REPORT

ELECTRICITY MARKET REFORM IN SOUTHERN AFRICA

MARCH 2016
ACKNOWLEDGEMENTS

This Report was produced by Promethium Carbon during the course of a research project titled Electricity Market Reform in Southern Africa, funded by the British High Commission in Pretoria, South Africa. The objective of the project is to identify electricity market reforms that are currently underway in the Southern African Development Community region.

This Report was informed by inputs from various organisations, institutes, government departments in the member states of Southern African Development Community including: Botswana (British High Commission in Gaborone, Cenkal, Department of Energy and Kalahari Energy); Lesotho (Lesotho Energy and Water Authority); Malawi (Malawi Energy Regulatory Authority); Mozambique (Aggreko Mozambique, Department for International Development Mozambique and Fundo de Energia); Namibia (NamPower); South Africa (Cennergi, Department of Trade and Industry, Eskom, Industrial Development Corporation of South Africa, IPP Office, South African Independent Power Producers Association, South African Wind Energy Association, Standard Bank); Swaziland (Swaziland Electricity Company); Zambia (Copperbelt Energy Corporation, Lunsemfwa Hydro Power Company); Zimbabwe (British Embassy Harare, Counterfactual, Confederation of Zimbabwe Industries and the Zimbabwe Electricity Supply Authority) and the Southern African Power Pool.

ENSafrica have contributed to the interpretation and understanding of the legal infrastructure, especially with respect to the South African legislative framework.
Goal 7 Affordable and Clean Energy
Ensure access to affordable, reliable, sustainable and modern energy for all
**EXECUTIVE SUMMARY**

The topic of this research report is electricity market reform. In the broadest sense it is about how the electricity supply industry is Southern Africa is changing either by intentional interventions or through opportunistic endeavours by stakeholders in the industry.

The scope of the report covers the electricity supply industry in the Southern African Development Community and countries participating in the Southern African Power Pool in particular. While the national utilities are the dominant players in the industry at present, most of the electricity market transformation is initiated by policy and legislation driven by government and investments by the private sector.

The research methodology was to conduct interviews and workshops with various stakeholders within the electricity supply industry. This included national utilities, energy regulators, government departments, independent power producers, industry associations, municipalities and large consumers of electricity. Twenty three workshops/meetings were held. In addition to interviews and workshops various national and regional conferences and workshops related to the electricity market were attended for information gathering and networking opportunities.

Findings are made in relation to a number of themes: economics, competition, regulatory frameworks, environmental impacts and risk. At the national level there is a general desire to be electricity self-sufficient and in several cases countries expressed the intension to be net exporters of electricity.

Various instruments for reducing the risk and improving confidence in the electricity sector are considered such as trading frameworks i.e. the Southern African Power Pool, competition within the region, aggregators local competition and structure, and financing instruments such as contracts-for-difference (CfD).

This research concludes that privatisation of existing infrastructure is not a required step in the market liberalisation of the Southern African region as sufficient diversity of supply can be created by simply allowing new entrants to bring generation capacity to the market. The concurrent benefits of such a step would be to alleviate the supply shortage that currently exists in the market.

The pathway to follow to unregulated prices is a major decision in any market liberalisation strategy. It is clear from the cases considered in this research project that a transition period in which both liberated and regulated prices exist in the same space is possible.

The shortest pathways to a liquid market, within the context of the current regulatory framework will be to scale up the participation in the SAPP through the introduction of more private sector players, or to develop a market based on the electricity aggregator model that can trade on existing commercial infrastructure in the region such as the JSE.
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1 INTRODUCTION

Electricity market reform, as a process to address significant challenges in the electricity supply industry, is a global phenomenon. Market liberalisation, as has happened in many regions in the world since the 1980’s, is today viewed as being a solution to many problems. These problems include aging infrastructure, shortages of state funding for new electricity generation capacity and a rapidly changing technical environment.

This report explores how the electricity markets in Southern Africa have changed and might change given existing market opportunities and regulatory frameworks.

The current state of the electricity market in Southern Africa is characterised by aging infrastructure, electricity shortages, increasing electricity prices, high levels of GHG emissions and susceptibility to climate change. These are aggravated by growing but depressed electricity demand and limited human and institutional capacity. Constraints on available generation capacity in the region negatively impact the business environment and limit economic development. Competitive markets can provide a mechanism for encouraging investment, promoting efficient electricity pricing.

There are two main challenges in the electricity supply sector in the Southern African region. These challenges give context to the work done in this report. In summary they are:

- There is a growing demand for electricity in the Southern African region, but the regional economy is constrained by capacity limitations. Any intervention that could alleviate the capacity constraints in the region will have immediate positive impacts on the regional economy;
- The construction of new capacity presents a challenge is the increase in the marginal price of electricity to accommodate the depreciation of the new plant. This is seen in South Africa at the moment as the Medupi and Kusile power stations capacity becomes available between now and 2021.
- Electricity price signals have not reflected the scarcity of capacity in the region, as much of the existing capacity has already been paid for. The marginal cost for the national utility is diluted by the average cost of the existing and aging plant. The costs for the reserve capacity, however, are covered in the tariff in a centralised system. Decisions by IPPs to invest in new capacity are made by comparing the marginal cost to build a new plant with a regulated average electricity price based on old, depreciated plant.

Based on the above, the problem statement addressed in this project is: **What are the options for market reform in Southern Africa to create an environment conducive for investment in new capacity?**
The aim of the project is thus to develop and showcase pathways to, and opportunities for, electricity market reform in the countries linked to the Southern African Power Pool (SAPP).
2 METHODOLOGY

The overall approach to this project is to build on experience from two areas. The first is to understand the existing frameworks within the member countries of SAPP. In this context it is important to understand how the electricity suppliers and consumers interact within the SAPP framework. The second is to understand the history of electricity market reform. Lessons can be learnt from the motivations, experience, successes and failures of reform in other countries.

In the context of the Southern African region we performed literature reviews followed up by interviewing various government departments, regulators, and other stakeholders within the electricity supply industry of each country in the region. The purpose of the interviews was to solicit first-hand knowledge of the changes to the electricity supply industry within each country, such as the state of the electricity market systems and intended changes.

In the international context, the research focussed on literature reviews on countries in which electricity market reform was implemented.

The analysis then followed with a review of the various plausible pathways or mechanism which could be used in transforming the market and involves considering the structural changes that may be required. These pathways are highlighted as case studies.

The main procedure followed to identify pathways of electricity market reform are illustrated in Figure 1 and include:

- Review of existing frameworks, policies and legislation governing electricity market development;
- Explore case studies of the pathways that have been achieved and what the challenges and key points to success;
- Provide recommendations to guide interested parties on how to streamline their electricity selling/buying/trading aspirations.
The literature survey covered the following areas:

- Review of research on the Southern African electricity market;
- Consultation with stakeholders – consult with local regulatory bodies and experts in order to summarise the salient points of the regulation pertaining to the supply of power by independent power producers and the trading of electricity;
- Analysis of regulatory environments in SAPP region – this analysis will be based on the consultation with relevant stakeholders and analysis of the relevant legislation and regulations;
- International examples and best practice in electricity market reform;
- Development of options – this stage involves the development of pathways to electricity market reform in the region. This draws on its deep experience in the technical, commercial and financial aspects of energy and carbon trading to perform this task. This forms the central part of the project in which innovative ways to stimulate the market reform investigated in a similar way as done in the development of the carbon offset market in SA;
- Summarise the information collected, analysis performed and conclusions reached;
- Analysis of the potential market for private sector energy transaction (private buyers and private sellers);
- Regulatory issues that prevent the large scale utilisation of the SAPP infrastructure for private sector energy transactions; and
- Pathways to electricity market reform within the context and limitations of the SAPP member countries.
3 Status Quo of the Electricity Landscape in Southern Africa

In this section a brief review of the status quo of the electricity industries in each county is considered. The state of the electricity supply industry, the underlying policies, legislation and regulations and key stakeholders in the industry are discussed. The section is concluded with a consolidated summary giving the regional context of transformation.

3.1 Regional Structures

3.1.1 Southern African Development Community

The Southern African Development Community (SADC) is the geographical region defined by a treaty between the member states concerning socio-economic development, defence, politics, security and regional integration. The organisation within SADC is specified by a number of protocols, defining common objectives.

The SAPP was formed at the 1995 SADC summit when the member governments signed an Inter-Governmental Memorandum of Understanding (IGMOU) for the formation of a power pool in the region. Three other key documents which were agreed to and signed subsequently are:

- Inter-Utility Memorandum of Understanding (IUMOU), which established SAPP’s basic management and operating principles;
- Agreement Between Operating Members (ABOM), which established the specific rules of operation and pricing; and
- Operating Guidelines (OG), which provides standards and operating procedures.

The Protocol on Energy was signed in 1996. It supports power pooling, electricity trading and regional integration of energy systems such as the Southern African Power Pool. The Protocol has a specific requirement to “Co-operate in the development of energy and energy pooling to ensure security and reliability of energy supply and the minimisation of costs”.

Since the adoption of the Protocol, the SADC has enacted several strategic plans for energy development in the region:

- the SADC Energy Cooperation Policy and Strategy in 1996,
- the SADC Energy Action Plan in 1997,
- the SADC Energy Activity Plan in 2000,
- the Regional Infrastructure Development Master Plan and its Energy Sector Plan in 2012. The Regional Infrastructure Development Master Plan – Energy Sector Plan sets out the proposed institutional arrangements for the energy sector in the region. The institutions relevant to this project are shown in Figure 2, and
- more recent initiatives include the Regional Industrialisation Strategy and Roadmap which sets out industrial development objectives for a fifty year period.
Nine member states of SADC have merged their electricity grids into the Southern African Power Pool, reducing costs and creating a competitive common market for electricity in the region. Similarly, SADC has established the Regional Electricity Regulatory Association, which has helped in harmonising the region’s regulatory policies on energy and its subsectors.

The electricity supply situation in the region deteriorated significantly since the early 2000’s as the reserve capacity on the SAPP grid declined below zero. This was mainly because of the electricity crisis in South Africa that was highlighted in a dramatic fashion with the load shedding in the country in early 2008.

One of the important requirements for a liquid market is price differentials. Markets operate in a way that allows for price discovery and optimisation. The large differentials in the SAPP region (as can be seen in Figure 4) are indicative of a dysfunctional market.
3.1.2 Southern African Power Pool

The Southern African power pool (SAPP) (see Figure 5) was set up by the Southern African Development Community as a means for national electricity utilities to trade electricity amongst each other. Initially SAPP's members consisted only of national utilities from the Southern African region. Electricity was primarily traded between South Africa and other Southern African member countries as South Africa would have surplus capacity available to assist other countries that could not meet their own electricity demands.
SAPP’s visions are:

- Facilitate the development of a competitive electricity market in the Southern African region;
- Give the end user a choice of electricity supply;
- Ensure that the Southern African region is the region of choice for investments by energy intensive users; and
- Ensure sustainable energy developments through sound economic, environmental and social practices.

All of the items listed in the vision statement above relates to the objectives of electricity market reform. It is for this reason that this research focussed on the SAPP as a potential platform to achieve a liberated market.

The SAPP revised its Inter-Utility Memorandum of Understanding in April 2007. In terms of the revised Inter-Utility Memorandum of Understanding, the SAPP Membership falls into the following categories:

- National Power Utilities;
Independent Power Producers (IPPs);
Independent Transmission Companies (ITCs); and
Service Providers

The supply of electricity in the SAPP countries is shown in the chart below:

**Markets**

**Bilateral Contracts**

The first market mechanism on the SAPP was the market for bilateral contracts. These contracts generally cover a period from 1-5 five years, but could be longer. The agreements provide for assurance of security of supply but are not flexible to accommodate varying demand profiles and prices. The prices are negotiated between willing buyers and willing sellers.

The bilateral contracts mechanism accounts for 90-95% of energy traded on the system (15 - 20 TWh per year). The mechanism provides for trade in peak, off-peak and standard times.

The bilateral contracts have proved essential for financing of new generation & transmission projects.

**Short Term Energy Market**

The short-term energy market (STEM) was introduced in April 2001 as a precursor to full competition. It catered for 5-10% of annual electricity energy trade – between 0.8 and 4.3 TWh per year.

The market provides for daily and hourly contracts. It operates mainly in off-peak periods as generators generally do not have spare capacity in the peak periods.

The market mechanism is based on participants sending bids and offers to the SAPP Coordination Centre. The
Coordination Centre then matches bids and offers and set a price based on matching bidders and sellers offers. Once matched these prices become firm STEM contracts. Participants are levied 1% administration fee on all transactions.

**Day Ahead Market**

The SAPP Day Ahead Market (DAM) is a non-regulated market – electricity is sold on the DAM to make a profit. During the winter (June, July and partly August) of 2015, Eskom was not able to sell on the DAM as they had no excess capacity that could be traded due to generation constraints within South Africa. Eskom could, however, have purchased electricity from the SAPP to mitigate load shedding at a cost that was higher than their own cost of generation – this however would then have to be traded off with the cost of unserved power for Eskom.

In August and September when the electricity consumption reduced in South Africa as winter passed, Eskom sold electricity to both Botswana and Swaziland on the SAPP DAM. If Eskom can generate sufficient amounts of electricity from coal sources to meet South Africa’s demand, the surplus is offered on the SAPP DAM.

Participants need to conform to the following conditions to trade on the DAM:

- Being licensed or granted permission by the host country;
- Acceptance as a member of SAPP in any of the membership categories in the Revised SAPP Inter Utility Memorandum of Understanding. These categories are:
  - National Power Utilities;
  - Independent Power Producers (IPPs);
  - Independent Transmission Companies (ITCs); and
  - Service Providers.
- Being party to a transmission system operator connected to a SAPP Control Area;
- Having an Agreement for Balance Responsibility with a SAPP transmission system operator and/or Control Area;
- Signing the DAM governance documents;
- Opening of the requisite accounts for trading purposes and having the requisite security for trading purposes; and
- Have at least One Certified Trader.

**Constraints**

Increasing liquidity is key to the development of the SADC electricity market. However, three main factors constrain the number of generators joining the SAPP platform.

**Infrastructure constraints**

In the event that large amounts of electricity are traded on the SAPP, the local transmission networks and interconnectors between countries could be overloaded. The potential risk of these imbalances is the primary limiting factor to the benefits of new members joining SAPP. To prevent imbalances, each country forming part of SAPP would have to implement and regulate internal grid balancing rules. The current role of SAPP does not extend to balancing the both generators and off-takers across each of the countries’ grids.
Balancing and metering are key components of an open market. Examples are the liberalised UK market, where metering is undertaken by the System Operator and access to the grid is heavily regulated.

SAPP infrastructure constraints are a major challenge to growth or reform in the SAPP electricity market; however there are ongoing initiatives to improve the regional transmission networks which should positively impact the operating environment in the short to medium term.

**Regulatory constraints**

International trade in the SAPP is complicated by the different regional, national and even municipal (provincial) regulations within the system boundary. The Regional Electricity Regulators Association (RERA) has been developed as the regulators’ association to assist in regional strategy and implementation.

The National Energy Regulator of South Africa regulates the electricity sector by issuing licences for import and export of electricity in South Africa. Municipalities in South Africa are also bound by the Municipal Finances Management Act which prevents them from purchasing power (for resale to their internal clients) that is not procured on a competitive basis or is more expensive than the price Eskom charges them for electricity.

**Participation Requirements**

The licensing requirements are not well described, detailed or available in all countries. This limits the participation the participation of new generators. A summary of the licensing requirements in SAPP countries is provided in the table below:

<table>
<thead>
<tr>
<th>LICENCES REQUIRED</th>
<th>Own Gen.</th>
<th>Generation</th>
<th>Transmission</th>
<th>Distribution</th>
<th>Trading</th>
<th>Import</th>
<th>Export</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola*</td>
<td>No data</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>Botswana</td>
<td>N</td>
<td>Y</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>DRC*</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>Lesotho</td>
<td>Unspecified**</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Unspecified*</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Malawi</td>
<td>Unspecified**</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Unspecified*</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Mozambique*</td>
<td>No data</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>Namibia</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Unspecified*</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Nigeria</td>
<td>N</td>
<td>Y</td>
<td>Y***</td>
<td>Y</td>
<td>Y</td>
<td>Unspecifiedd**</td>
<td>Unspecified**</td>
</tr>
<tr>
<td>South African</td>
<td>N</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

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*The licensing requirements are not well described, detailed or available in all countries. This limits the participation the participation of new generators. A summary of the licensing requirements in SAPP countries is provided in the table below:
### LICENCES REQUIRED

<table>
<thead>
<tr>
<th>Country</th>
<th>Own Gen</th>
<th>Generation</th>
<th>Transmission</th>
<th>Distribution</th>
<th>Trading</th>
<th>Import</th>
<th>Export</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanzania</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Zambia</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Unspecified*</td>
<td>Y</td>
<td>Unspecified **</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>Unspecified **</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Unspecified **</td>
<td>Unspecified **</td>
</tr>
</tbody>
</table>

* Electricity Acts are not in English, making information gathering difficult
** Not specified in Electricity Act
*** Retained under the federal government for security reasons

### 3.1.3 Regional Electricity Regulators Association

The Regional Electricity Regulators Association of Southern Africa (RERA) is a formal association of independent electricity regulators whose establishment was approved by the Southern African Development Community (SADC) Ministers responsible for Energy in Maseru, Lesotho on 12 July 2002. The Association was officially launched in Windhoek, Namibia on 26 September 2002 and it provides a platform for effective cooperation between independent electricity regulators within the SADC region. RERA currently has 6 energy regulators members. The members are:

- Angola: Institute for Electricity Regulation
- Lesotho: Lesotho Electricity and Water Authority (LEWA)
- Malawi: Malawi Energy Regulatory Authority (MERA)
- Mozambique: National Electricity Council
- Namibia: Electricity Control Board
- South Africa: National Energy Regulator of South Africa (NERSA)
- Swaziland: Swaziland Energy Regulatory Authority (SERA)
- Tanzania: Energy and Water Utilities Regulatory Authority
- Zambia: Energy Regulation Board
- Zimbabwe: Zimbabwe Electricity Regulatory Commission

RERA’s ultimate goal is to ensure that efficient cross-border deals are not constrained by unclear or complicated processes for making regulatory decisions. This means that the following goals are set:

- To clarify how regulators will carry out their powers and duties in regulating cross-border electricity transactions in order to minimise regulatory risks for power investors and customers;
- To promote efficient and sustainable cross-border electricity transactions that are fair to selling and buying entities, are consistent with least-cost sector development and help to ensure security of supply; and
- To promote transparency, consistency and predictability in regulatory decisions

RERA is a member of the African Forum for Utility Regulation (AFUR). This organisation was formed to support the development of effective utility regulation in Africa. AFUR was established in September 2000 as an informal arrangement to facilitate the exchange of information and lessons of experience between African regulators, and
to support capacity building efforts in the region. The forum focuses on issues broader than the regulation of electricity, including communications, transport, and water and sanitation industries.

The nine Regulatory Guidelines for regulating cross border power trading in SADC region are as follows:

- Regulator’s powers and duties in cross-border trading;
- Working to ensure compatible regulatory decisions;
- Timing of regulatory interactions for proposed cross-border transactions;
- Licensing cross-border trading facilities, imports and exports;
- Approving cross-border agreements in importing countries;
- Approving cross-border agreements in exporting countries;
- Approving cross-border agreements in transit countries;
- Approving transmission access and pricing and ancillary services; and
- Promoting transparency in the regulation of cross-border trading.

![Diagram of Regulatory Decisions for Cross Border Deals](Figure 8: Overview of Regulatory Decisions for Cross Border Deals (Sichone & Roets, 2011))
3.2 Countries

3.2.1 Botswana

Status of the electricity supply system

Botswana’s peak electricity demand is around 600 MW, largely derived from coal sources. During the 2014/15 financial year, 44% of the total supply was imported from Eskom’s coal-fired power stations in South Africa, in addition to imports from NamPower (4%), ZESCO (1%) and the Southern African Power Pool’s Day Ahead Market (1%). The electrification rate is reported to be 49% (Botswana Power Corporation, 2015).

The Botswana Power Corporation is the state-owned and vertically integrated utility which dominates the electricity sector. Generation in the country is currently derived from the state-owned Morupule B coal-fired power plant. Morupule B has an installed capacity of 600 MW, however, design and operating challenges have resulted in the need to import electricity from Botswana’s neighbours.

Two peaking power plants, Orapa (90 MW) and Matshelagabedi (70 MW), also supply the country with electricity generated from diesel. The Orapa power plant was commissioned in 2011 by Karoo Sustainable Energy through a tender issued by the Botswana Power Corporation. The utility issued an expression of interest in 2015 inviting prospective bidders to submit proposals to convert the Orapa diesel turbines to coal bed methane turbines in the near future (MMEGI Online, 2015). The Matshelagabedi plant is also owned by the Botswana Power Corporation.

Morupule A is another coal-fired power station owned by the Government of Botswana and has an installed capacity of 132 MW. Morupule A was not however operational during the 2014/15 financial year due to refurbishments. It is expected to resume operations in 2017 (Botswana Power Corporation, 2015). A survey by Botswana’s Department of Geology has revealed that the country has vast reserves, estimated at 17 billion tons, making coal the preferred source of electricity in the country.

Botswana has communicated its intention to achieve an overall emissions reduction of 15% by 2030 taking 2010 as the base year (Republic of Botswana, 2015), implying that investments in the renewable energy sector may be forthcoming in the near future.

Policies, legislation and regulations

The Botswana Energy Master Plan (1996, reviewed 2003) is the main policy that guides the electricity sector (Clean Energy Info Portal, 2014). Its electrification target is to reach 80% national power access and 60% rural access by 2016. The plan also aims to improve security and reliability of supply.


The Botswana Electricity Supply Act of 1973 (as amended 2007) is the overarching legislative framework for the electricity sector.
sector. The Act stipulates that licences are required for any activities relating to the generation, supply, transmission, distribution, export, import, use, work or operation in the electricity sector. The Act also authorises the participation of IPPs in the electricity sector, although currently only one IPP operates in the country.

Government-owned enterprises and own-generation installations below 25 kW are exempt from licence requirements.

The Act also stipulates that licences are required to access or use the transmission facilities and associated infrastructure owned and operated by the Botswana Power Corporation.

The Electricity Supply (Licensing) Regulations (26th November, 1993)\(^1\) establish the guidelines and requirements for electricity related activities. Notably, the Regulations specify that the IPP rates for the supply of electricity to consumers must be established in an agreement between the IPP and the consumer. The tariff must however be approved by the Minister of Minerals, Energy and Water Resources.

No legislation or regulations currently exist to support renewable energy projects specifically. The Government of Botswana has engaged the World Bank to assist in the development of a renewable energy strategy for the country, which is expected to be available in 2016 (Netherlands for the World Bank, 2015).

**Electricity industry stakeholders**

Botswana does not yet have an independent energy regulator. The Energy Affairs Division (under the Ministry of Minerals, Energy and Water Resources) currently has the overall responsibility for the energy sector and policy development in the country, including supervision of the Botswana Power Corporation.

The Botswana Power Corporation monopolises the electricity market in the country. The utility is owned by the state and is responsible for electrical power generation, transmission and distribution in Botswana. The state currently has no intention of unbundling the utility.

**Inputs from stakeholders during consultations**

Meetings with Cenkal and Kalahari Energy, stakeholders in the Botswana electricity sector, suggest that the lack of an independent energy regulator is constraining the sector and development of the country. The roles of the various players in energy delivery are not always clear, and the development of policies and subsequent measures are further reported as being hampered by a lack of information relating to energy policy, planning and decision-making.

The monopoly of the electricity sector in the country by the Botswana Power Corporation was considered as a major barrier to competition. The low tariffs charged by the utility do not reflect the costs of generation, further constraining growth in the market as new entrants to the market are unable to compete with the subsidised tariffs (Promethium Carbon, 2015). Botswana’s Department of Energy

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subsequently confirmed that electricity is currently sold at a loss as a social-good subsidy (Promethium Carbon, 2015).

The following points were generally noted as constraining growth in the SADC electricity sector:

• lack of liquidity in the market;
• poor quality of transmission lines, especially along the Democratic Republic of Congo and Zimbabwean corridors; and
• lack of integrated plans across countries in the region.

