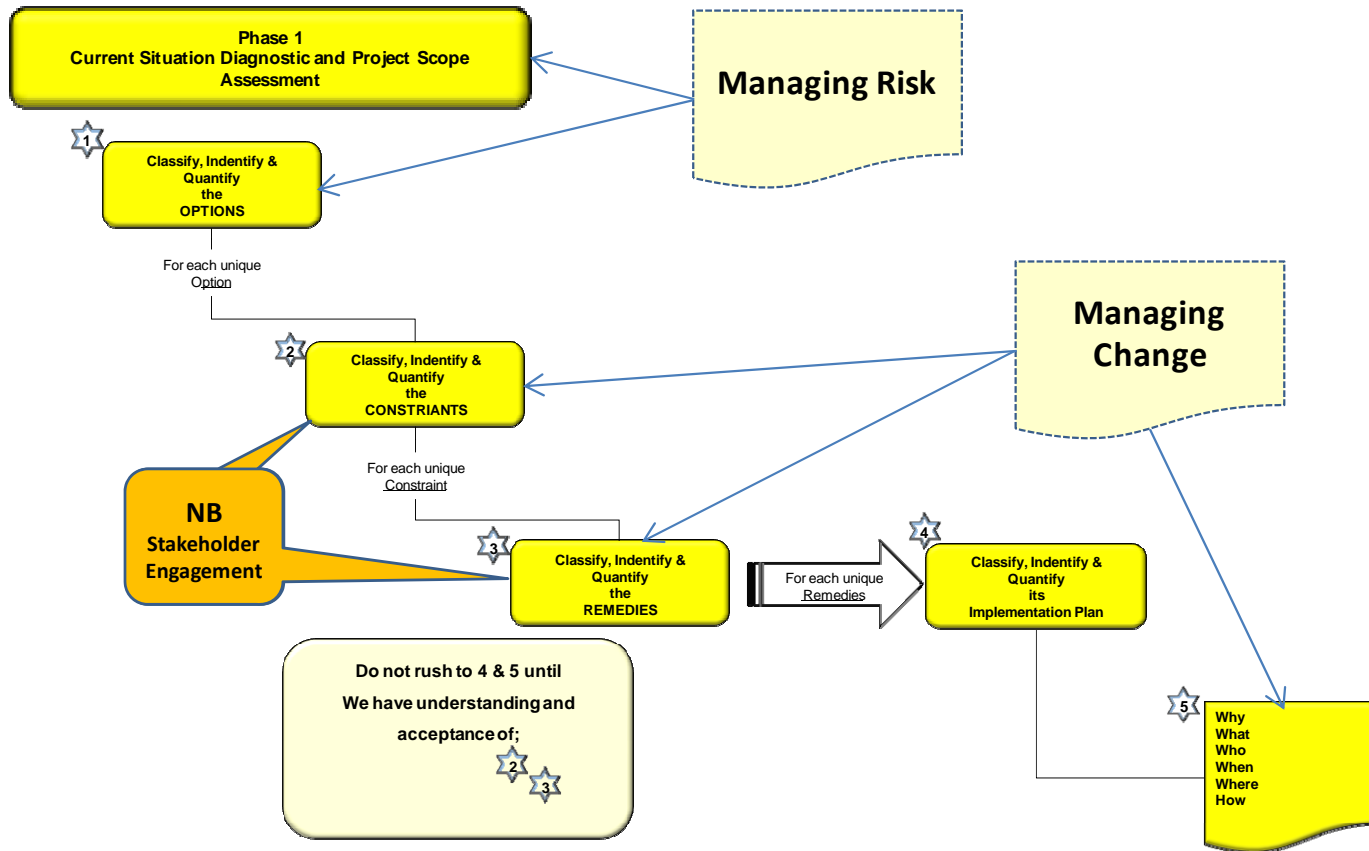
APPENDIX A

Summary Project Phase 2 Milestones



The above project milestones are based on the recommended phase 2 steps and processes to be followed, details of which are shown on the following page.