These challenges withstanding, the Department of Energy expects to be an exporter of electricity to SAPP by 2018 once the refurbishments to its coal-fired power stations are complete.

Summary

While Botswana has untapped renewable energy sources, coal is likely to continue as the dominant source of electricity in the country. The use of gas from coal bed methane in the country therefore also holds great potential as a cleaner alternative to coal fired power stations. However, while various electricity projects are reported to be in the pipeline and the Department of Energy, Minerals and Water Resources is positioning the country as one of the region’s main exporters of electricity by 2018 (Engineering News, 2015), progress in implementing and constructing the required facilities has been slow. Botswana’s growth is severely constrained by lack of adequate electricity supply.

3.2.2 Democratic Republic of Congo

Status of the electricity supply system

The Democratic Republic of Congo (DRC), formerly known as the Republic of Zaire, has a total installed electricity generation capacity of 2.44 GW, with an available generation capacity of approximately 1.23 GW (due to capacity sharing arrangements). Electricity is primarily generated through hydropower stations (98.6% of total generation capacity) while the remainder is produced from fossil fuels.

During a study conducted by the DRC’s national utility, Société Nationale d’Électricité (SNEL), in 2013, it was established that approximately 9% of the population has access to electricity. The poor rate of electrification is attributed to poor infrastructure, lack of investment (The DRC has a low credit rating and there is a lack of confidence in the current government), low level of education and technical skills shortages (Societe Nationale D’Electricite, 2013).

The DRC has access to an electricity import capacity of approximately 150 MW from Zambia. The Zambian state owned national utility, Zambia Electricity Supply Corporation (ZESCO), supplies the DRC with a 100 MW of import capacity while the remaining 50 MW is supplied by the Copperbelt Energy Corporation (CEC) (Market Monitor LLP, 2014).

The DRC sources the majority of its electricity from two hydropower stations: Inga I and Inga II. These two hydropower stations have an installed capacity of 351 MW and 1,424 MW respectively. The
The age of these two hydropower stations result in frequent maintenance and repairs being required. This significantly reduces the available generation capacity. The DRC, with aid from the World Bank and the African Development Bank, started the development of the Inga III Base Chute hydroelectric dam to expand the available generation capacity amidst the concerns around the ageing Inga I and Inga II hydropower stations (Market Monitor LLP, 2014).

The Inga III hydropower station has a planned generation capacity of 4.8 GW. The World Bank indicated that Eskom, the South African national utility, would purchase 2.5 GW while the DRC’s mining industry committed to purchase 1.3 GW. The remaining 1 GW of generation capacity is to be allocated to SNEL to help provide electricity to residents in and around Kinshasa (Market Monitor LLP, 2014).

**Policies, legislation and regulations**

To date, the DRC has not published an energy policy or framework for the electricity supply industry. There is also no electricity regulatory body established in the DRC.

Although no formal energy policy yet exists, the DRC makes use of government decrees which act as laws as to how the electricity supply industry should be governed. In 1956, a royal decree was signed that contained a set of regulations and general block notes which outlined the applicable principles and concessions for the public distribution of electricity. The Zairian government (the former government of the DRC) signed the first government decree, number 70/033, for the establishment of SNEL as a Public Enterprise Company in 1970. This was followed by a second Zairian government decree, number 78/196, which allowed SNEL to take over all generation, transmission and distribution within the DRC (Lukamba-Muhiya & Uken, 2006).

The Ministry of Energy in the DRC submitted a draft Electricity Bill to Parliament for approval. The Electricity Act includes an institutional framework for the Ministry of Energy, an Independent Regulator, a National Electrification Agency and a National Electrification Fund. The Bill also refers to licenses in the electricity supply industry (generation, transmission, distribution and supply) (di Panzu, 2011).

**Electricity industry stakeholders**

As no electricity regulatory body is yet established in the DRC, SNEL, a public entity reporting to the Ministry of Mines and Energy is largely self-regulating.

SNEL generates, transmits, distributes and supplies all electricity within the DRC.

**Summary**

The DRC has the largest hydropower potential in Africa. The size and depth of the Congo River provide ideal conditions to generate renewable energy in the form of hydropower that could, at full exploited capacity produce in excess of a 100 000 MW (Kadiayi, 2013). Despite this great potential, the DRC currently has a total available generation capacity of 1.23 GW which is mainly in the form of hydropower stations.

The total generation capacity provides electricity to approximately 9% of the population. The electrification in the DRC is low due to barriers which include poor
infrastructure, lack of international investment (due to the high political and financial risks in the DRC) and low level of education and technical skills shortages.

A draft Electricity Act has been presented to government for approval. Once accepted, the electricity supply industry will gain an Independent Regulator and various bodies to assist in improving the electrification levels. This will stimulate growth in the electricity sector and open the sector for more IPPs to become involved. With an Independent Regulator being established, it would strengthen investor confidence in the DRC.

3.2.3 Lesotho

Status of the electricity supply system

In 2014, Lesotho’s maximum demand was around 143 MW. About 56% of this electricity is generated locally from the Muela hydropower plant. The remainder of the electricity is imported from Eskom in South Africa. Lesotho is thus highly dependent on its neighbouring country to meet electricity demands.

Although Lesotho currently trades exclusively with South Africa’s Eskom, the Lesotho Electricity Company is also a full operating member of the Southern African Power Pool. This presents an opportunity for Lesotho to participate in the regional competitive electricity environment. Regional shortages of electricity within the Southern African Power Pool are however constraints that Lesotho has to take into consideration (USAID, 2008), as the required supply cannot always be guaranteed from the Southern African Power Pool market. This problem is further compounded by the country’s dilapidated electricity distribution network infrastructure.

Being a member of the Southern African Power Pool should allow a Lesotho-based independent power producer to access other generators of electricity. However, Lesotho is landlocked in the middle of South Africa, and Eskom owns the transmission networks neighbouring Lesotho. For this reason, access issues arise which would need to be resolved in order for an independent power producer in Lesotho to sell electricity to entities other than Eskom, (USAID, 2008).

Lesotho has significant hydro power generation potential, which has been demonstrated by the Lesotho Highlands Development Authority. In addition, the county’s location in the heart of South Africa could indicate cost benefit opportunities for transmission requirements. This is because a few of the bigger South African cities are nearer Lesotho than they are to some of Eskom’s large power stations. These opportunities for the electricity market within Lesotho are yet to be fully realised.

The Government of Lesotho is currently exploring long term solutions to increase national electricity supply. The opportunities include the expansion of the current Muela hydropower station to phase 2. Part of phase 2 of the project involves the proposed 1 200 MW Kobong pumped storage scheme (Wade Publications CC, 2015). In addition, the government is looking into developing new hydropower stations, as well as examining the possibility of wind energy. The government is also looking to support the use of off-grid renewable energy solutions such as solar and wind power, and
considering the re-commissioning of existing mini hydro-power stations, of which there are four.

To date, the Lesotho government has approved an application by a joint venture company, comprised of NETGroup and Powerdev Group, to develop a 42 turbine windfarm adjacent to the Lesotho highlands Letšeng diamond mine. It is estimated that the facility will produce around 25 to 35 MW of electricity (Wade Publications CC, 2015). These additional capacities could put Lesotho in the position to export electricity to its neighbouring countries in the future.

**Policies, legislation and regulations**

The principle legislation related to the electricity sector in Lesotho is the *Lesotho Electricity and Water Authority Act, No. 12 of 2002*. The Act, along with its amendments, requires all persons generating, transmitting, distributing, supplying, importing and exporting electricity to do so under the authority of a licence. The Act provides that no person may undertake a regulated activity without being in possession of a licence issued by the Lesotho Electricity and Water Authority.

Lesotho’s Department of Energy, through the Lesotho Meteorological Services, established the country’s Renewable Energy Policy for the period 2015 – 2025. The goals within the country’s Energy Policy include contributing towards the improvement of livelihoods, contributing towards economic growth and investment, ensuring security of supply and contributing towards the protection of the environment. The country’s ultimate vision portrayed in the policy is that “Energy shall be universally accessible and affordable in a sustainable manner, with minimal negative impact on the environment, (Lesotho Energy Policy: 2015-2025).”

**Electricity industry stakeholders**

The Lesotho Ministry of Natural Resources is in charge of developing the electricity sector legislation through its subsidiary, the Department of Energy. The Ministry is mandated to develop medium and long-term national energy strategies, promote new and renewable sources of energy and monitor energy sector activities (USAID, 2008). The Department of Energy is responsible for the implementation of all energy policies and the coordination and monitoring of energy programmes and projects.

The Lesotho Electricity Company is the monopoly transmitter and distributor, and remains the sole supplier of electricity in Lesotho. The Lesotho Electricity Company was established under the *Electricity Act No.7 of 1969* where it operated as a Government parastatal.

Lesotho’s electricity supply industry underwent a restructuring programme initiated by the government in 2001. The reforms were meant to address the problems of inefficiency and lack of financial resources in the sector. The restructuring entailed commercialisation and privatisation of the Lesotho Electricity Company, the establishment of rural electrification structures, making Muela hydropower facility prices competitive and the establishment of a regulator (REEEP & REN21, Lesotho 2012, 2013).

The Lesotho Electricity Authority was subsequently mandated with the authority to regulate all aspects of the electricity supply
industry, including the generation, transmission, distribution, supply, import and export of electricity. In 2007, the Government decided that the Lesotho Electricity Authority should be transformed into a multi-sector regulatory body, and provided with additional powers to regulate urban water and sewerage services in the country. This gave rise to the Lesotho Electricity and Water Authority in 2013.

The Lesotho Highlands Development Authority is the main generator of electricity through the Muela hydropower station. Lesotho Electricity Company and the Lesotho Highlands Development Authority thus remain the dominant players in the Lesotho electricity sector. The Lesotho Electricity Company has bilateral bulk Power Purchase Agreements with Muela and Eskom. Due to the planned extension of the electricity grid, and the goal of privatisation the energy sector as set out in the Kingdom of Lesotho’s Energy Policy of 2006, there may be room for development for small role players (REEEP & REN21, Lesotho 2012, 2013).

Inputs from stakeholders during consultations

The Lesotho Energy and Water Authority expressed its support for an independent power producer segment in the electricity market in the country. The African Development Bank is assisting with the development of a standardised power purchase agreement and other related legal documents in this regard.

Various barriers to entry exist, including subsidies provided to the national utility (which monopolises the sector) and the drought, which is severely affecting security of supply. Lesotho is mandated by SADC to transition to cost-reflective tariffs, which should incentivise independent power producer participation in the local market. The Lesotho Electricity Company reserves the right to first refusal of electricity generated by IPPs (Promethium Carbon, 2016).

Summary

Lesotho is currently very reliant on South Africa for electricity imports. There is however significant potential within the country to produce surplus energy which could in the future be exported. The opportunity for Lesotho lies within the hydro-power sector, specifically the commencement of phase 2 of the Lesotho Highlands Development Authority project. The opportunities for independent power producers are also located in the small-micro hydro segments of the market, as well as in the development of other renewable energy facilities.

3.2.4 Malawi

Status of the electricity supply system

Malawi is the only member country of the South African Power Pool which has no interconnection to the pool. The country is thus fully reliant on its own power generation. The Electricity Supply Corporation of Malawi Limited (ESCOM) is the national utility and is the sole producer of electricity for the country. ESCOM currently has approximately 351 MW of maximum capacity for generation; however the current demand is around 450 MW (Promethium Carbon, 2016). Thus without any interconnectors to other countries and without independent power producers the country’s energy demands can’t be met,
which significantly hinders development. In addition, the country has one of the lowest electrification rates in Africa. Less than 10% of the population has access to electricity (Breeze, 2014).

The state-owned and vertically integrate utility, ESCOM, completely dominates the Malawian electricity sector. Malawi follows a single buyer electricity model, where independent power producers may only sell their electricity to the utility and not directly to consumers. As yet, no independent power producers are operational in the country. The regulatory environment is still developing and there is no clarity as yet regarding independent power producers access to the electricity grid or what tariffs they may be able to receive (Breeze, 2014).

**Policies, legislation and regulations**

The Malawian electricity sector is guided by the Malawian Energy Policy, 2003, the Energy Regulation Act, No. 20 of 2004 and Electricity Act, No. 22 of 2004. The policy and energy laws encourage participation of the private sector in electricity generation and distribution. The Electricity Act, No. 22 of 2004 prohibits generation of electricity for sale, transmission, supply, distribution, importation and export of electricity without a licence issued under this Act. In addition no licensee can be granted more than one type of licence.

The Ministry of Natural Resources, Energy and Environment drafted the Feed-In Tariff Policy in 2012 to guide private sector investment within the market; however, to date it has not been made available to developers (Bloomberg New Energy Finance, 2015).

There are reports to suggest that further developments can be expected in the Malawi regulatory environment. Uncertainty remains, however, in key areas, such as independent power producer’s access to the electricity grid and what tariffs independent power producers could receive (Breeze, 2014).

**Electricity industry stakeholders**

The Ministry of Natural Resources, Energy and Environment oversees the Malawian electricity sector. The electricity sector is headed by the Department of Environmental Affairs. The Department sets the policy framework and legislative environment under which the electricity supply industry operates.

The Malawi Energy Regulatory Authority was mandated under the Energy Regulatory Act, No. 4 of 2004, as the energy sector regulator in the country. The regulator became operational in December 2007 with the aim of being an independent, transparent, efficient and cost effective energy regulator.

ESCOM is the vertically integrated government utility which owns and operates all of the main generation plants, all transmission and distribution infrastructure and has the responsibility for electricity trading within the country. ESCOM has little involvement in off-grid generation.

Malawi has one of the lowest electrification rates in Africa, less than 10% of the population has access to electricity (Breeze, 2014). Inadequate electricity supply, coupled with an ever increasing demand, is one of the major problems confronting Malawi and limiting its social, economic and industrial development (Taulo, 2015).
Private sector investment in electricity generation remains a challenge. Government funding provided to ESCOM for electricity generation gives it an unfair advantage over potential independent power producers who are not able to compete with subsidised prices. In addition, with Malawi following the single buyer model independent power producers must sell their electricity to ESCOM which prevents their direct access to consumers. As yet, no independent power producer deals have been established, regardless of a number of ongoing negotiations (Breeze, 2014).

The regulatory environment is still developing, generating uncertainty in key areas such as how independent power producer can gain access to the electricity grid and what tariffs they can receive (Breeze, 2014). The Malawi Energy Regulatory Authority has developed a template power purchase agreement that they hope to put to use to encourage investors to take advantage of the opportunities the country presents.

The government of Malawi recognizes that its electricity sector is key to the country’s economic growth. Solutions to prevent a power crisis within Malawi and to ensure an efficient and robust electricity market include (Electricity Supply Corporation of Malawi, 2012):

- interconnection to the Southern African Power Pool through Mozambique agreements;
- issuing licenses to Independent Power Producers;
- commissioning of new generation stations, which decrease dependency on hydro power from one water source (the majority (99%) of Malawi’s power comes from a series of hydropower plants on the Shire river); and
- vertically unbundling ESCOM into separate generation and transport (transmission and distribution) entities.

Challenges faced by Malawi are shortages in capital finance, which is leading to lack of investment in generation, transmission, distribution and overall power system stability. Aging generation equipment is also leading to frequent breakdowns and thus load shedding (Lapukeno, 2013).

**Inputs from stakeholders during consultations**

Stakeholder consultations in Malawi, with the Malawi Energy Regulatory Authority (Promethium Carbon, 2016), provided valuable inputs to the country’s current electricity sector and developments within the system.

Malawi is 90% reliant on hydropower, making it a very clean grid. Despite this, the sole reliance on one form of energy and no energy mix produces its own downfalls. It prevents any flexibility in the energy generation system and variations in water supply (too much or too little) can create significant issues. Such issues could result in damaged infrastructure from silting of dams or not enough water for generation. In addition it was mention that Malawi has no interconnection to other countries yet, and it is not foreseen in the near future due to lack of funding available.

Shortfalls of the Energy Policy of 2003 were mentioned. The Policy speaks of liberalisation of the energy market, which specifically implies the introduction of independent power producers into the market. However more than 10 years have
passed since the inception of the Energy Policy and no independent power producers have been implemented. The potential reason for such shortfalls is due to the monopoly that ESCOM holds over generation, transmission and distribution for the country. In addition, with ESCOM being government-owned, it receives various subsidies and thus the electricity tariffs are not cost reflective, preventing IPPs from competing.

The Malawian Government is busy undergoing various reforms including reforming the electricity sector. It is adopting a new power market structure to facilitate investments and independent power producers in the industry. The aim is to attract independent power producers to assist in meeting the shortfalls of the national demand. The government is hoping to achieve this with two approaches.

The first approach includes the unbundling of ESCOM into an entity for generation only and a separate entity for transmission and distribution. Within this transmission and distribution entity a single buyer position and a system market operator will be housed. The aim is to separate the existing company into two entities in order to increase transparency in the government body.

The second approach is the introduction of cost reflective tariffs. This should increase viability for other energy generators to enter the electricity market and compete against the ESCOM generation monopoly. The Malawi cost reflective tariff is to be made up of two components, a base tariff and an automatic tariff adjustment. In 2014 the concept of the base tariff was approved and came into effect. In January 2016 MERA implemented the automatic tariff adjustment which acts to restate the base tariff value in order to ensure it remains cost reflective when fluctuations occur such as inflation and exchange rate variations. Currently the cost reflective tariff amounts to approximately $0.12/kWh. The current tariff is to increase by 37% in order to obtain a tariff which is cost reflective. The Malawi government aims to increase the tariff over a four year period.

In terms of renewable energy policies and frameworks the Malawi Energy Regulatory Authority is working on the development of the independent power producer framework which should be complete by June 2016. In alignment with South Africa, Malawi aspires for a process similar to the Renewable Energy Independent Power Producers Procurement Programme, however they require small steps before attaining such a procurement process. The country does not have a Renewable Energy Policy and one is not being developed currently. It was stated that the country is first focusing on the unbundling process of ESCOM before elaborating on other areas of the electricity market.

**Summary**

The Malawian electricity sector is currently undergoing substantial reforms, and undertaking great strides in trying to open the market for independent power producers. Without any interconnectors to neighbouring countries, and none foreseen in the near future, the opportunities for independent power producers need to be made more accessible. Specifically if Malawi is to sustain the country’s growing energy demand and need for economic development, as well as increasing the access
to electricity for the population from a mere 10% (Breeze, 2014).

The Malawi market is one that should be closely watched to see how developments unfold and to determine the success of the government’s reform undertakings. The Malawian electricity sector has potential lessons which can be learnt by other countries in their respective electricity sectors.

### 3.2.5 Mozambique

**Status of the electricity supply system**

The country’s installed electricity capacity was approximately 2.64 GW in 2015. The dominant source of electricity generated in Mozambique comes from hydropower, accounting for 90% of the total electricity generation capacity (Global Climatescope, 2016). The electrification rate in the country is 12%-14% (Norton Rose Fulbright, 2013) and (Clean Energy Info Portal, 2012). While Mozambique has one of the larger generating capacities in the Southern African Power Pool, it is a net importer of electricity.

The electricity sector is based on a concession system, where entrants are required to tender for bids. Tariffs are not regulated. Bilateral agreements between generators and suppliers are the sole methods for the sale of electricity in Mozambique.

Competition in the sector is limited, where the state-owned utility, Electricidade de Moçambique, is the national transmission grid operator and also holds the balance of concessions for generation (vast majority from hydro sources), transmission, distribution and supply of electricity. While Electricidade de Moçambique owns the national grid, it does not control all of the domestic transmission and distribution networks. For example, MoTraCo, a joint venture between the Mozambican, South African and Malawian governments, facilitates the transmission of electricity from South Africa to the Mozał aluminium smelter. In other instances, smaller regional grids are controlled by the Ministry of Energy, through district governmental bodies.

Hidroeléctrica de Cahora Bassa produces most of the electricity consumed by the country. The dam Cahora Bassa is the largest on the Zambezi River. The majority stake in hydro facility is owned by the Mozambican State (85%), with the remaining shares held by the Portuguese Government. Around 75% of the electricity generated is exported to South Africa, which in turn transmits electricity back to the Mozał aluminium smelter in Mozambique. This electricity is sold to Electricidade de Moçambique at a higher rate than the rate at which South Africa purchases the electricity from Hidroeléctrica de Cahora Bassa.

The Electricity Act allows for third party access to the electrical networks. While the country has vast natural gas resources offshore, renewable resources and coal deposits which could be used for power generation, few projects have been realised in this regard. Private generators have recently developed one gas-fired plant of 110 MW and two coal-fired power plants, amounting to 900 MW.

Major barriers to entry, particularly those relating to access to finance and poor electrical infrastructure, are constraining
growth in the electricity sector and the country. Furthermore, low tariffs for electricity which do not reflect the costs of production are widely recognised as disincentives for private players in the space. Solar and wind technologies specifically cannot yet compete with the hydroelectric generation in Mozambique.

These barriers, in part, explain why there are no organised markets for the sale of electricity in Mozambique even though the country has abundant natural resources and is an operating member of the Southern African Power Pool.

As part of the Southern African Power Pool, Mozambique is interconnected to Zimbabwe to the west and South Africa and Swaziland to the south. While its interconnections offer the opportunity to trade electricity regionally, major problems persist with regards to the country’s outdated transmission and distribution networks (Mozambique Regional Gateway Programme, 2013). Various transmission upgrade projects are in the pipeline, however the current electrical infrastructure is not sufficient to meet demand. Growth and development in the country are seriously hampered by these constraints.

**Policies, legislation and regulations**

Resolution No. 10/2009, of 4 June 2009 (the Energy Strategy), is the current policy for the energy sector in Mozambique. The main policy goals for the electricity segment of the strategy include:

- to provide greater access to electricity and fuels to rural and peri-urban areas;
- to discourage the non-sustainable use of lumber as a source of energy;
- to stimulate the sustainable production of biofuels;
- to diversify energy sources; and
- to implement a cost-based tariff system, one which includes environmental externalities.

Mozambique also has a fairly recent policy (the Renewable Energy Policy) for the development of new and renewable energies with installed capacities of up to 10 MW. This policy aims to encourage investment in solar, wind, small-scale hydro, biofuels and biomass power, over a 15-year period.

The policy also calls for the establishment of laws to implement feed-in tariffs and create renewable energy-specific funding mechanisms through tax benefits and other exemptions to encourage investment in the sector. Currently however, no specific legislative frameworks exist for renewable energy projects and the implementation of the feed-in tariff structure is still under development.

The main framework legislation for the electricity sector is therefore the Electricity Act, promulgated in 1997. Regulation of this legislation is mostly adopted by the Council of Ministers in the form of Decrees. There are concerns that the current regulatory framework pertaining to the electricity sector is out of date, and revisions are anticipated in the near future (Law Business Research, 2015).

Mozambique does not have an independent regulator to govern the electricity sector. All activities in Mozambique relating to electricity generation, transmission, distribution and supply are regulated and
require licences from the Ministry of Energy, the Council of Ministers or local authorities. The National Transmission Grid Regulation regulates third party access to the electrical networks.

Concessions are provided following successful tender applications as per the Energy Concessions Regulation. The initial term of a concession is limited to 50 years for hydroelectric power projects and 25 years in all other cases.

Currently there is no prescribed form of power purchase agreement and the terms of supply, including tariffs, are subject to the relevant bilateral agreement between seller and purchaser. The Electricity Act does however require that tariffs are fair and reasonable, and that they ensure the least possible cost to consumers while providing a fair return on the capital investment to the developers.

**Electricity industry stakeholders**

The Mozambican electricity industry is regulated by the following bodies:

- Council of Ministers;
- Ministry of Energy; and
- National Electricity Council: Conselho Nacional de Electricidade (CNELEC).

In particular, the Ministry of Energy (in tandem with the Council of Ministers) has the authority to approve concession requests for the electricity sector. The Ministry is responsible for monitoring the activities of the concessionaires.

CNELEC is the regulatory body tasked with establishing relevant legislation for the electricity sector. The body also advises the Government of Mozambique on the granting of concessions for power projects, the establishment of electricity tariffs and the mediation and resolution of disputes between concessionaires, and between concessionaires and consumers in the supply of electricity. Although it has not yet fully assumed its role as such, it is anticipated that CNELEC will become the fully independent regulator for the electricity sector in Mozambique.

There are various other key stakeholders in the electricity sector, a number of which are highlighted below.

Between 1975 and 2005, Electricidade de Moçambique operated as a vertically integrated, quasi-monopoly of the generation, transmission and distribution of electricity in Mozambique. The state owned utility has since been unbundled, to a degree. It still however owns a single concession for the distribution and sale of electricity, the main transmission concessionaire, and is the national transmission grid operator. Electricidade de Moçambique has been working to reinforce the back-bone transmission network in Mozambique since 2003, using funding from a number of international development agencies. The successful culmination of transmission network reinforcement projects are widely recognised as key factors that could drive private investment in Mozambique’s electricity sector.

Hidroeléctrica de Cahora Bassa was established in 1975 following independence from Portugal. The company operates the Cahora Bassa hydro facility, located in the Tete province of Mozambique, which generates most of the electricity consumed by the country. Constructed in 1969 by the
Portuguese and South African governments at the time. Portugal initially owned 82% of the Cahora Bassa hydro facility, selling most of this equity to Mozambique in 2007. South Africa (Eskom) continues to purchase around 80% of the facility’s generated electricity, cheaply. Power is then transmitted back to the Mo zal aluminium smelter, at an increased rate, through the HVDC transmission line that Hidroeléctrica de Cahora Bassa co-owns with Eskom. Recent supply disruptions have fuelled growing concerns regarding the ageing infrastructure, questioning the reliability of supply from this source (Mail & Guardian Online, 2015).

Mozambique is addressing this concern, and one of the measures being taken is the development of small to medium electricity projects, particularly those with a focus on rural or off-grid electrification. Fundo de Energia is the governmental body established to fund the development, production and use of such technologies and projects. The fund receives its capital from donations and loans from international governments and non-governmental organisations, public funding allocated by parliament and levies on the sale of electricity by Electricidade de Moçambique.

As part of a 15-year strategy, the fund intends to provide solar power to 2.1 million people in rural areas. It provides financial guarantees to projects that support its objectives of promoting the conservation and sustainable management of power resources. To date, Fundo de Energia has supported a number of solar, biomass and mini-hydropower projects in Mozambique.

**Inputs from stakeholders during consultations**

According to the Fundo de Energia (Promethium Carbon, 2015), the Mozambican government supports the current trend to open up the electricity market in Southern Africa to participation by IPPs. A feed-in tariff is subsequently under development in the country, as are new regulations promoting mini-grids. In addition, the government is open to considering private sector participation in various operations and management functions that could be more efficiently undertaken by this sector. Lack of access to finance was however noted as a major barrier to entry into the electricity sector, where the costs of solar and wind technologies are not competitive with the hydroelectric generation in the country. Related to this barrier are the current national electricity tariff prices, which are not cost reflective. This further inhibits the growth and development of the IPP segment in the country.

Both Aggreko (Promethium Carbon, 2015) and the Department for International Development in Maputo (Promethium Carbon, 2015) noted however that the export of natural gas and hydroelectric power are important opportunity for growth in the sector.

**Summary**

The low electrification rate indicates that there are serious gaps in electricity supply and transmission in the country. These gaps present opportunities for private companies and recent developments in Mozambique’s regulatory environment support the participation of such entities and IPPs in the electricity sector. Currently however, the
market share remains dominated by the state owned, vertically integrated utility, Electricidade de Moçambique which supplies the country with power from hydro sources.

Gas and other renewable energy opportunities (such as hydro and solar) are present and accessible for development in the country. Lack of clarity regarding the regulatory frameworks, access to finance, poor infrastructure and non-cost-reflective tariffs in some instances were identified in the literature review and site visits as some of the major barriers to the development and growth of the electricity market in Mozambique.

3.2.6 Namibia

Status of the electricity supply system

Namibia’s installed capacity amounted to approximately 492 MW in 2015. With the country’s maximum demand at 657 MW, Namibia is heavily reliant on electricity imports from neighbouring countries. Electricity imports amounted to 58% (NamPower, 2015) of the country’s consumption in the 2015 financial year. Namibia generated 42% of its own power, with 98% of this power supplied by the Ruacana hydro power plant. The remaining 2% of local generation is produced by a coal power plant and emergency diesel power plants.

The vertically integrated electricity utility, Namibia Power Corporation (Proprietary) Limited, dominates electricity generation, transmission and trading in the country. Recently, with the intention of reforming the Namibian electricity market, regional electricity distributors (REDs) were created within the country. The REDs along with other electricity distribution entities are responsible for the distribution and supply of electricity.

Namibia’s electricity market model is currently in an evolutionary state. Historically it followed the single buyer model, with NamPower acting as the single buyer of electricity. However, currently it is a modified single buyer model, which permits small independent power producers, of less than 2.5 MW, to sell power directly to NamPower, regional electricity distributors and contestable customers. NamPower maintains exclusive rights to cross-border trade.

Namibia’s energy demand far exceeds its supply and thus there is an urgent need to exploit its abundant renewable energy resources for energy generation (Manyame, 2015). To date, Namibia has one independent power producer within its electricity market, the 4.5 MW Innosun-Omburu Solar PV plant which was commissioned in May 2015. The plant feeds power into the NamPower system.

In order to attract further investment by the private sector and independent power producers, Namibia has instituted out various enabling instruments. Namibia has developed a renewable energy procurement mechanism which is currently in implementation phase. The country is tendering for large wind power plants and concentrated solar power facilities, net metering was implemented for solar photovoltaics. Furthermore the Renewable Energy Feed in Tariff interim program was started to accommodate 14 independent power producers for landfill, small hydro, small wind and biomass (less than 5 MW). Projects have been initiated and support
measures such as soft loans and tax incentives are available.

Namibia is interconnected via the Southern African Power Pool to neighbouring countries and relies on imports of electricity from these countries. Namibia actively takes part in the SAPP trading market.

In 2015 Namibia imported 10% (NamPower, 2015) of its energy requirements from South Africa’s national utility Eskom. Namibia has however not managed to sign an extension of the Supplemental Supply Agreement between itself and Eskom. In 2015, Namibia began to operate under month-to-month extensions under which Eskom has reserved the right to curtail or even terminate supply in the event of load shedding in South Africa. This is a very unsustainable proposal for Namibia.

In addition, Namibia has secured significant supply of electricity through ZESCO. In 2015, Namibia imported 12% of its electricity from Zambia Electricity Supply Corporation. Through the Aggreko power supply agreement, Namibia imported approximately 14% of its electricity. This agreement is currently undergoing negotiations for an extension until the end of December 2016.

Through the Namibia - Zimbabwe Electricity Supply Authority - Zimbabwe Power Company, power supply agreement, Namibia imported about 21% of its electricity required in 2015. A further 1% of electricity was imported from the Electricidade de Mozambique power purchase agreement.

**Policies, legislation and regulations**

Namibia’s energy policy is articulated in the *White Paper on Energy Policy of 1998*. The goals of the Energy Policy which set a framework for the energy sector are as follows, (REEEP & REN21, Namibia 2014, 2014):

- effective governance;
- security of supply;
- social upliftment;
- investment and growth;
- economic competitiveness and efficiency; and
- sustainability.

The principle legislation related to the electricity sector in Namibia is the *Electricity Act, No. 4 of 2007*. The act prohibits generation, trading, transmission, supply, distribution, importation and export of electricity without a licence issued under this Act. A separate licence is required for each of these activities. A generation licence for an IPP must be obtained before commencement of construction of the project and prior to signature of a power purchase agreement.

The *Electricity Act, No. 2 of 2000* which has now been repealed by the *Electricity Act, No. 4 of 2007*, saw the establishment of the energy regulator within Namibia, the Electricity Control Board. This act expanded on the mandate of the regulator.

**Electricity industry stakeholders**

The Ministry of Mines and Energy is the custodian of Namibia’s energy sector, including the electricity sector. The Ministry is the policy maker responsible for the implementation of the *White Paper on Energy*
Policy of 1998, and is responsible for managing Namibia’s electricity sector by enforcing compliance with legal requirements of the energy regulations and legislation, such as the Electricity Act, No. 4 of 2007. The Ministry has the power to grant electricity licences, with recommendations obtained from the Electricity Control Board.

The Electricity Control Board is responsible for setting tariffs to regulate electricity generation, transmission, distribution, supply, import and export in Namibia. In addition, the Electricity Control Board advises the Ministry of Mines and Energy on the granting, repealing and modifying of licences. The Electricity Control Board is also responsible for promoting private sector investment in the electricity industry, in agreement with government policy (Norton Rose Fulbright, 2013).

The Namibian electricity sector is dominated by NamPower. The utility is also responsible for electricity trading within the Southern African Power Pool region and acts as the national electricity system operator (von Oertzen, 2012). It is a state-owned enterprise which reports to the Ministry of Mines and Energy and is regulated by the Electricity Control Board.

The regional electricity distributors along with other electricity distribution entities (such as local authorities, private entities, regional councils and NamPower) are responsible for the distribution and supply of electricity.

The Namibian power supply industry is represented in Figure 9.
**Inputs from stakeholders during consultations**

Stakeholder consultation in Namibia, with NamPower, provided valuable inputs regarding the country’s current electricity sector and developments within the system. It was mentioned that despite Namibia having approximately 492 MW of installed capacity, only about 372 MW is available due to the 120 MW coal plant undergoing refurbishments. This makes Namibia very dependent on electricity imports.

It was also established that NamPower has the first right of refusal for the purchase of some, or all, of the electricity generated by independent power producers in the country. If NamPower chooses to use only a portion of the electricity generated, then the independent power producer IPP can source a second, alternative off-taker for the surplus electricity. In this case, NamPower will charge wheeling rates to deliver the electricity to the customer.

NamPower is an active player on the Southern African Power Pool platform, specifically as an electricity purchaser. In the event where there are heavy rains, NamPower is sometimes able to sell electricity generated by the Ruacana hydro power plant on the market. Namibia prefers bilateral agreements to trading on Southern African Power Pool. The reason for this is that the electricity imported via bilateral arrangements is typically secure, and can assist the country mitigate unplanned outages.
In terms of receiving adequate imports from neighbouring countries, one of the major challenges facing Namibia relates to the inadequate interconnector capacities and the traffic on these lines. There are specific bottle-necks related to the Zambia-Namibia interconnector, where Zambia needs to strengthen the interconnector on their land or install a larger transformer. This will prevent Namibia from experiencing issues in terms of electricity shortages. A second barrier experienced by Namibia is the liquidity within the electricity supply industry. Thus, if more independent power producers were able to generate electricity, the liquidity would increase and could potentially solve this barrier.

**Summary**

While there are opportunities for growth in the Namibian electricity market, the sector remains constrained by various developmental barriers. For example, Namibia needs to develop specific renewable energy policies and frameworks to drive investment in renewable energy independent power producers. In addition, subsidies to support renewable energy uptake are required in order to mitigate tariff impacts (Manyame, 2015).

Another of Namibia’s barriers relates to the constraints on the interconnector lines to neighbouring countries. These constraints often hinder the amount of energy that Namibia can import its neighbours. In addition, lack of liquidity within the market is a further barrier. This could also be viewed as an opportunity for business developers as Namibia dramatically needs to reduce its reliance on electricity supply from neighbouring countries.

Namibia has however demonstrated its serious ambitions to liberalise the electricity market by choosing to follow a modified single buyer model. Furthermore, the creation of the regional electricity distributors within the country has opened the market to other players and allowed for the development of more cost reflective tariffs. These developments are positive signals for potential investors in the electricity sector in the country.

### 3.2.7 South Africa

**Status of the electricity supply system**

While South Africa has extensive coal reserves that continue to drive the electricity sector in the country, the use of renewable sources for electricity generation has increased dramatically in the last few years. Around 88% of the population has access to electricity (South African Government, 2015).

Eskom, a state owned utility, is the dominant generator in the country with a total nominal capacity of just over 45 GW (htxt.co.za, 2015). It generates approximately 95% of the electricity used in South Africa and approximately 45% of the electricity used on the continent (Eskom, 2015). Coal is the utility’s primary energy source (accounting for about 90% of its fuel mix), supplemented by the Koeberg nuclear station in the Western Cape, hydroelectric and pumped storage schemes and recently a 100 MW wind farm which contribute respectively to the utility’s total supply. Eskom’s footprint is comprised of large power stations that are concentrated in the interior of the country, near coal resources in Mpumalanga province (Eskom, 2015).
Eskom faces the challenge that most of its generation capacity is nearing the end of its life. The figure below shows the age of the Eskom power stations as in 2014:

![Figure 10: Age of Eskom power stations in 2014 (de la Rue du Can, Letschert, Leventis, & Covary, 2013)](image)

Whereas Eskom no longer holds exclusive rights to generation in the country, it continues to monopolise bulk electricity supply while new IPPs slowly develop their respective market shares. The new generation companies are facilitated by the Integrated Resource Plan (South Africa, 2013) which maps out the country’s projected energy needs and sources to meet the demand.

New entrants to the electricity generation sector include renewable energy producers, the majority of which have developed power stations under the Department of Energy’s Renewable Energy Independent Power Producer Procurement Programme (REI4P). The programme is based on a competitive bidding format, where prospective power producers submit bids which are adjudicated according to various criteria, price being the most critical.

The REI4P is guided by the provisions of the Electricity Regulation Act, which authorises the Minister of Energy to determine the scope of new energy generation under the programme. In 2011, the Minister made a determination stating that 3 725 MW of energy were to be generated from renewable energy sources under REI4P (Department of Energy, 2012). A further Ministerial determination was made in 2012, authorising an additional 3 200 MW (Minister of Energy, 2012) of renewable energy under the REI4P. The country’s Integrated Resource Plan makes provision for the generation of 17.8 GW of renewable energy by 2030, to be commissioned under the REI4P.

To date, around 79 projects have been approved in four Bid Windows under the Large Projects Programme, with further windows expected in the next few years (The Guardian, 2015). A Small Projects REI4P (for projects between 1 MW - 5 MW) was also launched and preferred bidders were announced under the first Bid Window in 2015. Further windows are expected, with the aim of generating 100 MW from small scale producers. Eskom is the single-buyer of electricity generated under the REI4P and grid connection
agreements between the IPPs and the utility are required as part of the development process.

Government (through the Department of Energy and National Treasury) has initiated a similar procurement programme for coal IPPs. The Coal Baseload IPP Procurement Programme aims to procure 2 500 MW of electricity from coal fired power stations, with individual bids capped at 600 MW per project. It is expected that the preferred bidders of the first bid window will be announced in early 2016. This programme includes options for a single buyer model, multi-buyer model and for cross border procurement. Shumba Energy has indicated its interest in building capacity in Botswana and selling electricity into South Africa.

While Government welcomes the entrance of new participants in the electricity sector, the country still experiences power shortages which affect the nation and neighbouring countries to which it sells electricity. While commissioning of new capacity (specifically large coal-fired power stations) is expected by early 2019, there have been numerous delays in implementing the new-build programme.

Eskom is the sole owner and operator of the national electricity grid, making it a vertically integrated utility which generates, transmits and distributes electricity to a wide range of customers and redistributors. The state entity distributes much of its power directly, along 368 331 km of transmission lines from the interior of the country down to coastal areas (Eskom, 2015), as shown in Figure 11.
Electricity prices have increased exponentially over the last 10 years and the country regularly faces shortages in electricity supply. There are a number of key factors that have led to these issues. According to the South African Department of Energy (Trollip, 2014), one of the major contributors is attributed to South Africa’s lack of significant investments in the energy sector over the past 20 years. Backlogs in infrastructure maintenance and developments are noted as key constraints in this regard, which have knock on effects on downtimes and the costs associated with repairs.

Another significant contributor to the crisis relates to arrears in metropolitan councils and municipalities accounts across South Africa. The amount owed to Eskom was reported at R10.8bn at the end of June 2014. Eskom told Parliament’s portfolio committees on energy and public enterprises that the outstanding debt was affecting the company’s bottom line and ultimately its sustainability (Business Day Live, 2014).

Furthermore, Eskom’s energy availability factor has been declining steadily since 2005, as indicated in Figure 12. The energy availability factor of a power plant is the amount of time that it is able to produce electricity over a certain period, divided by
the amount of the time in the period. The utility has been criticised for deferring its maintenance schedule on account of cash flow and budgetary constraints, and government has had to bail-out the state owned company on a number of occasions (Eye Witness News, 2014).

Additional power stations (from sources ranging from fossil fuels, renewables and nuclear) and major supplementary power lines are therefore being built to meet rising electricity demand in the country.

Eskom’s power station capacities as at 31 March 2015 (Eskom, 2015) are presented in Table 2. The difference between installed and nominal capacity reflects auxiliary power consumption and reduced capacity caused by the age of plant.

![Figure 12: Eskom’s declining energy availability factor (Promethium Carbon, 2015)](image-url)
Table 2: Eskom power station capacities

<table>
<thead>
<tr>
<th>Name of station</th>
<th>Location</th>
<th>Years commissioned first to last unit</th>
<th>Total installed capacity (MW)</th>
<th>Total nominal capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BASE-LOAD STATIONS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>COAL-FIRED (13)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arnot</td>
<td>Middleburg</td>
<td>1971-1975</td>
<td>3 754</td>
<td>35 721</td>
</tr>
<tr>
<td>Camden</td>
<td>Ermelo</td>
<td>2005-2008</td>
<td>1 561</td>
<td>1 481</td>
</tr>
<tr>
<td>Duvha</td>
<td>eMalahleni</td>
<td>1980-1994</td>
<td>3 600</td>
<td>3 450</td>
</tr>
<tr>
<td>Grootvlei</td>
<td>Balfour</td>
<td>2008-2011</td>
<td>1 180</td>
<td>1 120</td>
</tr>
<tr>
<td>Hendrina</td>
<td>Middleburg</td>
<td>1970-1976</td>
<td>1 893</td>
<td>1 793</td>
</tr>
<tr>
<td>Kendal</td>
<td>eMalahleni</td>
<td>1988-1992</td>
<td>4 116</td>
<td>3 840</td>
</tr>
<tr>
<td>Komati</td>
<td>Middleburg</td>
<td>2009-2013</td>
<td>990</td>
<td>904</td>
</tr>
<tr>
<td>Kriel</td>
<td>Balfour</td>
<td>1976-1979</td>
<td>3 000</td>
<td>2 850</td>
</tr>
<tr>
<td>Lethabo</td>
<td>Vereeniging</td>
<td>1985-1990</td>
<td>3 708</td>
<td>3 558</td>
</tr>
<tr>
<td>Majuba</td>
<td>Volksrust</td>
<td>1996-2001</td>
<td>4 110</td>
<td>3 843</td>
</tr>
<tr>
<td>Matimba</td>
<td>Lephalele</td>
<td>1987-1991</td>
<td>3 990</td>
<td>3 690</td>
</tr>
<tr>
<td>Matla</td>
<td>Bethal</td>
<td>1979-1983</td>
<td>3 600</td>
<td>3 450</td>
</tr>
<tr>
<td>Tutuka</td>
<td>Standerton</td>
<td>1985-1990</td>
<td>3 654</td>
<td>3 510</td>
</tr>
<tr>
<td><strong>Kusile</strong></td>
<td>Ogies</td>
<td>Under construction</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Medupi</strong></td>
<td>Lephalele</td>
<td>Under construction</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>NUCLEAR (1)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Koeberg</td>
<td>Cape Town</td>
<td>1984-1985</td>
<td>1 940</td>
<td>1 860</td>
</tr>
<tr>
<td><strong>PEAKING STATIONS</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>GAS/LIQUID FUEL TURBINE STATIONS (4)</strong></td>
<td></td>
<td></td>
<td>2 426</td>
<td>2 409</td>
</tr>
</tbody>
</table>

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2 Former moth-balled power station returned to service. Camden was originally commissioned in 1967-1969.
3 Due to technical constraints, the coal-fired power units at this station were de-rated.
4 Former moth-balled power station returned to service. Grootvlei was originally commissioned in 1969-1977.
5 Due to technical constraints, the coal-fired power units at this station were de-rated.
6 Dry-cooled unit specifications based on design back-pressure and ambient air temperature.
7 Former moth-balled power station returned to service. Camden was originally commissioned in 1967-1969. Due to technical constraints, the coal-fired power units at this station were also de-rated.
8 Dry-cooled unit specifications based on design back-pressure and ambient air temperature.
9 As above.
10 As above.
11 As above.
<table>
<thead>
<tr>
<th>Name of station</th>
<th>Location</th>
<th>Years commissioned first to last unit</th>
<th>Total installed capacity (MW)</th>
<th>Total nominal capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia</td>
<td>Cape Town</td>
<td>1976</td>
<td>171</td>
<td>171</td>
</tr>
<tr>
<td>Ankerlig</td>
<td>Atlantis</td>
<td>2007-2009</td>
<td>1 338</td>
<td>1 327</td>
</tr>
<tr>
<td>Gourikwa</td>
<td>Mosselbay</td>
<td>2007-2008</td>
<td>746</td>
<td>740</td>
</tr>
<tr>
<td>Port Rex</td>
<td>East London</td>
<td>1976</td>
<td>171</td>
<td>171</td>
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<tr>
<td><strong>PUMPED STORAGE SCHEMES (2)</strong></td>
<td></td>
<td></td>
<td><strong>1 400</strong></td>
<td><strong>1 400</strong></td>
</tr>
<tr>
<td>Drakensberg</td>
<td>Bergville</td>
<td>1981-1982</td>
<td>1 000</td>
<td>1 000</td>
</tr>
<tr>
<td>Palmiet</td>
<td>Grabouw</td>
<td>1988</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>Ingula</td>
<td>Ladysmith</td>
<td>Under construction</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>HYDROELECTRIC STATIONS (2)</strong></td>
<td></td>
<td></td>
<td><strong>600</strong></td>
<td><strong>600</strong></td>
</tr>
<tr>
<td>Gariep</td>
<td>Norvalspont</td>
<td>1971-1976</td>
<td>360</td>
<td>360</td>
</tr>
<tr>
<td>Vanderkloof</td>
<td>Petrusville</td>
<td>1977</td>
<td>240</td>
<td>240</td>
</tr>
<tr>
<td><strong>WIND ENERGY (1)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sere</td>
<td>Vredenburg</td>
<td>2015</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>SOLAR ENERGY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentrating solar power</td>
<td>Upington</td>
<td>Under construction</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>OTHER HYDROELECTRIC STATIONS (4)</strong></td>
<td></td>
<td></td>
<td><strong>61</strong></td>
<td></td>
</tr>
<tr>
<td>Colley Wobbles</td>
<td>Mbashe River</td>
<td></td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>First Falls</td>
<td>Umtata River</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Ncora</td>
<td>Ncora River</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Second Falls</td>
<td>Umtata River</td>
<td></td>
<td>11</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL POWER STATION CAPACITIES (23)</strong></td>
<td></td>
<td></td>
<td><strong>44 281</strong></td>
<td><strong>42 090</strong></td>
</tr>
<tr>
<td><strong>AVAILABLE NOMINAL CAPACITY</strong></td>
<td></td>
<td></td>
<td><strong>95.05%</strong></td>
<td></td>
</tr>
</tbody>
</table>

12 Pumped storage facilities are net users of electricity. Water is pumped during off-peak periods so that electricity can be generated during peak periods.
13 Use restricted to periods of peak demand, dependent on the availability of water in the Gariep and Vanderkloof Dams.
14 The Klipheuwel demonstration wind farm (3 MW) has been decommissioned.
15 Installed and operational, but not included for capacity management purposes.
Eskom recently reviewed its wheeling charges indicating that it is prepared to facilitate third party access to the grid. Eskom is also developing new Scheduling and Dispatch Rules, which will materially affect the way in which electricity is traded in the region and will contribute to clarifying processes around balancing. It was debated whether such rules could facilitate the inclusion of financial guarantees into licencing regulations.

This research found that Eskom cannot bar its clients from accessing its grid and buying power from IPPs (local or international) because the grid is considered to be critical infrastructure. In principle, both generators and loads can join SAPP. Examples discussed included City Power (could be a load as well generator through Kelvin Power Station) and MTN (which has excess capacity through some of its power projects). Local licencing noted as a challenge in addition to pricing constraints (i.e. municipalities cannot buy power at rates above Eskom rates) which do not take the business operating costs associated with electricity down-time into consideration.