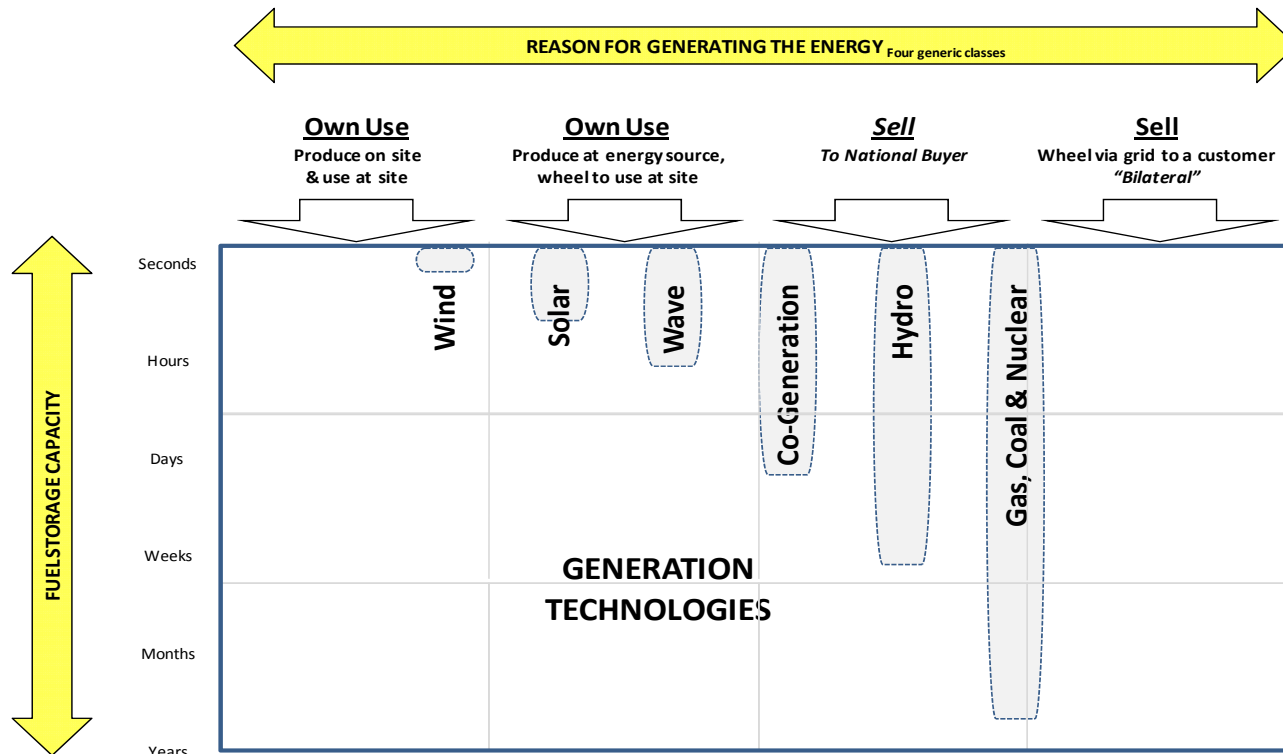
APPENDIX B



Project Phase 2 Key Steps and Processes to be followed

Steps 2 and 3 are critical to gain stakeholder understanding and acceptance.