Policies, legislation and regulations

South Africa’s electricity sector is underpinned by a number of key polices, legislation and regulations.

The White Paper on Energy Policy, 1998 (Act 34 of 2008), sets out a number of policy objectives such as increasing access to affordable energy services; improving energy governance; stimulating economic development; managing energy-related environmental and health impacts; and securing supply through diversity. The Paper also indicates government’s support for renewable energy technologies and intentions to reduce emissions in the country. The white paper promotes the introduction of independent power producers as a means to create competition in the electricity supply industry.

The White Paper had a strong focus on the introduction of independent players in the market:

- The distribution industry will accordingly be restructured into regional electricity distributors. Government will establish a transitional processes that will lead up to the establishment of independent regional electricity distributors (para 3.4.1);
- Government will consolidate the electricity distribution industry into the maximum number of financially viable independent regional electricity distributors (REDs) and while these distributors will be independent, they should co-ordinate on issues such as electrification planning, tariff issues and centralised bargaining. (para 7.1.3.3);
- The entry of multiple players into the generation market will be encouraged. Initially this policy will be implemented by obliging the national transmission system to publish National Electricity Regulator approved tariffs for the purchase of co-generated and independently generated electricity on the basis of full avoided costs... This policy will enable the economic exploitation of the significant available potential for nonutility generation in South Africa. Research has indicated that a technical potential of as much as 6 000 MW of non-utility generation could be exploited. Including environmental costs into the pricing
structure will encourage further developments of renewable and environmentally benign generation technologies such as hydro, wind, solar thermal, and waste incineration. (para 7.1.5.8);

- Government realises that competitive models and private sector participation hold the promise of benefits for electricity consumers and will therefore be closely following developments in countries implementing these new arrangements. Government will initiate a comprehensive study on future market structures; and

- For the South African electricity supply industry, in the light of the above, it is clear that the introduction of Independent Power Producers (IPP) will be allowed in the South African electricity market. Any fundamental market restructuring is likely to be delayed for a number of years while the distribution sector restructuring and the bulk of the electrification programme is undertaken. (para 7.1.6).

The Nuclear Energy Act, 1999 (Act 46 of 1999) provides for the establishment of the National Energy Corporation of South Africa and defines its functions, powers, financial and operational accountability, governance and management. The functions of this organisation include conducting research and development in the nuclear field, management of national nuclear research facilities, processing of nuclear material and to co-operate with stakeholders within nuclear research.

The White Paper on Renewable Energy, 2003, detailed South Africa’s target of producing 10 000 GWh of energy from renewable energy sources (specifically biomass, wind, solar and small-scale hydro) within 10 years from the date of the policy’s publication. The White Paper stated “Government will create an enabling environment to facilitate the introduction of independent power producers that generate electricity from renewable energy sources.”

The Electricity Regulation Act, 2006 (Act 4 of 2006) established a national regulatory framework for the electricity supply industry to be enforced by the National Energy Regulator of South Africa.

The National Energy Act, 2008 (Act 34 of 2008) was legislated to ensure that the country’s range of energy resources are available in sustainable quantities and at affordable prices by mandating the Minister of Energy’s responsibility to produce an Integrated Energy Plan. The Act provides for the increased use of renewable energies, contingency energy supplies, the holding of strategic energy feedstock and carriers, and adequate investment in energy infrastructure. It also legislates the South
African National Energy Research Institute, its purpose and structure.

The Integrated Resource Plan for 2010-2030\(^{16}\) was promulgated in March 2011. The aim of the Plan is to ensure electricity generation capacity to 2030 while integrating renewable energies into the mainstream energy economy to meet national emissions targets. The method in this regard involves the charting of the country’s energy needs against the proposed measures of supply. While coal is acknowledged as the dominant fuel source required to meet the country’s developing needs, the Plan also mandates the growth of the renewables sector and hence the development of the REI4P as the primary measure to achieve this goal.

Shortly after 2007/2008 power crisis DoE began preparation of several bills to address shortcomings in the Electricity Supply Industry. The draft Independent System and Market Operator Bill (ISMO Bill) was published for public comment in May 2011. The ISMO Bill’s goal is to restructure the ESI by inserting an ISMO as a new entity into the South African ESI.

The bill was not passed in parliament but the President mentioned that the legislation relating to the restructure of the ESI envisaged by the ISMO bill needs to be finalised during the State of the Nation Address in 2014. In addition, the Minster of Energy stated in her budget speech during 2014 that the Department of Energy will (DoE) would continue to consult and work on the ISMO Bill to provide a better regulatory environment for electricity providers in South Africa (Klees, 2014).

The functions of the new entity that would enter the ESI, the ISMO, was never clearly defined by government. Initially the government favoured an Independent System Operator (ISO) that would be an entity not linked to Eskom. The ISO was envisaged to handle all responsibilities with respect to planning, procurement and scheduling of generators that would balance the system demand and supply on a daily basis.

The choice of an ISO was changed to that of an ISMO shortly after the functions or responsibilities of the ISO were defined and found to be lacking. The ISMO’s core responsibilities can be divided into two distinct categories: System Operations and Market Operations. An additional secondary responsibility, Generation and Transmission Planning was also assigned to the ISMO.

System Operations entail overseeing and managing integration of the power systems in real time. The activities which relate to these responsibilities include electricity dispatch and operation of the integrated power system in a safe, efficient and sustainable manner.

Market Operations comprise of buying and selling electricity at a wholesale level. The ISMO would thus have to buy electricity from generators, traders and Independent Power Producers that are licenced to operate and selling to distributors (municipalities), traders and consumers of electricity. By assigning this task to the ISMO, the electricity supply industry will

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\(^{16}\) Developed by the Department of Energy in 2011 and updated in 2013. The plan is a ‘living document’ which will be updated on a regular basis, initially every 2 years or more frequently as required.
become more competitive as electricity could be bought from either Eskom or IPPs. The ISMO may only sell electricity to customers with whom it has signed a power purchase agreement.

Generation and Transmission Planning responsibilities require that the ISMO model scenarios, at suitable intervals which will assist the Minister of Energy with the Integrated Resource Plan. In addition, the ISMO will have to assist in the development and planning of the expansion of the transmitter of electricity in accordance with the forecasted electricity demand as outlined in the Integrated Resource Plan.

The ISMO will act as the single buyer of electricity from both state owned generation facilities and that of IPPs. All electricity, be it for commercial, wholesale or household use would have to be bought from the ISMO as it would act as the transmission subsidiary of Eskom.

The current status is that the ISMO bill is on hold and that there does not seem to be an intention by government to implement this legislation. An announcement was made in February 2015 that the ISMO Bill will be replaced with new draft legislation.

**Electricity Pricing**

South Africa’s electricity prices have traditionally been of the lowest in the world. This was mainly the result of the costing of the electricity sold on the basis of a depreciated capital base and the abundance of low cost coal. The price of electricity in South Africa compared to the rest of the world in 2010 is shown in the graph below:
The low prices were the direct results of twenty-five years of annual below inflation price increases. This is shown in the figure below:
Electricity industry stakeholders

There are a number of key regulatory bodies and electricity stakeholders in the South African environment.

The Department of Energy’s legislative mandate is to ensure secure and sustainable provision of energy for socio-economic development in South Africa. The Department is responsible for policy setting in the energy sector, and its mission is to regulate and transform the sector for the provision of secure, sustainable and affordable energy.

The Department of Public Enterprise is a key stakeholder because it is the shareholder representative for government (with oversight responsibility) within Eskom and various other State Owned Companies. The aim of the Department is to drive investment, productivity and transformation in the department’s portfolio of companies.

The National Energy Regulator of South Africa was established by the National Energy Regulator Act, 2004 to regulate the electricity, piped-gas and petroleum pipelines industries in terms of the Electricity Regulation Act, 2006 and the Petroleum Pipelines Act, 2003.

The National Nuclear Regulator is responsible for the protection of people, property and the environment against nuclear damage. Nuclear Energy Corporation of South Africa is a related entity, wholly owned by the state.

Eskom is the state-owned utility that dominates the South African electricity sector with regards generation, transmission and distribution of electricity to various customers and redistributors within South Africa.
Africa and across the continent. The utility is currently the single-buyer of electricity in the country. Eskom trades in the SAPP where it sells electricity to, and buys from, the member countries.

**Inputs from stakeholders during consultations**

While the South African government recognises the importance of increasing new generation capacity in the country, various obstacles to achieving this objective (on a significant scale) were identified by local stakeholders. Eskom, for instance, noted that even though the national grid is available to third parties, access has been limited because the costs of renewable energy generation are not yet competitive with the utility’s costs of generation (Promethium Carbon, 2015). Similarly, Standard Bank (one of the leading financiers of projects under the REI4P) also raised concerns that the current tariffs for renewable energy projects are comparatively low, which makes entry into the market less appealing for new participants (Promethium Carbon, 2015).

Concerns relating to grid limitations were also raised by Eskom, particularly with regards to the requirements for balancing that arise with the inclusion of non-base load electricity. Eskom also noted that cross-border supply, transmission and trading activities are currently limited, and proposed that a unified, regional regulatory framework could assist in facilitating these actions (Promethium Carbon, 2015).

In order to facilitate growth in the sector, the Department of Trade and Industry has a number of incentives available for IPPs. The Department has a dedicated investment promotion and facilitation unit that acts as a clearing house to assist foreign direct investment across all the *Industrial Policy Action Plan* sectors. Additional benefits offered by the Department of Trade and Industry include those related to operations located in demarcated Industrial Development Zones, tax incentives and various industrial and manufacturing funding programmes (Promethium Carbon, 2015).

In addition, the Industrial Development Corporation of South Africa (a state owned entity) actively supports the transformation of the electricity sector, as sanctioned by Government. The Industrial Development Corporation is mandated to develop industry, with a specific focus on developments that improve infrastructure and service delivery (Promethium Carbon, 2015).

One of the underlying trends identified during the course of the stakeholder engagements is the need for innovative tools which could be used to develop the national and regional electricity markets. Various potential financial instruments such as green bonds and contracts for difference were discussed with Standard Bank, as was the concept of an ‘electricity aggregator’ model which could decouple market price risk from IPP operations. This model was also discussed as an opportunity to stimulate growth through cross-border trade across Southern Africa with Cennergi, a prominent renewable energy IPP in the South African sector (Promethium Carbon, 2016).

The South African Independent Power Producers Association was also strongly in favour of measures to facilitate electricity trade across Southern Africa factors to enhance energy trading and the impact on
integration on a regional level were discussed (Promethium Carbon, 2016).

In contrast, consultation with the South African Wind Energy Association revealed that the body does not see meaningful value at this point in trading electricity, specifically on the day ahead market. The opportunity of long term power purchase agreements as measures to mitigate the risks of such trading was also discussed. Furthermore the potential of the IPP Office to function as a market operator was noted, as it already it coordinates the buying and selling of electricity between Eskom and IPPs (Promethium Carbon, 2016).

**Summary**

The regulatory environment in South Africa supports the participation of private companies in the electricity sector. As a result, an unprecedented number of IPPs (predominantly in the renewable segments) currently operate therein. This number is set to grow through additional bid windows under the large and small scale REI4Ps, as well as the initiation of the cogeneration and coal baseload IPP procurement programmes. While Eskom’s electricity supply shortages represent a risk in terms of energy security, they also present opportunities for IPPs to enter the local and regional markets even though the utility’s new build programme is under way.

Government is aware of the various challenges facing the IPP segment and has developed a number of incentives to assist electricity generators making the environment generally conducive for new business.

### 3.2.8 Swaziland

**Status of the electricity supply system**

Swaziland’s maximum demand was around 221 MW for the 2014 financial year. The country generates about 25% (Swaziland Electricity Company, 2014) of its own electricity requirements, mainly from state-owned hydro-power stations. Swaziland has four hydro-power plants in this regard, which generated approximately 302.6 GWh during 2014 (Swaziland Electricity Company, 2014). Swaziland is therefore heavily reliant on electricity imports from neighbouring countries. As a member of SAPP, Swaziland imports its electricity through this platform. Approximately 71.3% of electricity was imported in 2014, largely from ESKOM in South Africa, as well as from Electricidade de Mozambique in Mozambique.

Electricity is the backbone of socio-economic development in the country and provides numerous services to the population which directly enhances their quality of life. With the national electrification rate at only approximately 26% in 2012 (RERA, 2013), there is a great need to increase generation capacity within the country, along with increasing electrification. Swaziland is investigating options to increase the country’s installed capacity with an aim to reducing reliance on neighbouring countries. The generation mix currently under review includes thermal power, hydro, Solar (PV) and natural gas (Swaziland Electricity Company, 2014).
Policies, legislation and regulations

The electricity sector is guided by the Swaziland National Energy Policy 2002, Electricity Act, 2007 and the Energy Regulatory Act, 2007. Any entity generating, transmitting, performing the functions of integrated power system operator, distributing or importing and exporting of electricity into or out of the country is required to be licensed by the Swaziland Energy Regulatory Authority.

The promulgation of the Electricity Act of 2007, created the framework for IPPs to enter the national electricity sector, with licensing provided by the new regulatory body. However, the uptake of IPPs has been limited (REEEP International Secretariat, 2012). Government has developed a draft Renewable Energy and Independent Power Producer Policy in recognition of the country’s renewable energy potential. The main objectives of the policy are to (Government of the Kingdom of Swaziland, 2015):

- increase the utilization of Swaziland’s extensive local renewable energy resources;
- promote the deployment of independent power producer capacity to meet Swaziland’s electricity needs;
- stimulate and enable the deployment of embedded generation and mini-grid solutions to diversify Swaziland’s energy mix and increase energy access for rural customers;
- identify and facilitate access to various funding sources to overcome renewable energy financing constraints; and
- contribute to environmental sustainability and achievement of Swaziland’s green agenda (Government of the Kingdom of Swaziland, 2015).

These objectives will in turn help to increase the contribution of renewable energy to the local energy mix whilst at the same time reduce the country’s reliance on imported energy.

Electricity industry stakeholders

The Ministry of Natural Resources and Energy is the national energy authority within Swaziland. The Department of Energy, within the ministry, oversees the energy sector. The Ministry is the custodian of the policy and operating activities relating to the electricity sector.

The Electricity Act and Electricity Company Act of 2007 repealed the Electricity Act of 1963. This was the first reform within the Swaziland electricity sector. It resulted in the organisational restructuring of the national utility from a board (Swaziland Electricity Board) to a company, the Swaziland Electricity Company. The reform was undertaken to reduce the monopolistic nature of the national utility and preserve the state company as a more disciplined corporate entity. It also resulted in the establishment of a national energy regulatory body, Swaziland Energy Regulatory Authority.

The Swaziland Electricity Company dominates the national electricity sector, supplying and distributing the country’s power. Swaziland Electricity Company currently owns a monopoly on the import, distribution and supply of electricity via the national power grid, as well as the majority
of the country’s generation facilities. In addition, Swaziland Electricity Company is authorised to be the sole transmitter of electricity within the country (Khoza, 2015).

Ubombo Sugar limited is another key player within the Swaziland electricity sector. It is the first and only Independent Power Producer to be fully licensed as a power generating company within Swaziland (Nkambule, 2014). Ubombo Sugar limited generates electricity in the sugar industry through co-generation, using bagasse and wood chips as fuel. Swaziland Electricity Company has purchased an exclusive right to buy surplus electricity from Ubombo Sugar limited.

These players operate under licences issued by the Swaziland Energy Regulatory Authority. The regulator is mandated to regulate the electricity supply industry and ensure the security of electricity supply of the country through the issuance of licences, regulation of electricity tariffs and ensuring the quality of supply and services.

Inputs from stakeholders during consultations

Energy constraints are widely recognised as barriers to socio and economic development in the country. The Swaziland Electricity Company therefore has plans to develop 493 MW additional generation capacity by 2022, from independent power producers fuelled by solar, hydro, coal and biomass (Promethium Carbon, 2015).

The regulatory frameworks are being updated to support this approach. While Swaziland’s Integrated Resource Plan is not yet complete, the Ministry of Natural Resources and Energy noted that the recently revised Grid Code allows for third party access, and a new Energy Policy and Independent Power Producer framework are expected to be published in 2016. Swaziland’s aim is to export power to SAPP (Promethium Carbon, 2015).

The Swaziland Electricity Company reiterated the country’s position on increasing its generation capacity, noting that the utility is aiming to grow the electrification rate to 100% by 2022 (Promethium Carbon, 2015).

Summary

With a maximum demand of 221 MW, Swaziland has a very small electricity sector. The country is highly dependent on imports from neighbouring countries and will become more so if electrification rates increase and no new power plants are installed. A positive aspect is that the necessary policies, such as the draft Renewable Energy and Independent Power Producer Policy, are slowly being put in place to unlock the potential for IPPs within the market. Swaziland is focussed on reducing the country’s reliance on its neighbours and thus significant room exists for IPPs.

Some of the main challenges for the energy sector in Swaziland are security of supply, low rural electrification and high dependency on energy imports.

3.2.9 Zambia

Status of the electricity supply system

Zambia has a total installed electricity generation capacity of 2.35 GW. Electricity is primarily generated by means of hydropower stations (96% of total electricity
production) while the remainder is produced by means of diesel generators (AFRICAINVEST, 2016). The current electrification rate in Zambia is approximately 20% of the population (The World Bank Group, 2016). During 2014, Zambia imported 12.8 GWh of electricity and exported 1 256 GWh of electricity from the SAPP and other bilateral markets (Energy Regulation Board, 2014).

In the event that a drought occurs within Zambia, electricity generation is severely crippled due to insufficient water throughputs at the hydropower stations.

The current generation capacity is sufficient for the time being (during periods without droughts) but at an electricity demand increase of between 150 MW and 200 MW per annum, additional generation capacity has to be developed to meet the rising demand.

Zambia plans to meet the rising electricity demand with additional hydropower installations, improvement and expansion of existing hydropower installations, addition of solar PV farms and the possible addition of geothermal power stations.

**Policies, legislation and regulations**


All electricity related activities which require licensing are enforced by the Energy Regulatory Board (ERB) of Zambia according to the stipulated regulatory instruments. In the event that any undertaking wishes to purchase power from outside of Zambia, they shall apply to the minister for approval and shall submit to the minister a full report on the proposal.

**Electricity industry stakeholders**

The ministry of Energy and Water Development of the Republic of Zambia is responsible for any energy related concerns of the country. The energy regulatory board (ERB) in Zambia is the only regulatory body which governs electricity related activities. The primary stakeholders in the electricity industry in Zambia are ZESCO, CEC and LHP.

The Zambian electricity system is dominated by three companies: The Zambian Electricity Supply Corporation (ZESCO), Copperbelt Energy Corporation (CEC) and Lunsemfwa Hydropower Company (LHP).

ZESCO, the Zambian national utility, is a vertically integrated government owned electricity utility that generates, transmits, distributes and supplies the majority electricity within Zambia. CEC is an independent transmission company (ITC) that transmits and distributes electricity throughout Zambia and sub-Saharan Africa. LHP is an independent power producer (IPP) that generates electricity which they currently sell to ZESCO.

**Inputs from stakeholders during consultations**

While visiting Zambia, Promethium Carbon met with the Copperbelt Energy...
Corporation and Lunsemfwa Hydro Power Company. CEC was the first non-national utility to be granted SAPP membership while LHO was the first IPP to gain a generation licence within Zambia.

LHP’s main reason for joining SAPP was to gain access to information with respect to the regional and Southern African energy markets. By becoming a member of SAPP, LHP gained access to the shared knowledge of the other IPPs and the national utilities. This allowed LHP to strategically plan for future expansion and gain a better understanding of how the regional energy markets are evolving.

A key point that came out from discussions with the local stakeholders is that to provide more reliability and security in the Zambian electricity generation and reticulation system, a combination of both fossil and renewable energy sources would be required. Zambia relies on hydro power stations to meet their electricity demands. In the event that a severe drought occurs in Zambia, electricity supply would be constrained. An investment in fossil fuel sources would thus provide a reliable electricity generation source during droughts (Copperbelt Energy Corporation, 2015) (Lunsemfwa Hydro Power Company, 2015).

CEC purchases electricity on the SAPP market and provides any spare transmission capacity for other members of SAPP on the market to utilize should the need arise. In the event that insufficient generation capacity is available from the national utility or if electricity cannot be purchased at a reasonable price from the market, CEC makes use of their own generation capacity to meet their supply requirements at the mines.

By allowing IPPS and ITCs to join SAPP they gain access to information with respect to the regional and Southern African energy markets. This promotes regional growth and market liquidity as a greater number of members can pool both their generation and transmission capacity to growth the electricity supply industry in the Southern African region.

**Summary**

Zambia’s current electricity supply industry is able to meet the required demand in the event that the country does not become drought stricken. As the majority of electricity is generated by means of hydro power stations, droughts lead to significant demand deficits which in turn requires Zambia to import electricity through the SAPP. The majority of electricity generated in Zambia is consumed by the industrial sector (mainly mines). Approximately 20% of Zambia’s population have access to electricity, the majority of people still make use of wood and coal as their primary energy source.

Local stakeholders believe that the greatest way to expand the current electricity supply industry in Zambia would be to make use of a combination of both renewable energy sources and fossil fuel sources. As Zambia’s electricity is currently predominantly generated by means of renewable hydro power, the electricity supply industry is vulnerable to droughts. If fossil fuel based electricity generation is added to the current electricity generation fleet, it would add robustness and flexibility to Zambia’s electricity generation.

Electricity is still primarily supplied by the Zambian national utility, but the national utility is flexible in terms of allowing both
IPPs and ITCs to participate in the market. Currently, both the IPPs and ITCs have to sign bilateral agreements with the national utility if they wish to form part of the Zambian electricity supply industry. Zambia has however shown reforms towards a liberalised electricity supply industry as it has allowed both and IPP and ITC to become members of SAPP (The national utility in the country from which the IPP or ITC originate has the greatest influence in allowing the applicant to join SAPP).

3.2.10 Zimbabwe

Status of the electricity supply system

Zimbabwe’s current available generation capacity is approximately 1 GW. The electricity is primarily generated by five power stations. The Kariba hydropower station is the primary source (468 MW) while the remainder is produced by four thermal power stations: Hwange (416 MW), Munyati (26 MW), Bulawayo (19 MW) and Harare (19 MW). The Kariba hydropower station is currently not producing at full generation capacity due to water shortages in the Kariba Dam. The four thermal power stations were commissioned between 1946 and 1958 (The Financial Gazette, 2016). The current age of the power stations result in frequent breakdowns (as they are nearing end-of-life). This results in severely reduced available generation capacity.

The current electrification rate in Zimbabwe is approximately 40.5% of the population. The large electricity shortage has resulted in Zimbabwe signing a firm contract with Mozambique’s Hydro Cohora Bassa for 500 MW worth of imported electricity capacity. In 2016, Zimbabwe signed an agreement with the South African National Utility, Eskom, to import 300 MW of electricity due to declining available generation capacity. No electricity is currently exported from Zimbabwe to any neighbouring countries (MBendi Information Services, 2016).

Policies, legislation and regulations

Policies related to electricity generation, transmission, distribution and supply are implemented in the Electricity Act and the Electricity Amendment Act which were published in 2002 and 2003 respectively by the Zimbabwean government. Legislation and regulations applicable to electricity related activities are published in the Energy Regulatory Authority Act, 2011 (Chapter 13:23).

The Energy Regulatory Authority Act empowers the Zimbabwe Energy Regulatory Authority (ZERA) with a mandate to regulate the procurement, production, transmission, distribution, supply, importation and exportation of energy derived from any source. Licenses related to the aforementioned activities are published and enforced by ZERA according to the stipulated regulatory instruments that are outlined in the Energy Regulatory Authority Act.

Electricity industry stakeholders

The Zimbabwe Energy Regulatory Authority (ZERA) governs electricity and all other energy related activities in Zimbabwe. The primary stakeholders in the Zimbabwean electricity industry are Zimbabwe Electricity and Supply Authority (ZESA), Zimbabwe Power Company (ZPC) and Zimbabwe Electricity Transmission and Distribution Company (ZETDC).
ZESA, the Zimbabwean national utility, is a vertically integrated government owned electricity utility that generates, transmits, distributes and supplies the majority electricity within Zimbabwe.

The majority of electricity in Zimbabwe is produced by ZPC (the electricity generation subsidiary of ZESA) while a small portion of electricity is produced by four of 22 registered IPPs in Zimbabwe (ESI AFRICA, 2015). All registered IPPs in Zimbabwe are required to sell electricity to ZESA.

Electricity transmission and distribution is managed solely by ZETDC (the electricity transmission and distribution subsidiary of ZESA).

**Inputs from stakeholders during consultations**

During the visit in Zimbabwe, Promethium Carbon met with four stakeholders: The British Embassy Harare, Counterfactual, Confederation of Zimbabwe Industries (CZI) and the Zimbabwe Electricity Supply Authority (ZESA).

Zimbabwe is currently crippled by daily load shedding as the national utility can only produce approximately 50% of the total installed generation capacity. Half of Zimbabwe’s electricity is produced through hydro power while the other half is produced by means of thermal power stations and IPPs. (British Embassy Harare, 2016) (Counterfactual, 2016) (Confederation of Zimbabwe Industries, 2016).

The aging infrastructure of Zimbabwe’s thermal generation fleet leads to increased maintenance and downtime. This further reduces the available generation capacity of the national utility. Electricity production is severely constrained in Zimbabwe. The recent maintenance and repairs required at the Kariba dam and the current drought in the Southern African region caused by the El Nino effect have worsened the situation. The lack of available generation capacity has forced the national utility to make use of diesel generation to mitigate the current electricity shortage (British Embassy Harare, 2016) (Counterfactual, 2016), which is considerably more expensive than the hydro and fossil fuel power plants.

To cover the costs associated with the diesel based electricity generation and maintenance of the current generation fleet, the national utility has opted to increase the tariff by 49%. Multiple stakeholders in Zimbabwe expressed their concerns with the severe increase in the tariff stating that it would lead to further degeneration of both economic and industrial growth in the region. The severe increase in the tariff has led to certain stakeholders considering the construction and operation of their own private generation facilities as further tariff increases would lead to total collapse of operations (British Embassy Harare, 2016) (Counterfactual, 2016) (Confederation of Zimbabwe Industries, 2016).

Investors are not willing to invest in large scale electricity supply industry projects in Zimbabwe due to Zimbabwe’s current financial crisis. The low credit rating of Zimbabwe and lack of confidence in the current government are the two largest concerns that deter investors. The bankability of the electricity supply industry’s expansion projects in Zimbabwe are thus extremely low as no investors are willing to take the risk of supplying off-takers as an acceptable return on investment cannot be guaranteed. (Confederation of

To regain investor confidence in Zimbabwe, the reliability of the Zimbabwean electricity supply industry has to be improved. Suggestions made by stakeholders included reducing theft of electricity (which is a major concern in Zimbabwe at the moment), improving the maintenance and repair programmes for existing generation fleet, prioritise expansion of generation capacity, and present cost reflective tariffs. A critical point made was that the transmission and distribution systems should be regulated and controlled by a state owned entity and that this entity should allow third part access to the grid to enable independent power producers to access regional markets (Counterfactual, 2016) (Confederation of Zimbabwe Industries, 2016).

Neither the World Bank Group nor DFID are funding electricity generation projects from fossil fuel based technologies in Southern Africa. DFID however, have an Africa Energy funding initiative for off-grid energy projects in the Southern African region. DFID also mentioned that in the last 12 months, there has been a large shift to solar PV generated electricity in Zimbabwe. The “Eco Power Initiative” rents local resident’s roof space to produce electricity (British Embassy Harare, 2016).

Electricity can be wheeled in Zimbabwe but it makes use of a single buyer model. Regulations do not restrict wheeling but due to the financial state of Zimbabwe investors are not willing to generate electricity for off-takers other than the national utility (Confederation of Zimbabwe Industries, 2016).

The stakeholders which were consulted stated that incorporating IPPs into SAPP will stimulate electricity supply industry growth in the region. IPPs struggle in Zimbabwe due to the average cost of generation for the national utility remains lower than the proposed tariffs of the IPPs to sell to other off-takers or wheel electricity through the national utility’s network. The electricity that is currently generated by IPPs and sold to the national utility, is pooled with the electricity that is generated through other generation sources. This levels off the electricity cost making the tariff of the national utility more attractive than that of an IPP. All PPA’s are bilateral agreements at the moment. If SAPP could act as a counter party it would assist in creating different mechanisms to finance the offtake of electricity from IPPs (Confederation of Zimbabwe Industries, 2016) (Zimbabwe Electricity Supply Authority, 2016).

The stakeholders also confirmed that SAPP would be the ideal place to house a regional electricity market that would aid in reforming the electricity supply industry in the Southern African Region. Members of the Zimbabwean industry would be interested in becoming traders within the SAPP market (Confederation of Zimbabwe Industries, 2016) (Zimbabwe Electricity Supply Authority, 2016).

Most of the electricity traded in SAPP markets are through bilateral trade agreements. The Intraday and Day Ahead Market the two most active markets in SAPP. A larger pool of surplus power would open the market for increased volumes of electricity being traded. This would enable better utilization and growth of the market. The Zimbabwe Electricity Supply Authority stated that more projects related to
upgrading the power pool and regional infrastructure are required to encourage development in the Southern African region. The SAPP market is constrained due to underdeveloped regional transmission networks (Confederation of Zimbabwe Industries, 2016) (Zimbabwe Electricity Supply Authority, 2016).

Regional planning was proposed whereby all projects in the region are pooled and then ranked accordingly without considering the physical location within the region. This would facilitate regional integration of the Southern African region’s electricity supply industry. The resources in the region should be pooled which would allow a combination of generation technologies that would facilitate offsetting emissions in the region and facilitate market growth and liquidity (Zimbabwe Electricity Supply Authority, 2016).

**Summary**

As with most of the other developing countries in the region, Zimbabwe is struggling to increase growth in the electricity supply industry due to a lack of funding and aging generation, transmission and distribution infrastructure. The current financial status of Zimbabwe paired with low investor confidence in the government and a low credit rating discourage any form of investment within Zimbabwe. To improve investor confidence, the Zimbabwean stakeholders stated that the reliability in the electricity supply industry has to be improved.

The main concerns raised by the stakeholders relating to the reliability of the Zimbabwean electricity supply industry included cost reflective tariffs, reducing theft of electricity and allowing the transmission and distribution network to be regulated by a state owned entity and in future be opened up regionally.

The Zimbabwean national utility has a monopoly on all electricity supply industry services. IPPs are encouraged in Zimbabwe but currently they sell the electricity which they generate to the national utility for projects to be economically viable. The current cost of generation for new projects combined with the additional wheeling charges of the national utility make selling electricity to a dedicated off-taker other than the national utility non-viable. The rate of market liberalisation in Zimbabwe could thus considered to be slow. The national utility does however believe that IPPs would stimulate both electricity supply industry growth in Zimbabwe and in the Southern African region if they are allowed to join SAPP. If SAPP could act as a counter party it would assist in creating different mechanisms to finance the offtake of electricity from IPPs and act as a mechanism to increase the liquidity in the SAPP market. Members of the Zimbabwean industry indicated that they would be interested in becoming traders in the SAPP market.

Most of the electricity traded in SAPP markets are through bilateral trade agreements. The Intraday and Day Ahead Market the two most active markets in SAPP. A larger pool of surplus power would open the market for increased volumes of electricity being traded throughout the region.
4 International Developments in Electricity Market Liberalisation

4.1 UK Market

Electricity market reform in the United Kingdom started when the state-owned Central Electricity Generating Board (CEGB) was unbundled with the passing of the 1989 Electricity Act. This allowed for the CEGB to be privatised. It also granted consumers above 1 MW open access to the grid. The Electricity Act also gave rise to the launch of the trading Pool.

After unbundling, the electricity sector in England and Wales consisted of a transmission system operator, three generation companies and 12 regional electricity companies. The CEGB was divided into four bodies: National Power, PowerGen and Nuclear Electric and the transmission system operator, National Grid.

Figure 15: Structure of the UK electricity industry before privatisation (Simmonds, 2002)
The electricity prices in the Pool were lower than expected, right from the initial operation of the Pool. This was primarily as a consequence of the structure of initial electricity supply contracts. Prices started to increase between 2003 and 2004.

The Pool was replaced by the New Electricity Trading Arrangements (NETA) in 2001. NETA was a fundamental change of market design; the key feature for enhancing competition was to change the trading arrangements from the obligatory central dispatch in the Pool to decentralised bi-lateral trading through NETA. The only formal market in NETA is the balancing market, which determines prices through an auction with discriminatory pricing rather than uniform auction prices used by the Pool. NETA’s discriminatory auction price means that accepted bids will be paid at the bid price. This is fundamentally different from the pricing principles in most other electricity trading arrangements, in which prices are determined by the price in the marginal bid.
Various studies have been done to assess the impact of the British deregulation on the electricity industry. One such study used OECD grading system. The OECD grade use a band 0-6, where 6 means that the country is very far from achieving the result of fully open and free market economy. The process of privatisation in the UK electricity industry (Soukaina & Amal, 2015) is shown in the graph in Figure 18.

The UK market has developed to include a financial electricity market. This market trades contracts for difference (CfDs). CfDs are intended to provide long-term revenue stabilisation to electricity generators, allowing investments to come forward at a
lower cost of capital and therefore at a lower cost to consumers.

CfDs in the UK support new investments in all forms of low-carbon generation (renewables, nuclear power and Carbon Capture and Storage) and have been designed to provide efficient and cost-effective revenue stabilisation for new generation, by reducing exposure to the volatile wholesale electricity price. CfDs require Generators to sell energy into the market as usual but, to reduce this exposure to electricity prices, CfDs provide a variable top-up from the market price to a pre-agreed 'strike price'. At times of high market prices, these payments reverse and the generator is required to pay back the difference between the market price and the strike price thus protecting consumers from overpayment.

The CfD is implemented through a bilateral contract between the Generator and the Low Carbon Contracts Company (LCCC).

CfDs will be available to a wide range of low-carbon technologies supporting investment and encouraging competition as the UK makes the transition to a low-carbon generation mix.

![Operating principle of CfDs](image)

*Figure 19: Operating principle of CfDs (Low Carbon Contracts Company, 2015)*
4.2 Norway

Norway was one of the first countries to deregulate and liberalise its electricity sector. The reform was done through the enactment of the Energy Act in 1990 (Bye & Hope, 2005). The main motivation for electricity market reform was an increasing dissatisfaction with the performance of the sector in terms of economic efficiency in resource utilisation, particularly with regard to investment behaviour, which caused capacity to exceed demand considerably.

Simultaneous market liberalisation initiatives in other countries, such as New Zealand and the UK, increased awareness of the need for electricity reform. Developments in these countries influenced the design and implementation of the Norwegian legislation.

Prior to the start of the reform, Norway had about 70 power-producing companies and 230 network owners. There was some vertical integration between power generation and the network, particularly at the regional and local levels, but many power producers were not integrated. The largest of them, Statkraft, accounted for approximately one-third of total generation. About 85 percent of the electricity system was publicly owned by local, regional and state-owned companies. The power production capacity of the energy-dimensioned hydro system in 1991 was approximately 108 TWh in a normal year, of which the energy-intensive industries consumed approximately one-third. Annual production could vary considerably from year to year because of the variable nature of water inflow to the hydro system.

The main elements of the Norwegian electricity market reform were, as introduced by the 1990 Energy Act are as follows:

- The design was built on the established spot market model for trade in interruptible power. It was structured as a regular spot market incorporating demand. The market was open immediately to all potential buyers, including households. The market was initially organised as a separate legal entity within the transmission company Statnett;
- Common carriage principles requiring access to the network system on a transparent and non-discriminatory basis facilitated market-based trade;
- The dominant, state-owned and vertically integrated company, Statkraft, was split vertically into two separate legal entities: the generating company, Statkraft SF, and the transmission company, Statnett SF. For the other vertically integrated power companies, companies were separated into generating or trading divisions and network divisions for accounting purposes, but were not split into companies with separate legal identities;
- The network companies were subject to natural monopoly regulations designed to achieve economic efficiency in network operations. The regulatory regime was administered and enforced by the sector-specific regulator, the Norwegian Water Resources and Energy Directorate (NVE), on the basis of rate-of-return regulation; and
- The market liberalisation reform was implemented without changes in ownership, because the privatisation of
the power sector was politically unacceptable. This contrasted with the UK, where privatisation was implemented before market liberalisation. There, privatisation was considered a prerequisite for successful electricity market reform from an economic efficiency perspective.

A complete market-based power system should be equipped with markets for the following basic requirements or functions (Bye & Hope, 2005):

- markets for trade in electricity;
- markets and instruments for risk hedging in accordance with risk preferences;
- short-term markets for production capacity and balancing supply and demand; (d) markets for investment in new capacity; and
- markets for trade in environmental energy products (such as green-certificate markets).

Nord Pool is a non-mandatory power pool. It started in 1993 as a power exchange for Norway. In 1996, the exchange area was widened to include Sweden. Finland followed in 1998, Western Denmark followed in 1999 and Eastern Denmark in 2000 (Nordic Energy Regulators, 2010).

Nord Pool organises approximately 40 percent of the total trade in electricity in the Nordic power market. The rest is organised on the basis of bilateral contracts. Nord Pool’s share in total trade on the organised spot market is a useful indicator of the liquidity of the market. The supply and demand of the Nordic market after market liberalisation is shown in Figure 20.
The Nordic market after market liberalisation is structured as shown in Figure 21.
When trading started on the Nord Pool market, only a physical day-ahead market was present. A financial market with clearing services was introduced soon thereafter.

Some years later Nord Pool’s clearing services were also made available for OTC trade and bilateral trade in exchange-listed contracts. The Nord Pool product development has meant that exchange-listed contracts now also include options, contracts-for-difference (CfD) regarding price area differences, peak-load contracts and year contracts up to five years after the current year (Nordic Energy Regulators, 2010).

The markets operating in the Nord Pool at the moment are (Stavseth, 2013):

- Elspot market (Nord Pool Spot): Day-ahead auction. Equilibrium between supply and demand is established for delivery the following day;
- Elbas market (Nord Pool Spot): Intraday market with continuous trading up to one hour before delivery. Approximately 34 hours;
- Regulating market (Transmission System Operators (TSOs)): Operated by the respective TSOs where final adjustments are made to achieve balance between supply and demand. Price set after delivery by TSO, participant is price taker; and
There are certain aspects of the Nordic financial market that contribute to its efficiency:

- The four Nordic countries function to a large degree as a common electricity market, with a substantial combined consumption which is the third largest market within EU after Germany and France;
- About 70% of the consumption in the Nordic countries is traded day ahead on Nord Pool Spot. This gives a solid base to the reference price;
- The reference price is the system price, which is the price that would be the price if there were no congestions within the Nordic area; and
- No physical delivery is required. The settlement of the financial market is totally financial.

### 4.3 Germany

In the late 1990s, Europe adopted a number of directives created to open up EU member state domestic electricity and natural gas markets. European power markets were transformed in 1996 following the European Union Electricity Directive. This directive was subsequently replaced by successive directives in 2003 and 2009 further safeguarding principles of a level power-generation playing field, non-discriminatory transmission and distribution charges and third-party network access rights. These directives enshrine the principles of an internal energy market and customer choice (Germany Trade and Invest, 2016).

Germany’s domestic electricity market was fully liberalized in 1998 (Energy Industry Act). Prior to liberalization, a defined supply area was typically served by a single supplier (e.g. local utility) operating in near-monopolistic market conditions.

The German energy market currently has four vertically integrated suppliers – Amprion (formerly RWE), EnBW Transportnetze, TenneT Transmission System Operator (formerly E.ON), and 50Hertz Transmission (formerly Vattenfall Europe). These 4 companies supply
approximately half of the market. A single-price settlement scheme with quarter-hour settlement periods is implemented in the four control areas supplied by the four main suppliers, with the European Energy Exchange (EEX) acting as a common point of reference for domestic electricity prices.

More than one thousand market participants are active in the fully liberalized German electricity market, with new market actors – who do not own power plants or supplier networks - successfully entering the domestic electricity market.

The creation of the Bundesnetzagentur ("Federal Network Agency") regulatory office for electricity, gas, telecommunications, post and railway markets in 1998 further opened up the power market, thanks to the introduction of a raft of measures promoting competition including legal unbundling for suppliers with more than 100 thousand customers. The agency is responsible for ensuring non-discriminatory third party access to power networks and control fees charged by Germany's transmission system operators.

**Figure 23: German electricity market value chain**
4.4 European market

The European market reform started with a directive in 1996, followed by refinement in 2004. The directives forced EU member states to move away from monopolistic, vertically integrated, electricity supply industries towards deregulated electricity markets. These markets are characterised by competitive wholesale generation, free entry of new plants, unbundled transmission and distribution systems, regulated non-discriminatory tariffs, competitive final supply markets and regulated trade across international inter-connectors (Pollitt, 2007).

Table 3: European electricity market reform

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Analysis of the European deregulation (Pollitt, 2007) identified three aspects of best practice in regulatory reform:

- Form of regulation. This relates to the powers and responsibilities of the regulatory agency;
- The process of regulation. This relates to the way in which this agency carries out its activities; and
- The outcome of regulation, which relates to the measurement of success for a regulatory agency. In each case they suggest metrics for best practice.

The European Commission identified a number of issues to consider in electricity market reform (European Commission, 2006):

- Improvements of security standards in the context of critical infrastructures;
- Integration of both central and distributed generation;
- Integration of innovative technologies into existing grids;
- Harmonisation of equipment standards to allow “plug-and-play”;
- Increased funding for large research incentives, including public and private sharing;
- The impact of neighbouring electricity systems on the European network; and
- Higher education and skills issues.

One of the outcomes of electricity market deregulation is the privatisation of the industry. The level of privatisation in the European Union is shown in Figure 25.
4.5 Japan

Electricity sector reform started in Japan in April 1995 with the revised Electric Utilities Industry Law (TEPCO, 2014). This law opened the way for Independent Power Producers to enter the power generation market. It made it possible for electric power companies to procure electricity from other businesses in addition to other electric utilities. Specified Electric Utilities (businesses using their own generation, transmission and distribution facilities to supply electricity directly to customers in defined areas) also gained market access.

The electricity tariff system was revised at the same time with the introduction of the yardstick assessment method for tariff revision approval, optional contract provisions, fuel cost adjustment system, and management efficiency review.

The Electric Utilities Industry Law was revised again in 1999. This extended market liberalization to cover extra-high-voltage customers (20,000 V or higher, with contracted power of at least 2,000 kW as a rule) from March 2000. This extension covered mainly large factories, office buildings and department stores. This change made it possible for Power Producers and Suppliers (PPS) to supply electricity to eligible customers using the transmission networks of electric power companies. In addition, retail wheeling service rules were established for use of electric power company transmission networks by a Power Producers and Suppliers, and restrictions on entry into other businesses were lifted.

It also became possible to lower rates to on regulated customers simply by making notification, without the need for the approval process in effect up to that time;
and conditions for setting rate plan options were relaxed.

The Electric Utilities Industry Law was revised again in 2003. When part of the changes went into effect in April 2004, retail liberalization was expanded to high-voltage customers contracted for 500 kW or more. Then when the law was fully effected in April 2005, the retail market became liberalized for all high voltage customers (50 kW or above).

As a result of these reforms, approximately 60 percent of Japan’s electricity market in sales volume became liberalized. At the same time, rules of conduct went into effect for ensuring fairness and transparency in the transmission and distribution sector (separate accounting, and prohibitions against information use for other than the intended purposes and of discriminatory treatment).

The existing electricity sector is to be radically reviewed as a result of the Great East Japan Earthquake and the Fukushima Daiichi Nuclear Power Station accident in March 2011. In April 2013, the Cabinet decided a “Policy on Electricity System Reform”, consisting of three main pillars:

- expanded operation of wide-area electrical grids,
- full liberalization of the retail market and power generation, and
- legal structural separation.

![Timeline for Japanese electricity market reform](TEPCO, 2014)

In 2015 Japan had 10 vertically integrated Electricity Power Companies (Yamazaki, 2015).
Reform going forward is to be divided into the following three phases, to be pursued with full reviews carried out at each stage and necessary measures taken:

- **Phase 1:**
  - Establishment of the Organization for Cross-regional Coordination of Transmission Operators; and
  - Establishment of an independent regulatory organization;

- **Phase 2:**
  - Introduction of a license system for power generation, retail, and power transmission / distribution network business;
  - Liberalization of participation in the retail market (continuation of existing retail rate regulation as a transitional measure);
  - Full liberalization of power generation; and
  - Establishment of a 1-hour-ahead-market enabling transactions until immediately before supply;

- **Phase 3 (in about 2018-2020):**
  - Separate incorporation of power transmission & distribution network divisions of power companies (legal structural separation);
  - Abolition of retail rate regulation; and
  - Establishment of a real-time market enabling power transmission & distribution network divisions to procure power sources to adjust the power supply-demand balance.

Under the Revision of the Electricity Business Act for phase 1 in November 2013 and for phase 2 in June 2014, respectively, phase 1 and 2 are to be moved toward implementation. The Organization for Cross-regional Coordination of Transmission Operators, to be newly
established as one of the reforms in Phase 1, will constantly monitor the state of national supply and demand and will have sweeping powers to instruct electric utilities to supply when the supply-demand balance is tight. It will also arrange a mechanism for wide-area absorption of output variation in renewable energies.

Liberalization of the retail market in Phase 2 will enable all customers, including household sector to choose any electricity supplier, although electric power companies can only supply for household sector currently. In the future, bills for revision to the Electricity Business Act are to be submitted to the Diet for Phase 3.

The design of Japan’s future electricity market is shown in Figure 29.
4.6 Texas

The Texas legislature started the deregulation of the electricity market in 1999 with the passing of Senate Bill 7 (Kleit & Kiesling, 2009). This bill started the restructuring to retail electricity markets. It created a market restructuring process in which the state’s investor-owned, vertically integrated utilities were split into separate business units. Provision was made for a five-year transitional period that ran from 2002 to 2007. The first step in 2002 was the opening of the market. By 2007, full deregulation of retail electricity prices was in place.

The Texas market has been successful based on many important objective indicators across a number of dimensions (Kleit & Kiesling, 2009):

- Retail market entry. The Texas retail market has low entry barriers that have provided opportunities for unusually large numbers of competitive providers. As of 2008, there were over sixty active suppliers providing over 100 products in the market;
- Customer switching. Since Texas provided no price protection to industrial customers at market opening, virtually the entire industrial-customer load switched almost immediately to competitive offers. In addition, a significant number of residential customers chose competitive providers, which serve over 50 percent of the

Figure 29: Future design of Japan’s electricity market (Yamazaki, 2015)
residential load, as of 2009. Over 80 percent of residential customers were taking a competitive product offering, even if provided by an incumbent supplier;

- Power generation. Power generation companies have built over 25,000 MW of new gas-fired generation, representing an investment of over $25 billion, since 1995. As of 2009, the Electric Reliability Council of Texas has a project queue of over 100,000 MW - all built or to be built with private capital and without any risk to Texas customers;

- Fuel diversification. The market apparently is providing incentives to diversify Texas’s power supply, with three large generation companies vying to build the first nuclear power plant in the United States in over twenty-five years, as well as the only nuclear power plants ever to be proposed anywhere in the world with private-risk capital and no ratepayer support; and

- Renewable power generation. By 2009, Texas led the United States in wind energy development, with close to 9,000 MW of existing renewable resources and a transmission development program that could support up to a total of 18,000 MW of wind projects.

![Figure 30: Electricity supply in Texas (Kleit & Kiesling, 2009)](image)

4.7 Chile

Chile has the first and longest standing comprehensive electricity reform in the period post-World War II. The reforms came in the form of the 1982 Electricity Act against a backdrop of turmoil in the energy
sector (Pollitt, Electricity Reform in Chile Lessons for Developing Countries, 2004).

The reform was inspired by aspects of the energy systems in the UK, France and Belgium. The reform ideas included; separating generation and distribution companies, paying for electricity according to a cost based formula (cost reflective tariff), introducing a dispatch system using marginal cost pricing and setting up a power trading system between generators to manage customer contracts. These ideas lead to the partial vertical unbundling of the energy sector and the creation of a wholesale power trading system.