APPENDIX C1

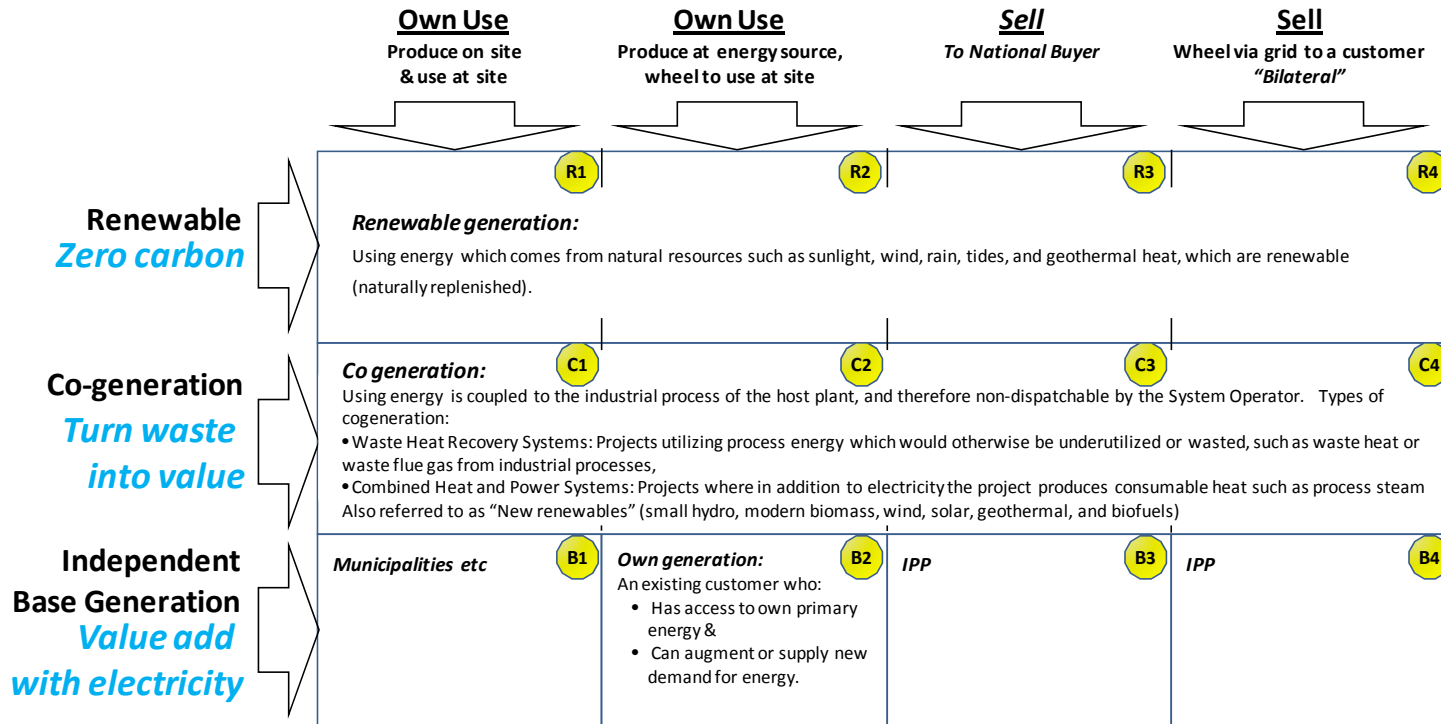


Classification of Non- Eskom Generation

Note: There are 12 generic non-Eskom generation options, each of which has unique:

- "Fuel Storage Capacity" – This determines the level of confidence in a technology's ability to generate electricity in the short, medium and long term. For example, wind reliability in the short term is low. If, however, sufficient turbines are installed and distributed across the country they could, on average over a year, produce ~30% of their installed capacity. Sun could be stored in the form of heat for a few hours but cannot produce at night. Gas, coal and nuclear can produce >85% of their installed capacity in the short, medium and long term. If gas is to be imported it can be expensive;
- Constraints preventing them from coming into operation and remedies necessary to break the constraints; and
- Costs, capacity potential, lead times to build and technical strengths and weaknesses.

APPENDIX C2



Non- Eskom Generation Options

Note: The constraints, potential capacity and form of generation differ for each of the above 12 unique options.

For example: Contractual complexity is lowest for Columns 1 & 2 (Same producer same consumer). Most options in rows R & C initially require subsidised tariffs to get started. Columns 2 & 4 are self funded but require a fair and equitable energy "transportation" system. Column 3 is dependent on Regulator approved funding for Eskom.