Under the initial restructuring Endesa, a state-owned company with vast national generation, transmission and distribution assets, was split into 14 separate companies. These included six generation companies (one of which was still Endesa), six distribution companies and two small isolated generation companies. Other regional government owned electricity companies were also split into separate generation and distribution companies. The privatisation was financed by public auction, stock exchange listing and sale of shares to the public. Endesa still retained its position as the primary electricity generator during the initial stages of the electricity market reform.

As the reform progressed throughout the years to come, the ownership privatisations structures evolved in such a manner that Endesa’s share in the market declined in each passing year. The decline resulted from the growth of a competing generation company, Colbun, who gained increased public and private favour. The updated ownership privatisations structures favoured Colbun as a generator which lead to a sharp decline in Endesa’s share in the Chilean electricity supply industry. The rise of smaller generation companies lead to an even greater decline in the market share for Endesa as they became the favoured sources of generation as opposed to Endesa.

A number of regional power markets based on the concept of an Independent System Operator were established in 1986 after the break-up of the incumbent integrated companies. There are two dominant regional energy markets, one in the north of the country and one covering the southern and central regions. Within these markets generators were mandated to declare availability and plant marginal operating cost each hour. This information would be used to set the spot price for energy. The regulated prices for generated electricity are set for six months and are calculated from the expected spot price for the following four years using sophisticated software packages that take multiple factors into account when creating price forecasts.

The tariffs set for distribution were unrelated to the actual costs of the distribution companies and thus gave them incentives to cut costs. This avoided the distortions with systems regulated on rate of return as a distribution company’s revenue was instead based on the costs of a model company.

The unbundling of the vertically integrated electricity supply industry in Chile lead to a new business structure for the transmission sector. Generators were required to pay transmission companies a tariff per kWh delivered through their transmission network infrastructure to the end user. For existing transmission access payment was
based on negotiated tariffs with compulsory access rights where capacity was available. New connections and related upgrades to the existing transmission infrastructure were paid for by the generators. Generators were free to negotiate costs with transmission companies or to alternatively construct their own transmission infrastructure for delivery of electricity to end users.

Customers were classified into two distinct types, ‘regulated’ and ‘free’. Customers with a maximum demand greater than 2 MW were classed as ‘free’ and were allowed to directly negotiate contracts with generators for power supply. ‘Regulated’ customers were those who dealt with the local distribution companies and could not negotiate contracts directly with generators. They paid the regulated price of distribution plus a node price of energy.

The updated regulatory framework for the electricity supply industry included the creation of entities such as; The National Energy Commission, the Economic Dispatching Centre and a Superintendent of Prices of Electricity and Fuels. The National Energy Commission advises the Minister of Economy on electricity policy and sets the regulated distribution charges. The Economic Dispatching Centre coordinated the purchases, transmissions and distributions within each market. The Superintendent of Prices of Electricity and Fuels collects data required for enforcement and regulation, handles customer complaints and manages service quality fines and customer compensations.

With the aim of adjusting to development in the energy sector there have been efforts to amend the 1982 Electricity Act. In response to droughts and electricity rationing a law was adopted in 1999 to force distributors to compensate customers for energy shortfalls through rationing and set an obligation for generators to meet reasonable expectations from distributors even without contracts.

In January 2004 the Short Law (Ley Corta) was passed. It aimed to address the shortcomings in the system at that time, primarily the concerns around the lack of interest in investing in new generation and transmission due to the low node price and issues with agreements for new transmission lines. The accepted variability of node price (paid by captive consumers) from the market price was reduced from 10% to 5%. This reduced the risk for generators. The threshold level to be classified as a ‘free’ consumer was reduced from a 2 MW to 500 kW maximum demand. This moved most non-residential consumers out of the captive market and increased competition for directly connected grid consumers.

Chile has seen some marked improvements in the functioning and performance of the energy sector since 1982 (Kessides, 2012). Over the period of 1982-2004 the installed capacity had been increasing by 10.2% p.a. and 4.1% p.a. in the northern region and south central region respectively. This equated to an increase of the combined installed capacity from 3 141 MW to 10 625 MW.

In the same period the length of transmission lines grew at a rate of 14.9% in the northern region and 3.7% in the south central region. Consequently the percentage of electrified household has increased from 38% to 86% in rural areas and 95% to 98% in urban areas.
Furthermore, over the ten year period prior to 2002 the average electricity prices have decreased by nearly 30% in real terms, which is superior to the price changes in; water, gas and telecommunications.

The low electricity price and high investment rates in the electricity supply industry have been complemented by the strong financial performance of the companies involved. While financial performance was decent before privatisation it improved substantially afterwards.

The combination of the reduction in electricity prices and rising rates of return reflect great improvements in efficiency. Some companies saw labour productivity improve between 6 to 14 fold over a 12 to 16 year period. Particularly rapid improvements occurred where domestically controlled companies were taken over by foreign investors. This was coupled with the electricity supply industry’s total employee numbers reducing from 8,264 to 5,706 between 1999 and 2002.

Finally the quality of supply has sufficiently improved in the Chilean electricity supply industry since 1982. Losses due to resistance (technical) and theft (non-technical) decreased significantly. This was derived from the fact that across the country technical energy losses in the distribution system were 10.2% in 1982 and 6.2% in 2002.

### 4.8 Malawi

A liberalised electricity market may be defined as an electricity market where the competitive environment determines the price of electricity. A case study for the liberalisation of an electricity market in the Southern African region is Malawi. Currently the Malawi government is taking certain steps in an aim to liberalise its electricity market to a certain extent.

The Malawi Energy Policy of 2003 speaks of liberalisation of the national energy market. Malawi believes that liberalisation would enhance competition within the electricity market. This would ultimately enhance power access and promote economic growth in the country.

The way in which the Malawi electricity market is first going about moving towards liberalisation is through unbundling of the national utility. The purpose of the unbundling is to remove conflicts of interest and separate the market into different areas of competition. This is to ensure that one part of the value chain cannot subsidise another part, creating an unfair advantage. It is hoped that such unbundling and in effect the removal of subsidies would open the way for independent power producers to compete with existing power plants.

To date Malawi’s electricity sector has been dominated by the Electricity Supply Corporation of Malawi (ESCOM). ESCOM is a vertically integrated government utility which owns and operates all of the generation plants and the transmission and distribution infrastructure in the country. In addition, ESCOM has the responsibility for electricity trading. Due to subsidies received from government, the tariffs charged by ESCOM for electricity have not been cost reflective. This has prevented independent power producers from entering the Malawian electricity market.

With the objective to move towards a liberalised market, the Malawi government
has decided to take various steps towards reforming the electricity market. One of the reforms is to unbundle ESCOM into two separate entities, with the purpose of increasing transparency in the government body. The split would result in the creation of new company which deals solely with the generation component of the current ESCOM. The remaining company would deal with the transmission and distribution. In addition the transmission and distribution company will assume a single buyer position and function as a system and market operator. The single buyer model will be adopted by Malawi, where any independent power producer generating electricity will sell the electricity to the transmission and distribution company.

Another reform within the Malawi electricity market in an aim to ensure further liberalisation, is to introduce cost reflective electricity tariffs. The introduction of cost reflective tariffs will increase viability for other energy generators to enter the electricity market and compete against the ESCOM generation monopoly. The Malawi Energy Regulatory Authority, who is in charge of regulating the electricity market, has begun implementing measures to obtain a cost reflective tariff. The Malawi cost reflective tariff is to be made up of two components, a base tariff and an automatic tariff adjustment. In 2014 the concept of the base tariff was approved and came into effect. In January 2016 the regulator implemented the automatic tariff adjustment which acts to restate the base tariff value in order to ensure it remains cost reflective when fluctuations occur such as inflation and exchange rate variations. Currently the cost reflective tariff amounts to approximately $0.12/kWh\textsuperscript{17}. The current tariff is to increase by 37% in order to obtain a tariff which is cost reflective. The Malawi government aims to increase the tariff over a four year period, starting in 2016.

It is important to note that the country’s 2016 maximum generation capacity is 351 MW. This is in contrast to the current, 2016, maximum demand of 450 MW\textsuperscript{18}. The unbundling and introduction of cost reflective tariffs is aimed at stimulating competition and private investment within electricity generation. Once the tariff meets a reflection of costs, other independent power producers will more likely be able to compete against the generation arm of ESCOM. This would provide alternative energy generation opportunities and assist in the country meeting its demand requirements. In addition this would improve the country’s energy mix which is currently dominated by hydropower. The introduction of independent power producers is very important as Malawi has no interconnections to neighbouring countries, and no interconnectors planned.

\textsuperscript{17} The cost of the current electricity tariff was provided during stakeholder meetings held in Malawi, with the Malawi Energy Regulatory Authority (MERA). The meeting was held on Monday 1\textsuperscript{st} February in Lilongwe, with three members of MERA: Welton Saiwa, Dennis Mwangonde and Mathews Kandodo.

\textsuperscript{18} The current maximum capacity and maximum demand figures were provided during stakeholder meetings held in Malawi, with the Malawi Energy Regulatory Authority (MERA). The meeting was held on Monday 1\textsuperscript{st} February in Lilongwe, with three members of MERA: Welton Saiwa, Dennis Mwangonde and Mathews Kandodo.
for the near future. Malawi is thus not able to rely on neighbouring countries to meet its electricity demand, but can only rely on generation capacities within the country.

The liberalisation of the Malawi electricity market is a work in progress. Currently there is movement towards achieving the unbundling of ESCOM and the introduction of cost reflective tariffs, however the success of these steps will only be understood in the near future. It is difficult to devise any conclusions from the study and determine whether these steps are successful in opening the market to other generation players. However it is key that the developments within the Malawi electricity sector remain under surveillance to determine the success of its liberalisation approach.
5 Market Transformation

Competition is the key driver of innovation that benefits consumers. It is clear that competition is delivering for consumers in those parts of the electricity sector that are competitive. (Simon Bridges, Speech to the Electricity Networks Association Annual Conference, New Zealand, 6 October 2015)

5.1 Global context

Electricity market reform, as a tool to stimulate decarbonisation and growth, is a global phenomenon. The UK and Europe are reforming its electricity markets to improve the amount of renewable energy on the grid. This has not yet happened in southern Africa.

The market for electricity is a natural monopoly due to the high capital costs required for generation plant, transmission and distribution networks. This has caused the global electricity industry to develop around business models that saw large central generation plant in government control. Many countries have however realised since the 1990’s that liberalisation of the electricity markets can yield significant benefits and have implemented such reforms.

The International Energy Agency reported in 2005 that “Electricity market liberalisation has delivered considerable economic benefits. Under pressure from competition, assets in the electricity sector are used more efficiently, thereby bringing real, long-term benefits to consumers. Liberalisation to introduce competition is, however, a long process rather than an event: it requires on-going government commitment to resolve challenges when vested interests and cross-subsidies are unwound.” (International Energy Agency, 2005).

The biggest benefit from liberalisation lies in increased levels of competition in the market. Increased competition leads to more competitive pricing. This in turn leads to better matching of supply and demand. In the electricity industry the results of liberalisation was also the diversification of generation technologies.

Market liberalisation has been ongoing for almost 20 years now. A number of lessons can be learnt from the experiences of countries that did liberalise their electricity markets (Pollitt, 2009):

- The number of firms participating in the markets has increased and the market share of participating firms has decreased. This has led to competitive markets;
- The removal of barriers to entry is important as it can significantly impact on the number of firms entering the market;
- The market size increased after market liberalisation; and
- Countries with liberalised markets have harmonised their rules and regulations.
Electricity market liberalisation has delivered considerable economic benefits. Under pressure from competition, assets in the electricity sector are used more efficiently, thereby bringing real, long-term benefits to consumers. Liberalisation to introduce competition is, however, a long process rather than an event: it requires ongoing government commitment to resolve challenges when vested interests and cross-subsidies are unwound (International Energy Agency, 2005).

It is important that market liberalisation addresses the whole electricity market value chain. Important issues in this respect are energy security, adequacy of supply and system security.

Many countries have adopted a standard model for electricity liberalisation. This is called the "British model" (Thomas, 2005) and consists of six reforms:

- Creation of a competitive market for electricity;
- Breakup of monopolized supply such that each consumer can select his provider;
- Separation of network maintenance from generation;
- Separation of direct supply from the generation of electricity;
- Creation of an incentive structure to set market prices in monopolistic competition; and
- Privatization of formerly state-owned assets.

Figure 31: The value chain for reliable energy supply (International Energy Agency, 2005)
Regions like Chile and Texas have adopted the models similar to the British model (Joskow, 2006). This has led to greater demand price-response, allowing for the more efficient use of electricity and increasing the response of consumers to prices so fewer costs are afforded to them. The greater interconnectedness of networks in these models has allowed for markets to be more able to respond to peak energy demand and thereby increase the security of energy networks.

The key characteristics of the British model are (Stern, 2014):

- **Independence.** The independence covers two important aspects,
  - Independence from government;
  - Independence from regulated companies;
- **Forward-looking Incentive Regulation.** This model focuses strongly on price regulation through the periodic resetting of regulated prices in the context of expectations of efficiency gains and investment requirements. The electricity price cap period has been in the order of 5 years. More recently, periods have been extended to 8 years;
- **Focus on Consumers and their Welfare.** The regulatory environment in this model has a strong focus on consumers and the prices. The quality of service and security of supply is also important;
- **An Emphasis on Competition.** Competition has been seen by the UK as the best means of maximising the welfare of consumers of utility industry services since the 1980’s. The view is that regulation is a poor substitute for regulation when it comes to consumer protection. The role of regulation has been to address problems of major and unavoidable monopoly power. One such example is the access to and pricing of monopoly network services. The focus in this area of regulation has been to regulate networks so as to facilitate competition;
- **Private Ownership.** Private ownership has been a key focus of the regulation model since the 1980’s; and
- **Strong Legal Processes and Well-defined Appeal Rights.** Strong legal processes and appeal rights have been a central feature of the British model. The regulatory system makes provision for adequate appeal mechanisms.

Governments of countries in which market liberalisation took place have also been able to reduce the greenhouse gas emissions of fossil-fuel power stations. This was achieved by securing greater environmental protection concurrently to the market reform process. The increased price-response of liberated markets provides for more efficient companies. This is based on increasing the visibility of price signals from the market.

An analysis of electricity market reform in economies in transition (Pollitt, 2007) concluded that:

- Political and judicial institutions and energy resource endowments matter for progress with reform;
- **Privatisation improves efficiency if accompanied by independent regulation,**
  - Competition improves efficiency in generation; and
  - Independent regulation alone is not significant for efficiency improvements;
- Impacts on prices:
  - Privatisation has no significant effect on prices;
  - Competition has a mixed effect on prices; and
  - Regulation has no significant effect on prices.
- Private investment is stimulated by the strength of property rights protection and the presence of independent regulation; and
- Vertical integration reduces the amount and value of privatisation.

The IBL Liberalization Index (Istituto Bruno Leoni, 2014) for the electricity sector evaluates the degree of liberalization and competition characterizing electricity market segments such as generation, transmission, distribution, and supply. According to the 2014 Index of Liberalizations, the EU15 member state with the most liberalized electricity market is the UK (that under the 2014 Index methodology scores 100%), followed by Portugal (99%) and Spain (97%). The least liberalized country is France (48%), followed by Luxembourg (58%) and Denmark (59%).

Research by the OECD on the impacts of electricity market reform came to the following conclusions (Nguyen, 2008):

- Liberalisation of electricity markets has delivered significant benefits based on the experience of OECD countries;

![Figure 32: Index of electricity market liberalisation in 2014 (Istituto Bruno Leoni, 2014)](image-url)
• Effective competition requires independent system operation and transparency;
• Cost reflective prices is the corner stone for efficient market response;
• Competitive markets need an improved framework to empower consumers for demand participation;
• Institutional arrangements are required for market monitoring and coordinated planning; and
• There is no “one-size-fits-all” market model.

Electricity market reform must be done in response to needs – it cannot happen for its own sake or in a vacuum. There are a number of ways in which these needs can be articulated. Some of these are (European Commission, 2006):

• **Security of supply**: limited primary resources of traditional energy sources, flexible storage; need for higher reliability and quality; increase network and generation capacity;

• **Electricity networks renewal and innovation**: pursuing efficient asset management, increasing the degree of automation for better quality of service; using system wide remote control; applying efficient investments to solve infrastructure ageing;

• **User-centric approach**: This can be driven by increased interest in electricity market opportunities, value added services, flexible demand for energy, lower prices, microgeneration opportunities;

• **Liberalised markets**: responding to the requirements and opportunities of liberalisation by developing and enabling both new products and new services; high demand flexibility and controlled price volatility, flexible and predictable tariffs; liquid markets for trading of energy and grid services;

• **Interoperability of regional electricity networks**: supporting the implementation of the internal market; efficient management of cross border and transit network congestion; improving the long-distance transport and integration of renewable energy sources; strengthening security of supply through enhanced transfer capabilities;

• **Distributed generation and renewable energy sources**: local energy management, losses and emissions reduction, integration within power networks;

• **Central generation**: renewal of the existing power-plants, development of efficiency improvements, increased flexibility towards the system services, integration with renewable energy sources and distributed generation;

• **Environmental issues**: reaching internationally agreed emission reduction targets; evaluate their impact on the electricity transits; reduce losses; increasing social responsibility and sustainability; optimising visual impact and land-use; reduce permission times for new infrastructure;

• **Demand response and demand side management**: developing strategies for local demand modulation and load control by electronic metering and automatic meter management systems; and

• **Politics and regulatory aspects**: continuing development and harmonisation of policies and regulatory frameworks.
5.2 Role of national utilities in transformation

The centralised model of electricity generation is oriented around concentrated sources of energy which are developed through large power stations located at sources of energy and rely on transmission lines to transport generated electricity to points of demand. A centralised national utility is often a single government owned entity charged with generating, transporting or distributing electricity (typically national government for generation and transmissions and local government for distribution). In several of the SADC countries all services are conducted entirely by the national utility. The national utility came to be as cheap electricity was recognised as an essential input into economic development. Parts of the electricity supply system are natural monopolies such as transmission networks and are typically funded by government. With large infrastructure project such as hydropower stations, nuclear and large coal power stations it is only governments who have sufficient resources to finance them.

5.3 Liberalised markets

A liberalised electricity market may be defined as an electricity market where the competitive environment determines the price of electricity. The individual independent components of the electricity supply system have clearly defined boundaries for the services they provide and are price according to these services. The IPP will price the electricity they sell to the grid, the grid will price the transport of electricity (transmission) and the distributor will price the distribution of electricity to the end use. Additional services may be priced for the retail of electricity, where wholesalers will buy from distributors and sell to end consumers. Prices are determined by market forces at each part of the value chain rather than a price regulator. The market also allows transparent price signals to be sent to all parties being active in the market which results in increased competition in the market. The transmission and distribution grids, however, are natural monopolies and require regulation to ensure fair pricing.

Allowing private entities to generate electricity alongside the national utility provides for more capital to be invested in the sector and government funds to be spent on other social goods. The competitive nature of the market leads to the average price of electricity being driven down in the region. A market operator would only regulate the market to ensure collusion and price fixing does not occur.

An example of an electricity market that has liberalised is the Nord Pool Spot market. It is the largest electricity trading market in the Europe. Countries trading in the Noord Pool Spot include Norway, Denmark, Sweden, Finland, Estonia, Latvia, Lithuania, Germany and the UK. The Nord Pool Spot was the world’s first multinational exchange for trading electric power.

For various reasons including raising of capital, introduction of competition, reducing cross subsidisation across electricity systems and general economic reform governments have embarked on liberalisation or deregulation of their electricity systems. This would usually involve in the national utilities being
unbundled through legislation so that certain services such as generation or distribution, which form part of the electricity supply chain, are sold to independent companies. The purpose of the unbundling is to remove conflicts of interest and separate the market into different areas of competition so that one part of the value chain cannot subsidise another part creating an unfair advantage. This is particularly the case when market liberalisation opens the way for independent power producers who need to compete with existing power plants but the national utility who provides access to the grid also has a vested interest in the profitability of its generation plants.

5.4 Future Markets

The global landscape for electricity markets is changing at a rapid rate. The change is driven by technological innovation, cost reductions, changing energy business models and market perceptions. The demands for future electricity system are shown in Figure 33.

![Figure 33: Demand for future electricity systems (European Commission, 2006)](image)

The changes in the electricity markets are driven by a move away from highly centralised systems with little to no distributed generation (DG) to systems with significant levels of embedded and distributed generation.
Market liberalisation under current conditions will be constrained by the grid and the system operator’s ability to handle large numbers of generators, many of which may be intermitted suppliers. (EurActiv, 2008). These constraints will however change over time as global electricity markets are going through rapid transformation that is un-connected to market regulation and liberalisation. This transformation is driven by technological advances including:

- Rapidly declining costs of distributed renewable energy generation. This is enabling many homes, offices and factories to install power generating systems such as solar PV system; and
- Development of smart grid technology. This allows users to accurately manage their energy demand (and supply) based on instantaneous grid and market conditions.

The grid of the future will be further impacted by nascent technologies that will further enhance the ability of power consumers to manage their demand:

- Energy storage will enable both generators and consumers to match their grid behaviour with instantaneous grid and market conditions; and
- The Internet of Things (IoT) will provide intelligent devices that can manage its energy demand based on instantaneous grid and market conditions. This will have a dramatic impact on demand flexibility.
One of the strongest requirements for the reform of the global electricity market lies in the need to decarbonise the electricity sector over the next 3 decades. This means that the fundamental drivers of the system have to change. The historical situation with respect to energy planning is shown in Figure 36 (CERES, 2010). In this scenario planning is driven by growth and the minimisation of costs.
The requirements for the current scenarios are significantly different from the historic situation. In the current situation the following needs to be considered:

- **Market Drivers and Constraints impact on:**
  - How carbon costs are recovered, and the resultant financial impact, can impact portfolio choices;
  - Resources availability, grid integration and transmission issues for renewables can have varying financial impacts, influencing portfolio choices; and
  - Time lags between load growth and renewable mandates could result in over capacity, impacting finances;

- **Regulatory Requirements impacts on:**
  - Portfolio choices are complicated by balance sheet impacts of stringent renewable energy mandates and pending GHG disclosure requirements;
  - Carbon costs could impair coal generation assets impacting balance sheet or trigger adjustment clauses in power purchase agreements, impacting costs; and
  - Portfolio choices can be complicated by electricity rate impacts associated with balancing lower carbon compliance costs with the high installation costs of renewables;

- **All of the above in turn impact on:**
  - Generation Level and Fuel Mix of Portfolio.
Another view on the future structure of the electricity industry involves the development of new types of businesses (Nelson, 2014). These could include:

- **YieldCos**: New infrastructure style companies or funds will become the owners of non-dispatchable, larger-scale low carbon generation such as wind and nuclear. These assets will be owned by institutions and other investors seeking steady, predictable, bond-like returns. YieldCo vehicles have already begun to emerge in 2013, with NRG’s spin off of a YieldCo and UK’s Greencoat Wind fund’s initial public offering;

- **Municipal and industrial owned and financed generation**, where long term low carbon energy supplies are purchased directly from developers. For companies, this provides long-term energy price certainty, while for municipalities it can leverage lower cost financing to provide energy to meet its own needs and supply those of its residents;

- **Crowdsourced energy investment** where consumers can buy shares of generating units or companies and receive payments as a share of energy rather than financial return. This idea is in early stages as significant legal and regulatory obstacles remain, but the
longer term benefit for consumers to purchase fixed price, long term energy supplies (and potentially bundle the supply with a property) could make the system attractive; and

- **Balancing generation companies (Balancing GenCos)** will play an increasingly important role in a future dominated by intermittent renewable energy. They will focus on providing balancing services using flexible fossil-fuel and hydroelectric generation and storage systems. The majority of their profits will be derived from their flexibility rather than the units of electricity provided.

The UK roadmap for the electricity industry of the future consists of three phases (Ofgem, 2014). The first phase is focused on capturing the short-term benefits of deploying smart technologies and solutions, whilst also preparing for the accelerated deployment of distributed generation and increasing electrification of heating and transport projected to take place in the 2020s. The second phase of smart grid deployment sees a much greater role for the consumer, following the successful roll-out of smart meters across Great Britain. The third phase will see the country achieve its vision objectives, where a smart grid enables it to develop a fully integrated smart energy system and a platform for the further development of technologies to support the increasing electrification of the heating and transport sector as well as smarter homes and businesses.
5.5 Pathways to Electricity Market Transformation in Southern Africa

This section analyses potential pathways to market liberalisation in Southern Africa. The main areas of focus in this research are:

- Market liberalisation in many countries focussed on the creation of a competitive market through the privatisation of state assets. The question is if this is a necessary step for electricity market deregulation in Southern Africa;
- Market liberalisation focussed on the separation of generation from transmission and distribution. This was deemed necessary as is it seen as uncompetitive if companies have to procure services from their competitors. The question is if this is a necessary step for electricity market deregulation in Southern Africa;
- Liberalised markets moved from regulated prices for electricity to using the market to set the prices. In the UK the deregulation was followed by a period in which a price ceiling was set by the regulator; after this the price for certain customers was totally unregulated. The question in this research is if a market can have areas where customers buy from a regulated price concurrently with a system where customers buy at an unregulated price; and
- Countries in Southern Africa seem to prefer the single buyer model. In areas like the UK and Europe the first phase of liberalisation consisted of a system where a single buyer was present. Generators had to compete with each other to supply power to this single buyer. As market liberalisation progressed, the single buyer model was
changed to allow direct competition between off takers as well. The question is if one can have a competitive market running concurrently with a single buyer model.

5.5.1 Privatisation

The privatisation of the state assets was deemed to be necessary in many of the areas where electricity market liberalisation occurred over the last 20 years. The motivation for this step lied in that it was seen as a prerequisite to the creation of a competitive environment. It must, however, be kept in mind that there was an oversupply of generation capacity in many of these countries. The only way to create competition between generators was therefore to sell off existing generation capacity.

The countries in Southern Africa do not have excess generation capacity. The opposite is true in that there is a severe shortage of supply. Competition can be created in such an environment by simply allowing new entrants to compete with new capacity in a competitive market place.

Another justification for market reform is allowing the private sector to supply capital for the construction of new generation capacity. In many of the regions this formed part of the longer term planning scenarios. In the Southern Africa region the supply of capital is an immediate need. The experience with the REI4P in South Africa has shown that significant levels of capital can be available in the market if a scheme is structured in a way that is acceptable to private sector funders. Risks to private funders were mitigated by providing state guarantees that the single buyer will buy the electricity. The risk either reverts to the state or the tariff payer if the regulator allows for tariff increases.

This research concludes that privatisation of existing infrastructure is not a required step in the market liberalisation of the Southern African region as sufficient diversity of supply can be created by simply allowing new entrants to bring generation capacity to the market. The concurrent benefits of such a step would be to alleviate the supply shortage that currently exists in the market. The necessary frameworks will need to be in place to ensure the private funders are able to gain an adequate return on their investments. This depends on the sovereign credit ratings and the certainty of being able to collect revenues.

5.5.2 Unbundling

Unbundling of transmission and generation was a prerequisite in many of the areas considered in this research. This is motivated by the idea that a fair market would not require a company to purchase services from a competitor. If a company is forced to do so, it may lead to unfair business practices as the owner of the services that need to be shared could unduly benefit himself to the disadvantage of the competitor.

Unbundling of electricity generation and transmission can happen at two levels: accounting unbundling and legal unbundling. When the generation and transmission is unbundled on an accounting level, it allows for separate cost structures according to which grid access costs and usage charges can be managed. Legal unbundling speaks to the separation of ownership of the generation and
transmission assets into separate legal entities. The European Union unbundled the electricity system on an accounting basis in 1996 and on an ownership level in 2003.

This research finds that, as long as third party access to the grid can be guaranteed and a mechanism for fair pricing of grid access can be established, full legal unbundling should not be a prerequisite for electricity market reform.

An example where accounting unbundling in Southern Africa can be seen is with the structuring of Eskom in South Africa. Transmissions, distribution and generation are separate divisions in the company. The Eskom tariffs are structured in a way that gives clear visibility of the cost of energy as opposed to the network access charges.

5.5.3 Price regulation

The transition of regulated electricity pricing to free market pricing differed in many of the areas covered by this research. In some countries, like the UK, the first step to free market pricing was to set a price ceiling. Other countries, like Japan, allowed only large consumer to buy at market prices in the first rounds. The logical conclusion of the deregulation process is to remove all forms of price regulation when the process is complete.

The pathway to follow to unregulated prices is a major decision in any market liberalisation strategy. It is clear from the cases considered in this research that a transition period in which both liberated and regulated prices exist in the same space is possible.

5.5.4 Single Buyer Model

Many countries in the Southern Africa region have a single buyer model whereby all generated electricity is first sold to a national utility before being distributed. This is similar to the UK where the first phase of market liberalisation established the “Pool”. All generators had to sell power to the Pool. The Pool then sold the electricity on to the end users.

The question in this regard is if it is possible to operate a totally liberated market where generators sell directly to loads in parallel with a market where generators sell to a single buyer or if the consumers can directly access the power pool. This research shows that that such an arrangement is possible. One example is the Japanese market where the first phase of market liberalisation allowed large consumers to buy power directly from generators and wheel the power through the grid. The CEC within the SAPP membership also provides an example of an independent transmission company which can buy from the pool and transmit to large consumers.

The study concludes that it is possible to allow certain sections of the market to trade directly between generators and loads through the wheeling of electricity through the grid, while other parts of the market sells electricity to a “single buyer”. The essential element, which in many cases is already in place, is to balance the network through the appropriate flow of information to the system operator.
6 CASE STUDIES OF TRANSFORMATION INSTRUMENTS

6.1 Bio2Watt

Bio2Watt was established in 2007 by Sean Thomas. The company develops, owns and operates waste-to-energy projects in Africa. Bio2Watt is the first commercially viable renewable energy IPP in South Africa that makes use of embedded generation to supply its off-taker with electricity. The Bronkhorstspruit Biogas Plant (BBP) started producing electricity on 10 October 2015, 7 years after project inception. The off-taker of the electricity is BMW. The electricity is distributed from the generation facility that is situated at the Beefcor Farm, in the Bronkhorstspruit municipal region, to the BMW plant situated in Rosslyn, Pretoria.

The biogas plant project has a maximum installed capacity of 4.4 MW with an additional 3 MW of energy available in the form of heat if the need for it arises. Organic waste from food producers that would conventionally be sent to landfill sites, is collected and used as feedstock along with cattle manure to produce biogas by means of anaerobic digestion. Electricity is then generated by means of engines that combust the methane rich biogas. The generation of electricity from biogas in this project has the added benefit of reducing emissions from organic waste and stopping the leakage of toxins into the surrounding natural water system. The project is a sustainable solution for waste treatment as it treats approximately 90,000 metric tonnes per annum. One of the greatest benefit of this project is that it created 10 jobs per MW of generation capacity.

Under normal circumstances, an off-taker would purchase electricity at the cheapest possible rate. As the national utility has a large pool of generation facilities with very high generation capacity and sunk costs for older generation plants, the average cost per unit of electricity is low compared with the marginal cost of new generation capacity. This makes it difficult for IPPs to penetrate the market as their cost per unit of electricity produced is almost always more expensive than that of the national average cost. Market penetration is further limited by wheeling charges which are added to the proposed tariff of the IPP. Off-takers would prefer to purchase electricity from the national utility.

In the Bio2Watt case however, BMW has a renewable energy policy in which they commit to using electricity generated from renewable sources where possible. BMW was thus willing to pay a premium for the electricity generated by the Bio2Watt BBP project. BMW signed a power purchase agreement (PPA) with Bio2Watt as the primary off-taker of the electricity generated by the BBP project. The BBP project is the first commercially viable biogas project in South Africa (Bio2Watt, 2016).

The success of the first commercially viable biogas project in South Africa however was not without challenges. The major barriers to making this project a success were
funding, licensing, gaining buy-in from the landowners from which the organic waste was produced, negotiating the PPA with BMW, negotiating the wheeling agreements with Eskom and Tshwane Municipality and lengthy waiting periods associated with issuance of required licences, PPA and wheeling agreements.

The project funding barrier resulted from high project development costs, finding investors willing to take the high risk, not being able to use off-the-shelf technology, fluctuations in currency, the current cost of electricity, the intricacies of project finance requirements and low return on investment of the project. The funding barrier was overcome by finding investors who were patient and willing to invest even though the return on investment would take a lengthy period of time. The project was funded through capital from Bio2Watt, a grant fund from the Department of Trade and Industry and a loan from the Industrial Development Corporation.

One of the greatest if not the largest barrier was with respect to gaining all the required licenses, permits and agreements signed. It took approximately 6 years to get all the required licences and agreements signed. The project required a pre-feasibility study (1 year), environmental impact assessment (approximately 2 years), a supply agreement and PPA with BMW (just over 2 years), connection agreement with Eskom and a wheeling agreement with the Tshwane Municipality (approximately 2.5 years) and gain approval for all the required licenses and permits that are listed below (approximately 4 years).

Licenses required included an Environmental Impact Assessment (EIA), Water Use Licence Agreement (WULA), Waste Licence, Air Emissions Licence and Subdivision of Agricultural Land Act (SALA) lease. The Tshwane Municipality had to issue a building plan approval and consent of use for the project. A letter from the Department of Energy (DoE) was required to gain a generation licence from NERSA and access to the grid had to be granted by Eskom.

The wheeling agreement with Tshwane Municipality was the major barrier to getting the PPA signed with BMW. This was due to the complexities associated with the wheeling agreement and negotiations regarding the tariff, revenue management system and billing system.

The Bio2Watt BBP project has highlighted that IPPs who wish to produce and sell electricity to an off-taker other than Eskom will face many barriers in terms of funding, licencing and agreements with Eskom and local municipalities. Bio2Watt has however proved that IPPs can penetrate the electricity supply industry in South Africa with the aid of patient investors, willing off-takers of renewable electricity and patience with respect to licenses, agreements with Eskom and permits from municipalities.

Recommendations that could assist IPPs in penetrating the electricity supply industry with a bit more ease include the following:

In terms of licencing, the EIA process needs to be shortened. All licenses required should have clear time frames in which they need to be processed. Currently no time frame exists for the processing of licensing applications. The duration of the processing of the application is dependent on the official who evaluates it.
Municipalities require clear directives for waste management and a protocol for wheeling of electricity. As these items are not yet in place, the process is slowed considerably due to municipal officials not having any protocols that outline the exact procedure that needs to be followed.

Lastly the DoE, NERSA and Eskom should outline a strong policy framework that is clear, fair and robust. The application to gain access to the grid also needs to be simplified and streamlined as it currently acts as a barrier for IPPs to penetrate the South African electricity supply industry, particularly at the municipal level. Access to the grid should ideally be managed by an independent broker rather than a government entity (Bio2Watt, 2015).

6.2 MTN Own Generation

The MTN Group is a multinational telecommunications operator with over 229.2 million subscribers across its markets in 22 countries in Africa and the Middle East (MTN, 2015).

Over the last seven years, MTN South Africa has embarked on a programme to develop and commission alternative, clean energy facilities to power the company’s operations in South Africa. Included in this programme are a 2 MW trigeneration facility, various small solar and wind plants, and a larger concentrated solar cooling plant (330 kW) which is the first-of-its-kind on the continent (HTXT AFRICA, 2014). These projects are aligned with the company’s aims to make its head office, in the Westrand of Johannesburg, independent of grid-electricity in the near- to medium-future.

The trigeneration plant is particularly successful example. Commissioned in 2010, the facility provides 2 MW of the head office’s electricity demand which is between 5.5 MW and 7.5 MW (Engineering News Online, 2010). The trigeneration plant has three collaborative functions as depicted in Figure 40.
Cooling the company’s data centre is one of the most expensive components of MTN South Africa’s operation, with between 700 kW/m² and 1 400 kW/m² required for air-conditioning of the area. This, coupled with electricity price increases, meant that MTN’s return on investment was expected within five years of commissioning (Engineering News Online, 2010).

MTN’s concentrated solar cooling plant was commissioned in 2015. The plant produces high temperature water under high pressure. This heat source is used to power absorption chillers that supplements the chilling requirements on site. This lowers their dependence on the local electricity grid.

The system consists of 242 solar mirrors covering a total area of 484 m² which track the sun to generate pressurised hot water at 180°C. Much like the trigeneration process, the hot water from the solar facility powers an absorption chiller. The chilled water is subsequently used to cool the IT equipment in the data centre.

The commissioning of the trigeneration and solar facilities at MTN’s head office in South Africa are part of the company’s massive investments into its South African network. The operator is increasingly focussed on rolling out infrastructure in rural areas where access to electricity from the grid may be limited.

Up until now, the lack of electrical power in remote areas made it costly and difficult for operators to roll out network infrastructure. The use of own generated electricity is therefore proving to be an innovative and successful strategy to enter into previously inaccessible market territories.

While the company carries the risks associated with such capital expenses, MTN is able to mitigate operational risks associated with downtime due to power failures or load shedding, through own
generation. Even though the capital costs of such facilities remain comparatively high, these technologies (particularly solar and wind) have matured to a stage where they are now viable alternatives to both no-power scenarios and back-up diesel-powered generators. Consider that MTN Group spends more than $100m/year on diesel for its operations across the continent, and where diesel accounted for 6% of MTN Nigeria’s operational expenditure in 2010 (Tech Central Online, 2010).

As the second largest market player in the highly competitive telecommunications space in South Africa, MTN’s response to electricity constraints and concerns regarding security of supply have been very proactive. While the strategy has successfully enabled the company to grow its market share in new territories, the opportunities associated with excess power are yet to be exploited.

6.3 Kalahari Energy

Kalahari Energy is a gas exploration and development company based in Gaborone, Botswana. The company possesses a number of prospecting permits in eastern Botswana. The company’s focus is on capitalising a significant recoverable base of coal bed methane which has been identified in the area by global energy producers as well as independent feasibility studies.

Kalahari Energy was part of the consortium that commissioned and owns the 90 MW Orapa duel fuel power plant. This consortium is also reported to be the first IPP in the country (Frost & Sullivan, 2012). Kalahari Energy has, in conjunction with a number of its sister companies, commissioned and installed a small solar photovoltaic facility on its premises in Gaborone.

Botswana has excellent solar resources, making such investments particularly attractive. While licences for own generation facilities under 25 kW do not require licences from the Department of Energy Affairs (which is also the regulating authority in the country), there is currently no third party access to the grid and no wheeling. This limits the opportunities for selling excess power to third parties.

6.4 Kamuzu (Malawi) and Moshoeshoe I (Lesotho) International Airports

The Japanese government provided grant funding for the installation of small solar photovoltaic farms at two international airports in Malawi and Lesotho. Both plants were commissioned in 2013.

The 830 kW facility at Malawi’s Kamuzu International Airport is the first ever solar power project connected to the national grid in Malawi, which is owned by ESCOM, the state utility (Embassy of Japan in Malawi, 2013). The smaller 281 kW solar plant at Lesotho’s Moshoeshoe I International Airport is also connected to the grid (Mokheseng, 2015). Both facilities provide electricity which feeds the respective airports. They have also been designed to feed excess electricity back into the national grids.

The regulatory environment in Lesotho is particularly supportive of such activities, where own generation (and commercial
generation) facilities only require a licence in they are greater than 2 MW. The regulations pertaining to own generators in Malawi are not so clear, whereas all commercial generation activities in the country require a licence from the regulator.

While comparatively small in size, these projects are significant as clean energy developments. They simultaneously provide electricity to national key points (such as airports) in countries that are severely constrained in their generation capacities. Furthermore their design as embedded generators demonstrates that the activity can be realised and replicated in both Malawi and Lesotho.

### 6.5 Amatola Green Energy

Amatola Green Power (Pty) is an electricity aggregator. The company is the only private sector business issued with a trading licence from the National Energy Regulator of South Africa to buy and sell renewable energy within the voluntary market in South Africa. Amatola Green Power does so by matching the demand of various loads to the supply of electricity from a portfolio of generators.

While each power purchase agreement is different, Amatola Green Power reportedly pays its generators between R0.62 and R1.05 per kWh supplied. The aggregator subsequently charges its customers between R0.80 and R1.40 per kWh of electricity purchased, based on long-term (10, 15 to 20 years) contracts (Euston-Brown, Ferry, & Giljov, 2014).

The aggregator’s largest customer to date is the Nelson Mandela Bay Municipality, which in 2012 signed a 20 year Wheeling or Use of System Agreement with Amatola Green Power. This agreement allows the aggregator to trade up to 10% of the municipality’s consumption.

The six-year projections for renewable energy supply from Amatola Green Power’s various solar, wind and biomass generators are detailed in the trader’s licence (NERSA, 2014) and provided in the table below:

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19 Amatola’s trading licence was renewed and extended on the 15 January 2014 for a term of 15 years.
Some of the company’s notable generators include the Electrawinds facility in the Coega Industrial Development Zone as well as a rooftop solar facility in the area. With regards to the Electrawinds’ project, Amatola Green Power sources 5 GWh per annum from the facility at an agreed price. The electricity is subsequently placed in a metaphorical ‘aggregators pool’, allowing Amatola Green Power to broker purchase agreements from the ‘stock’ in the ‘pool’ with off takers.

Amatola Green Power wheels its electricity, transmitted via the Municipality’s grid network, to its various customers including BHP Billiton, Bridgestone, SPAR retail outlets and others that have signed long-term power purchase agreements with the aggregator. Renewable electricity typically accounts for between 27% and 100% of Amatola Green Power’s customers’ demands (NERSA, 2014).

Agreements are made with Amatola Green Power’s customers on a “take or pay basis”. This means that if a customer commits to purchasing a certain amount of green energy and actually uses less, that customer will still be required to pay for the energy that it did not use. This commercial framework, based on agreed prices on an extensive term as noted above, substantially reduces the project risk for the renewable energy developer. A reduction in risk ultimately makes sourcing the necessary funds for the project investment somewhat easier (Euston-Brown, Ferry, & Giljov, 2014).

Nelson Mandela Bay was the ideal Municipality in which to pilot the aggregator concept. The Coega Industrial Development Zone, situated within Municipality, has been established as the green technology manufacturing hub of South Africa and there are also plans to build up to 1200 MW of renewable energy there (Euston-Brown, Ferry, & Giljov, 2014). Furthermore, the Nelson Mandela Bay Metropolitan Municipality was the first in South Africa to allow small scale embedded generation below 100 kW, without the requirement of a generation licence. The motivation behind this regulatory adjustment was to expedite the development of small scale, affordable electricity generation in the country. The country’s electricity shortages in turn contributed to the market need in this regard, as businesses and industry in South Africa began to feel the adverse effects of disruptions and restrictions in the electricity supply.

Amatola Green Power identified the market-gap, where the current energy crisis calls for innovation and private sector involvement. The company has therefore implemented a mixed business strategy based on product differentiation and cost competition to achieve its aims. One of the primary goals in this regard is the

### Table 4: Amatola Green Power’s generation capacity projections

<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>kWh equivalent</td>
<td>3,376,234</td>
<td>5,428,604</td>
<td>15,740,539</td>
<td>15,714,106</td>
<td>15,687,806</td>
<td>15,661,637</td>
</tr>
<tr>
<td>Total cumulative projections (MW)</td>
<td>1.84</td>
<td>1.86</td>
<td>3.60</td>
<td>3.60</td>
<td>3.60</td>
<td>3.60</td>
</tr>
</tbody>
</table>
stimulation of the small scale, clean energy segment of the electricity market.

While the aggregator only represents a small percentage of the Nelson Mandela Bay Municipality’s total annual electricity demand, the novel wheeling agreement with the Amatola Green Power has opened the way for further power generation projects. A case study commissioned by the South African Local Government Association notes that these included a private development of an additional 24 wind turbines as well as a 10 MW PV installation within Coega (Euston-Brown, Ferry, & Giljov, 2014).

Amatola Green Power achieves its strategic goals by matching smaller scale renewable energy generators (or the excess capacity of larger generators) with demand, typically in the industrial or commercial sectors. The transactions are seamless and convenient as facilitated by appropriate information and communication technology. Furthermore, the price structures benefit the generator and consumer.

The advantages of the aggregator model also flow to the Nelson Mandela Bay Municipality, which benefits in terms of wheeling charges access to additional sources of clean power, investments in the green economy via increased manufacturing processes and job creation. In addition, increased generation capacity ensures that the economy in the Municipality is not hampered as a result of inadequate supply while simultaneously providing a saving on the municipality’s network demand changes from the national utility, which could be significant in the future.

Amatola Green Power’s business model is successful because it matches the needs of its clients (electricity users) in addition to the needs of its suppliers. In the process the needs of the Municipality are also accounted for, as the link between economic development and energy provision is leveraged.

Another key factor in Amatola Green Power’s success is its niche focus on small scale renewable energy. The company does not compete for market share in the highly competitive large scale renewables segment of the South African electricity sector, and thus avoids direct competition with Eskom, the large state owned and vertical integrated utility. Amatola Green Power remains the only private entity with a trading licence in the country.

The Amatola Green Power model compliments the concept of splitting the value of the physical electricity that is generated and traded from the electricity’s ‘green’ component. The ‘greenness’ could be sold to clients who have environmental conservation requirements, such as multinational companies who are required to reduce their greenhouse gas emissions. Such transactions could be facilitated by registering the renewable energy projects on platforms that facilitate the generation of various renewable energy certificates. Many of these certificates are recognised as tradable Proof of Origin instruments, and this market mechanism is proven and used around the world. A small renewable

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20 Examples of such platforms include the Clean Development Mechanism, the Verified Carbon Standard and the Gold Standard, among others.
energy certificate market does exist in South Africa, and could be leveraged to the benefit of existing and potential renewable energy IPPs in the country and further afield in the region.

A number of other municipalities in South Africa have also recently embraced the concept of embedded generation in their local regulations, supporting the basis of the aggregator model. These municipalities include the City of Cape Town, the City of Johannesburg and eThekwini. One of the key opportunities in this regard relates to the unbundling of tariffs through cost of supply studies. The case study commissioned by the South African Local Government Association notes that such measures can facilitate an increasingly dynamic tariff setting process. Flexible and dynamic tariffs may assist municipalities not only with wheeling of electricity, but also with a range of processes related to efficiency and renewable energy development, such as establishing small scale renewable energy feed-in rates (Euston-Brown, Ferry, & Giljov, 2014). These in turn may be catalysts for the transformation of the region’s electricity markets.

6.6 Resellers

Resellers buy electricity in bulk or generate their own electricity and sell it within their own private network. Many examples of resellers exist in the housing sector such as blocks of flats or other sectional title accommodation. Many shopping centres are resellers and there is a trend in installing PV above parking areas to generate electricity.

Recently guidelines were published by the National Energy Regulator of South Africa to guide the pricing of electricity by resellers and some municipalities have published regulations (e.g. Johannesburg and Cape Town). The general approach is to keep the resellers price of electricity in line with the municipal price of electricity. This provides an opportunity for resellers as they do not need to subsidize other services from electricity sales like municipalities. In the short term this will help cover the higher capital cost of the PV plants. But as technology costs decrease and municipal cost increase the resellers may make windfall profits in the longer term.

Situated in Roodepoort to the west of Johannesburg, Clearwater Mall was built in 2010 by Hyprop, a property development company. A 500 kW solar photovoltaic facility was initially installed on the mall’s roof-space for its own-use, and the facility was recently increased by 1 000 kW. The panels cover an area of approximately 12 000 m², making it the largest rooftop system in Africa to date (Engineering News Online, 2015).

The 1 500 kW facility is expected to provide up to 10% of the mall’s total consumption, and Hyprop intends to replicate the model across its portfolio of properties in the near future. On average, the system generates 2 500 000 kWh electricity a year, which is the equivalent of the consumption of approximately 347 average households in the same period. The photovoltaic facility saves approximately 3 000 tonnes of coal per year, which is an equivalent saving of 2 500 tonnes of carbon dioxide emissions per year (Eprop.co.za, 2015). Clearwater Mall is able to resell its own-generated renewable supply of electricity to its tenants, who deal directly with the Mall as opposed to the national utility.
As the majority of the mall’s operations are undertaken in daylight hours, seven days a week, the solar facility is the ideal alternate energy source for the property development company. As weekends are typically peak shopping times for malls, the use of the solar system at this time means that the asset is efficiently utilised, thereby reducing the payback period on the capital investment. A further benefit is that the photovoltaic panels and system require minimal maintenance.

The motivation behind increased instances of embedded generation stem from a number of factors. Dramatic increases in the price of electricity, coupled with rising risks of load shedding in the country, are undoubtedly major drivers of this phenomenon. Furthermore the costs associated with commissioning renewable energy (solar facilities in particular) have decreased as market demand and innovations have increased. Globally there have also been increased public and regulatory pressures to mitigate the effects of climate change through the adoption of measures such as solar photovoltaic systems.

These factors have driven the likes of the City of Johannesburg to champion embedded generation as one of the various initiatives to alleviate load-shedding, which simultaneously meets market demands for cleaner electricity sources. While the mall does not have excess capacity at this point to feed electricity back into the grid (i.e. operate as a ‘net’ generator), it does mitigate the need for additional supply from the City of Johannesburg, which means that this quantity can be used elsewhere.

The regulatory frameworks in South Africa also support the embedded generator model, particularly with regards to solar photovoltaic facilities. The updated *Integrated Resource Plan 2010-30* states that 9 770 MW of solar photovoltaic capacity is planned for South Africa by 2030. The plan estimates that, ideally, 22.5 GW could be supplied by photovoltaic embedded generators in the residential and commercial sectors by 2030. While this may be optimistic, it indicates that there is significant potential in this electricity segment.

Furthermore the National Energy Regulator of South Africa exempts small scale, own-use generators (under 1 MW installed capacity) from applying for generation licences (Republic of South Africa, 2011, p. 37). Regulations notwithstanding, there are however concerns that the cost implications to the grid owner (notably Eskom) and the required infrastructure have not yet been considered or configured appropriately in order to safely facilitate embedded generation on a meaningful scale in the country.

Additional national licensing and connection frameworks are therefore in various stages of development in South Africa. In the interim, a number of municipalities  have published policies and tariff structures that enable them to accommodate embedded generation in their networks, on the basis that parties will comply with the terms of any future regulatory system implemented by the Regulator.

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21 At the time of writing these included the City of Cape Town, the City of Johannesburg, the Drakenstein Municipality, Ekuruleni Municipality and eThekwini Municipality.
The rate of growth in this sector is therefore likely to escalate dramatically in the near future as electricity resellers take advantage of the favourable business environments. One of the drivers behind the growing instances of reseller models relates to the increasing technological innovations in global solar markets which are inversely proportionate to the costs of these technologies.

The disruptive potential of solar power is discussed extensively in the McKinsey Quarterly (David Frankel, 2014). The article asserts that the sharp decline in installation costs for solar photovoltaic systems has further boosted the competitiveness of solar power. These cost reductions could soon put solar on a par with traditional power-generation technologies, such as coal, natural gas and nuclear energy. While grid-parity is increasingly evident in the South African environment, the reseller model represents an opportunity for transformation in the local electricity markets within the region.
7 Potential Players in a Reformed Market in SADC

7.1 Expanding role of existing market operators

A market operator is the independent entity responsibility for overseeing the clearing and settlement of transactions (bids and offers) undertaken on the market platform.

The commodities within an electricity market generally consist of three types: power, energy and derivatives. Power is the metered net electrical transfer rate at any given moment and is measured in megawatts (MW). Energy is electricity that flows through a metered point for a given period and is measured in megawatt hours (MWh). Derivatives typically consist of futures and options. The derivative is based on an underlying metric or index. These are typically measured at fair value, established using various valuation techniques.

7.1.1 Southern African Power Pool

The Southern African power pool (SAPP) was set up by the Southern African Development Community as a means for national electricity utilities to trade electricity amongst each other. Initially SAPP’s members consisted only of national utilities from the Southern African region. Electricity was primarily traded between South Africa and other Southern African member countries as South Africa had surplus capacity available to assist other countries that could not meet their demand.

The SAPP manages the trading of electricity between members with the use of an electronic trading platform. This market platform allows for week ahead, day ahead and intraday trading. The most popular markets at the moment are the day ahead and intraday. Electricity is physically transferred between SAPP members by means of interconnectors between member countries.

The SAPP constitution allows for independent power producers and independent grid operators to join the organisation. Increased membership within the SAPP will strengthen the basis of a competitive electricity market in the region.

The SAPP market was expanded by allowing Independent Power Producers and Independent Transmission Companies to join the national utilities as members of the market. The first member to join SAPP that was not a national utility was The Copperbelt Energy Corporation (CEC) from Zambia. They joined as an Independent Transmission Company who bought electricity on the market and provided spare capacity for the Zambian national utility when required.

To date, trading volumes have been relatively low as many of the interconnectors between countries are not developed well enough to trade large
quantities of electricity. The largest barrier to trade at present is the low market liquidity. As the members consist mainly of national utilities, electricity is only traded when the member country is in need of electricity, or when it has spare some capacity. By allowing more independent entities to enter the market, generators will start to produce electricity not just to meet their own national demand, but with the intention of selling it on the market as a commodity to make a profit. This increases market liquidity as competition between generators would facilitate more trades to take place as prices per unit electricity would be reduced.

**7.1.2 Johannesburg Stock Exchange**

The Johannesburg Stock Exchange (JSE) is ranked the 19th largest stock exchange in the world by market capitalisation and the largest exchange on the African continent.

The bourse offers a number of primary and secondary capital markets across a diverse range of securities. These include the alternative exchange for small and mid-sized listings, the Yield X for interest rate and currency instruments, the South African Futures Exchange, the Bond Exchange of South Africa and five financial markets (JSE, 2013).

While the JSE has various sophisticated commodities markets which could be used to trade power and energy across the Southern African region (and further), it is the bourse’s derivatives markets which are of particular interest in the context of this report. The JSE has a very well established derivatives platform. It was ranked the 6th largest exchange by number of single stock futures traded and 9th by the number of currency derivatives traded in 2012 in the World Federation of Exchanges Annual Derivatives Market Survey. The JSE offers derivative trading of futures and options on equities, bonds, indices, interest rates, currencies and commodities (JSE, 2013). The potential to trade electricity derivatives, such as renewable energy certificates, is yet to be fully explored.

**7.1.3 Resellers - Micro monopolies**

The reselling of electricity occurs when an off-taker purchases bulk quantities of electricity from a regulated electricity supplier (national utilities or municipalities that are licensed by the national regulatory authority to sell electricity to end-users) and then resells the electricity to captive end-users - tenants in residential complexes or store owners within shopping centres. The reselling of electricity occurs via an embedded network that is owned by the reseller.

A reseller is defined by the South African Energy Regulator as a non-licensed trader of electricity, that supplies electricity to dwellings in high density housing complex; residential flat building, residential gated sectional title units and/or free stands in a complex, shopping complex, commercial building and has the ability to meter its customers and provide a bill clearly stating the kilowatt hours consumed, the tariff per kilowatt hour and the total amount charged.

As the reselling of electricity is not regulated by NERSA in South Africa, resellers are able to sell the electricity at rates that are higher than the prescribed tariffs rates for licensed suppliers. As the reseller makes use
of an embedded network to supply electricity to the captive users, specialist utility management services (sub-metering and maintenance of embedded network) are required to assist the reseller in monitoring exact usage and recovery of costs associated with each captive user’s consumption. This results in additional charges which are typically passed through to the captive user which results in tariffs that are higher than that prescribed for licensed electricity retailers.

Resellers may also generate their own electricity (embedded generation) and sell this to consumers within their private network. This is not usually regulated but regulators may have guidelines as to how the electricity is priced.

7.2 Market for Ancillary services

Ancillary services are defined as a collection of services which are required to ensure the reliable, secure and efficient transmission and distribution of electricity to end-users exclusive of basic energy and transmission services.

The following services in the electricity supply industry are defined as ancillary services: operating reserves; regulation and load following; black start and islanding; reactive power supply and voltage control from generation sources; and energy imbalance.

Operating reserves are required to ensure secure capacity is available for reliable and secure balancing of supply and demand in real-time. Operating reserves are currently classified as: instantaneous reserves, regulation reserves, 10-minute reserves, emergency and supplemental reserves.

Voltage regulation, among others, refers to the provision of generation and load response capability that responds to automatic control signals issued by the system operator. Load following refers to the provision of generation and load response capability that is dispatched by the system operator to match electricity generation and demand in a scheduling period.

Black Start refers to the provision of generation equipment that, following a total system collapse can start without an external electrical supply and re-energise a predefined segment of the interconnected transmission system to act as a start-up supply for other units in the interconnected transmission system. Islanded units refer to units within the interconnected transmission system that can continue operating in the event that a total system collapse occurs.

Reactive supply and voltage control is interrelated in the sense that the voltage is affected by changes in the reactive power flow. System stability depends on the voltage profile across the interconnected transmission and distribution systems. In certain instances it is required to employ certain power stations to supply or consume reactive power whether or not they are producing active electricity, for the purpose of voltage control across the interconnected transmission and distribution system.

Energy imbalance is the service supplied by a power station (typically a thermal or nuclear power station) by constraining its power output below or above the unconstrained schedule level. The service is
required to ensure that the interconnected power system remains between appropriate operational thermal, voltage or stability limits.

Ancillary services may be outsourced to private companies to facilitate competition and liquidity in an electricity supply industry. Ancillary services could be traded on the same platform as the Day-Ahead or Intraday markets. Market liquidity would be increased by opening up the trade for ancillary services as independent companies could offer any of the ancillary services mentioned above for both national utilities and private companies. Ancillary service supply could thus become cheaper as national utilities would not be the only participant that could supply these services.
8 Business Models for New Participants

One of the starting points of this research was to try and formulate a pathway to market liberalisation in the Southern African region that could be implemented within the context of the existing regulatory infrastructure.

8.1 Virtual Power Stations/Market Aggregators

8.1.1 Concept

The concept of a regional aggregator and related trading platform was proposed as a potential tool to reform the electricity market.

Vertically-integrated utilities and energy cooperatives are examples of traditional electricity aggregators because they pool the electricity generated from multiple power stations and facilitate the needs of a group of customers with the aim of achieving optimum tariffs and efficiencies. By this definition, an aggregator may refer to a wide range of operations, from business associations, tenants' association or municipalities that supply end customers with electricity.

In essence, an aggregator acts as a buyer from generators and seller to the end-user. The aggregator could act either as a trader or a broker. An electricity trader will buy and sell electricity in the same way that commodities are bought and sold. The trader buys from multiple generators and sells to multiple end-users via pre-negotiated purchase and sale contracts. A broker is defined as a portfolio manager. The broker sets up supply and distribution contracts between generators and end-users but does not actively partake as a trader in the market itself.

Aggregators are also distinct from distributors. Distributors will usually buy in bulk from the national utility and sell this electricity to many consumers. The role of the distributor relates primarily to the physical distribution of electricity. An aggregator collects (or aggregates) electricity from multiple generators and sells this to multiple consumers. The role of the aggregator is therefore virtual, in that it does not typically take delivery of the electricity. An aggregator relies on the infrastructure owned by others i.e. the transmission and distribution network owners. In a way, the aggregator plays a market operator role.

The traditional form of aggregators is clearly changing as electricity markets world-wide are transforming. In particular, more and more utilities have been fully or partially unbundled and utilities in Southern Africa are by-and-large following suite. This has, in part, motivated the development of private electricity aggregators which broker supply agreements from different electricity sources.

Aggregators often assume other roles in order to provide customers with efficiencies and savings. They carry the risk and gain the benefits of a mixed portfolio of technologies with varying characteristics.
8.1.2 Examples of Aggregators

Amatola

Amatola currently acts as an aggregator in South Africa. The cost of electricity generation was noted as the largest barrier to entering this market as a competitor to Amatola because the green premium on Amatola’s electricity makes the cost of generating electricity competitive with that of Eskom’s. Amatola currently only wheels physical electricity as opposed to derivatives such as tradable renewable energy certificates (RECs).

Smartestenergy

The UK’s Smartestenergy and Aggregated Micro Power were noted as successful case studies of aggregators.

In Europe and the USA the market has sufficient liquidity due to the large amount of buyers and sellers who make use of the liberated electricity market. This facilitates competition between generators and distributors of electricity which allow competitive prices for the off-taker. Regulatory costs related to the trade of electricity in a liberated market amount to approximately 30% (Maintenance, Transmission and Distribution, Grid support costs). The remaining 70% of the cost related to electricity trading is variable – which facilitates competition between generators, traders and distributors.

Interconnections between European countries allow prices to be competitive as electricity may be traded between countries from numerous generators/suppliers – Variations in electricity prices (per unit) in different countries allow the trader or off-taker to choose from which generator/supplier they wish to purchase electricity. The electricity market in North-Western Europe become liberalised as a result of reduced electricity costs in the liberated market as opposed to only have a fixed regulated market. The European electricity market has ring-fenced specialities for each step in the electricity market cycle.

Each seller/reseller of electricity has a base (financial investment/target) from which they work each year – the quantity of electricity purchased and traded is based on this base value of the seller/reseller.

Some specific examples in international electricity markets which are liberalised include the UK market which has an over the counter (OTC) scheme as well as a regulated supply market in which suppliers in the liberated electricity market will try to sell off contracts if the supply cannot be met; the spot price of electricity is determined in real time every 5 minutes in the Australian electricity market and; the Norwegian market has sufficient liquidity and confidence in the market itself that physical trade is factored out and only financial trades take place.

Google uses renewable energy for all of the data centres in Europe as a measure of energy security and control. Making use of renewable energy sources allows the cost to be controlled more effectively as Google believes the cost of using energy derived from fossil fuel will be much higher than that of renewable sources in 10 years’ time.
8.1.3 Considerations for a potential aggregator model in South Africa

Different possible permutations of an aggregator platform exist. If the aggregator is a trader they would take the risk of unserved load and costs associated with end-users not purchasing generated electricity. The aggregator thus effectively becomes an off-taker if it takes on the role of a trader. The aggregator could then do back to back transactions to sell the purchased electricity which it procured from a recent trade. In this way the aggregator could act as a platform to connect buyers and sellers in the SAPP region.

It was reiterated that such a concept is theoretical in nature as constraints of growth in the IPP sector are hampering liquidity in the electricity market. The role of the Integrated Resource Plan (to be updated in 2016) in South Africa was identified as a potential constraint to stimulating growth in the IPP sector. NERSA is apparently reluctant to licence new IPPs unless they are allocated under the national IRP and it was agreed that the regulatory environment would need to support an aggregator model.

Embedded generators could support the aggregator model if their volumes were sufficient considering that they are typically small to medium in size. An embedded generator is defined as an entity that operates one or more electric power generation units that are connected to a distribution system (NERSA, 2015, p. 4). While the fuel sources of embedded generators may vary, in the SADC context the term is frequently used in reference to generation from small photovoltaic facilities.

Embedded generators are typically grid-tied and rely on a utility to supply them with electricity when their generation capacity does not meet their consumption demand. Conversely, during periods of surplus supply, embedded generators are able to feed electricity back into the grid.

Grid-tied embedded generators therefore have the potential to supply various end users, so long as they share access to the same grid. Where the grid is owned by a separate entity, the embedded generator must enter into an agreement with the grid-owner to determine the conditions and fees for ‘wheeling’ the electricity over the electrical network to the third party, electricity consumer.

Even though the practice of embedded generation is fairly new in the SADC region, the number is growing as electricity constraints and insecurity of supply persist. Furthermore the costs associated with the respective energy technologies (particularly relating to rooftop photovoltaics) are decreasing. While licences are required for commercial generation operations across the region, there are thresholds (that differ across nation states) under which generators may operate without requiring licences. Smaller facilities are often exempt from requirements in this regard, increasing the ease of installing such facilities.

The following case study examines a recent embedded generation development in South Africa, which may be replicated in the near future.

Some legislative aspects that should be considered in the aggregator model are:

- The aggregator (trader or broker) could potentially require overarching SAPP
import/export licences to facilitate the trade for both generators and suppliers across regional borders between the SAPP member countries;

- Imbalances in the contractual requirements between generator and load needs may exist. Generators typically want a 25 year off-take agreement with either traders or off-takers. Traders typically want a 5 year agreement and off-takers typically want a 1 – 3 year agreement. Liquidity was raised again as a barrier;

- For the market to be successful, competitive and robust standardised agreements on the market platform are required for electricity and regulatory contracts. It was proposed that the regulatory requirements for an electricity import/export license in South Africa are among the largest constraints currently barring the trade market in South Africa. It was noted that according to the Competition Act, the dominant market player is an entity that controls 45% of the market share. No dominant player may refuse a new player/entity to gain access to critical infrastructure (grids or markets – that cannot be easily replicated); and

- The legislative and regulatory environments are complex within the SAPP region. Ideally, the market should be regulated to the correct extent that it can allow free trade but still protect the consumer. A more flexible market is a more economical market but the market should always first and foremost protect the end-user.

Some financial aspects that should be considered in the aggregator model are:

- Currently there is little liquidity in the SAPP. In South Africa for example, banks will not provide funding for long-term power generation unless the generator can provide the quantity of electricity produced and an extensive list of buyers who have signed contracts agreeing to purchase the electricity from the generator (long term PPA);

- The current cost at which Eskom produces electricity makes wheeling unfavourable as the IPPs produce electricity at a much higher cost per unit. However it was noted that the utility bears costs in this regard which need to be recouped;

- Other financial implications associated with imbalances between generators and suppliers were also analysed. In the event that a generator cannot produce the agreed upon load, it could face penalty charges as the market operator or aggregator would have to source the electricity from an alternative generator that would potentially charge a higher rate per unit of electricity sold. A similar scenario could exist if the off-taker does not purchase the entire amount of agreed upon electricity from the generator/supplier. The supplier would thus carry the financial liability of generated electricity that cannot be sold at the agreed upon price and would potentially have to sell the capacity at a lower rate per unit of electricity and according reducing the generator/supplier’s profit margin; and

- ‘Supplier of Last Resort’ concept needs to be addressed in the aggregator model. The default supplier (of last resort) is activated when the customer cannot find a supplier on the market. It was noted
that this could however be a barrier for market entry for new suppliers.

With respect to infrastructure requirements:

- The electricity passing through the transmission network (grid) could be labelled at the point of generation as being either renewable (green) or fossil fuel based (brown) electricity;
- Balancing rules would be required if additional generators are added to the current system to effectively manage all generation and supply and distribution networks. Currently the rules for balancing demand and supply in South Africa are implemented within the national utility (Eskom). In the event that more generators come onto the regional grid, a dedicated system operator (SO) would be required to balance the loads moving across all interconnectors. Scheduling dispatch rules already allow for multiple buyers and sellers in South Africa;
- It is noted that ancillary services would be critical in order to manage system reliability and electricity quality as there are different reserve categories related to start-up and the size and time at which electricity is required; and
- Infrastructure and network constraints across SAPP were noted a priority areas underpinning market reform across Southern Africa. It was agreed that proper metering is one of the first step required to enable a successful electricity market.

8.2 Market tools

A derivative is a risk management instrument that can be used in electricity markets. The value of a derivative is derived or determined from another indicator (or value) within the market such as the prevailing market price, stock value or market index.

Derivatives are typically used as a form of insurance against interest rate or energy price increases. They can also be used to improve the investment quality of a utility’s issues of bonds or other types of commodity securities (PricewaterhouseCoopers, 2008).

A contract for difference (CfD) is a form of derivative which can be used between an electricity generator (typically generating electricity from a low-carbon source or renewable energy) and a government-owned entity. The contract for difference is used as a market tool to account for over or under estimation of electricity prices and can be used to help financing of electricity generation infrastructure.

The contract for difference is used to pay the difference between the strike price (the projected market price of electricity) and the reference price (a measure of the average market price for electricity in the market). This tool adds additional stability and security for private companies in the electricity supply industry that makes large investments in infrastructure to generate electricity. It reduces the private generator’s exposure to volatile wholesale prices and ensures a relatively constant stream of revenue. It also protects the end-users from unreasonably high electricity prices by mitigating the need for the end-user to carry additional cost of the generator that choses to use a renewable generation source that typically has a higher cost of generation (UK Department of Energy and Climate Change, 2014).
9 Conclusion and Recommendations

The information and analysis presented in this report finds that there is general acceptance globally that competition in electricity markets will yield, and has yielded, significant benefits. The benefits include lower prices (except in areas where historic subsidies led to non-cost reflective prices), better allocation of capital, increased access to capital and better long term planning.

It is generally thought that there are a number of prerequisites for competition in the electricity markets. The first is a (large) number of independent generators, the second is independence between the generators and the transmission system and lastly reasonable, cost reflective market prices.

A large number of countries viewed privatisation of the generation industry as a prerequisite to achieving the first requirement mentioned above - a large number of independent generators. In some countries (like Norway) privatisation was not required to achieve this, while in countries like the UK, where there was only one national utility, it was necessary.

It is however of significance that many countries where privatisation was required were facing an oversupply of electricity generation capacity at the time of the start of the market reform. The analysis in this project found that areas where a shortage of supply exists (like the SADC region in 2016) can achieve sufficient levels of competition simply by allowing new entrants to the market to enter the market with new generation capacity. Such a move would however require electricity prices on the system that is reflective of the cost of power generation in new plant.

The issue of independence of generators from transmission operators can be achieved in a number of ways. The European Union followed an interesting approach by first unbundling generation from transmission on an accounting basis in 1996. This was followed by full legal separation 6 years later in 2003. France however still has a vertically integrated utility with only accounting separation.

This research found that electricity reform in the Southern African region started at very much the same time as what it happened globally. The Southern African Power Pool was formed by the Southern African Development Community in 1995. This was 6 years after the UK market reform started, but 1 year before the first market reform directive of the European Union. Japan also started the electricity reform in 1995 and Texas only started in 1999.

The intent to entrench the reform was very strong in many of the SAPP member countries at the time. South Africa published the White Paper on Energy Policy in 1998. This document, if implemented, would have achieved a fully liberated market in the country with separately owned Regional Electricity Distributors (REDs) and access to the grid for independent power producers.

Namibia introduced the concept of independent regional electricity distributors in their 1998 White Paper and implemented the first REDs in 2005. Zambia introduced
an independent transmission system operator, the Copperbelt Energy Corporation (CEC) in 1997 with the privatisation of the Zambia Consolidated Copper Mines (ZCCM) Power Division. This independent transmission operator operates within the framework created by the 1995 Electricity Regulation Act.

The enigma in the Southern African region is therefore that many of the building blocks for a liberated electricity market actually exist, but such a market does not exist. The process of creating a liberated market was derailed in December 2010 when the South African cabinet terminated the implementation of the unbundling of the electricity distribution industry through the REDs.

South Africa has traditionally produced over 75% of the electricity in the SAPP region. It has done so at prices that was significantly below levels required for the operation of an efficient market.

The failure of South Africa to implement the 1998 White Paper on Energy Policy has significantly impacted on the development of an electricity market in the whole region.

The resulting situation in the first quarter of 2016 is as follows:

- The regulatory infrastructure required for a liberated electricity market is substantially in place in many of the jurisdictions in the region.
- Even though the reform process was stopped in South Africa with the abandonment of the REDs legislation in 2010 and the subsequent abandonment of the ISMO Bill in 2015, the legislated principle of free and fair access to the grid stands.
- The fact that there Eskom has unbundled the transmission and distribution in South Africa on both accounting and management levels means that some of the benefits of unbundled transmission and distribution do exist in South Africa.
- Some impediments to market development in the region still exist in the following:
  - Limits to interconnector capacity between countries.
  - Progress is still to be made towards fully cost reflective tariffs in some of the countries in the region.
  - Some licensing issues still exist in South Africa. One such example is the ministerial determinations required by the legislation in terms of the country’s integrated resource plan.

Within the context of the above, this research project concludes that there are at least two reasons why the development of a liquid market for electricity is possible without further regulatory reform:

- The first is that there has been sufficient reform in the regulatory environment to make such a market possible.
- Secondly, the electricity crisis in South Africa has precipitated a rising electricity price path that brings the region within reach of cost reflective prices.

The study concludes that the two most likely pathways to the creation of a liquid market in the short term are:

- Scaling up the participation in the SAPP. This will only happen if independent
power producers and large off takers will join the SAPP in larger numbers.

- The development of an electricity aggregator that trades on one of the established trading platforms in the region such as the JSE.
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