Challenges facing the wind energy industry in South Africa

Lessons learned from international experience in promoting wind energy

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I know the meaning of plagiarism and declare that all the work in this paper, save for which is properly acknowledged is my own.

Signed: ___________________________

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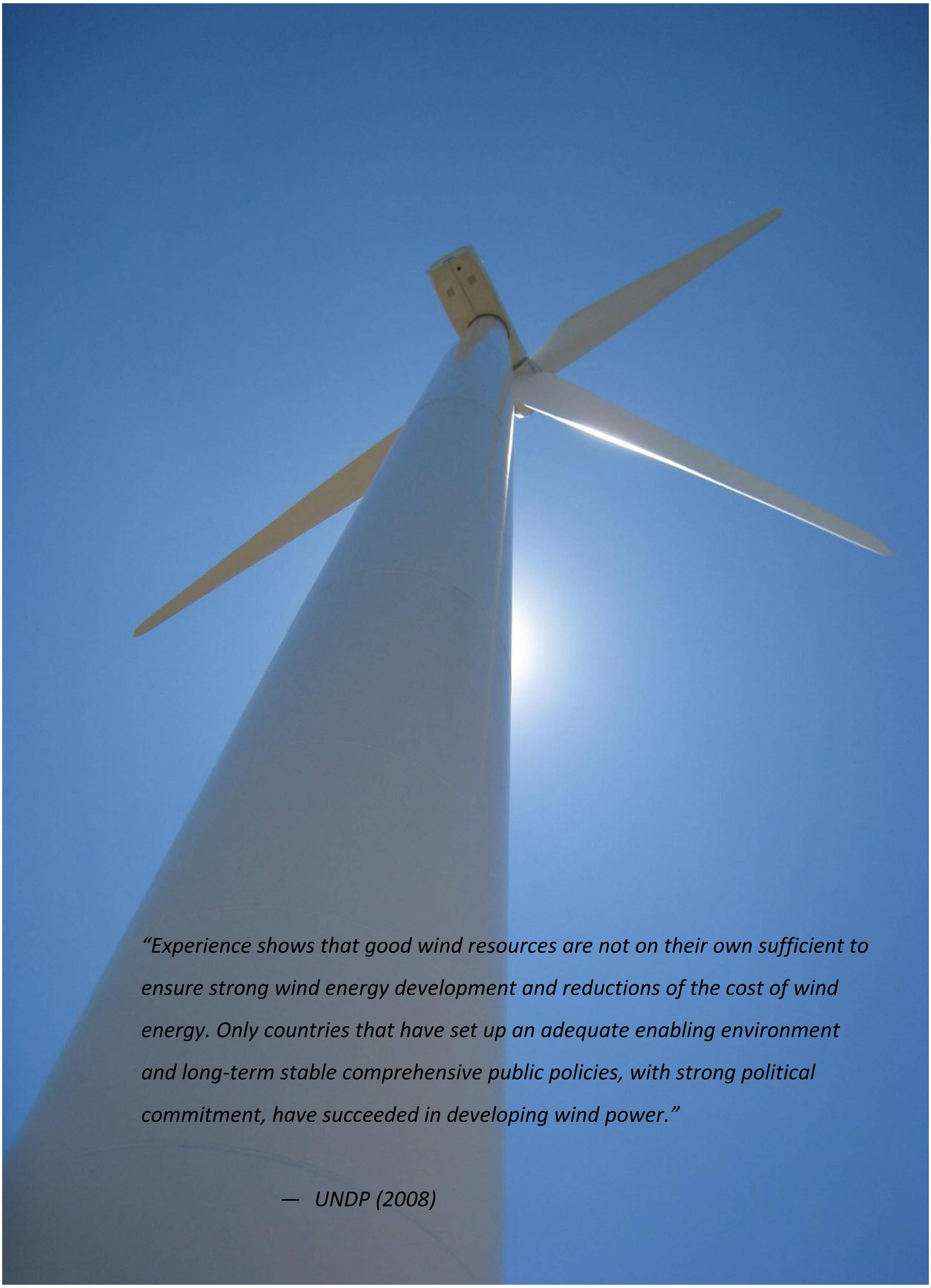
Abstract

Growing concerns regarding climate change, energy security, long-term carbon price exposure, fuel-price risk and fossil fuel depletion have continued to drive growth in wind energy globally over the past decade. In spite of South Africa's renewable energy target and feed-in tariff for renewable energy, the current deployment of wind energy in South Africa is extremely low. Consequently, as the country embarks upon promoting the development of renewable energy, it is important to consider the challenges facing the wind energy industry in South Africa.

This paper identifies the challenges facing the wind energy industry in South Africa and analyses how South Africa could address these challenges and create an enabling environment to support the development of a large-scale wind energy industry in the country by considering the lessons learned from international experience in promoting wind energy.

The outcome and benefits of a potential large-scale wind energy programme in South Africa are quantified through an energy modelling tool known as SNAPP. The challenges to wind energy development in South Africa are identified and analysed through primary research in the form of interviews and through a literature review. The lessons learned from international experience in promoting wind energy are identified through an international literature review.

The analysis found that the current low deployment of wind energy highlights a lack of implementation and policymaking at the government level and is largely attributable to a number of policy, regulatory, legal and institutional challenges which are currently facing the wind energy industry in South Africa. The main findings from an examination of experience in other countries in promoting wind energy reveal that the implementation of a set of policy measures in South Africa over the short, medium and long term could serve to address the challenges facing the wind energy industry and create an enabling environment for the development of a large-scale wind energy industry in South Africa.


"Experience shows that good wind resources are not on their own sufficient to ensure strong wind energy development and reductions of the cost of wind energy. Only countries that have set up an adequate enabling environment and long-term stable comprehensive public policies, with strong political commitment, have succeeded in developing wind power."
— *UNDP (2008)*

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ACED	African Clean Energy Developments
AIIF2	African Infrastructure Investment Fund 2
AET	Annual Electricity Tariff
CaBEERE	Building in Energy Efficiency and Renewable Energy
Capex	Capital expenditure
CEF	Central Energy Fund
CER	Certified Emission Reduction
COD	Date of commissioning
CSIR	Council for Scientific and Industrial Research
CSP	Concentrated Solar Power
CTF	Clean Technology Fund
DANCED	Danish Co-operation for Environment and Development (currently “DANIDA”)
DANIDA	Danish Co-operation for Environment and Development (formerly “DANCED”)
DARLIPP	Darling Independent Power Producer
DBSA	Development Bank of Southern Africa
DEA&D:P	Western Cape Department of Environmental Affairs and Development Planning
DFI	Development Finance Institution
DME	Department of Minerals and Energy
DOE	Department of Energy
EA	Environment Authorisation
ECA	Export Credit Agency
EEG	Renewable Energy Sources Act (or Erneuerbare Energien Gesetz)
EIA	Environmental Impact Assessment
ESI	Electricity Supply Industry
EU	European Union
GHG	Greenhouse Gas
GTZ	German Development Cooperation
GWh	Giga Watt hour
IMC	Inter-Ministerial Committee on Energy
IPP	Independent Power Producer
IRP	South Africa’s Integrated Resource Plan, currently IRP1 and successive IPR will be IRP2010
ISMO	Independent System Market Operator
KWEDF	Klipheuwel Wind Energy Demonstration Facility
KWh	Kilo Watt hour
kV	Kilo Volt
LTMS	Long Term Mitigation Scenarios
MTPPP	Medium Term Power Purchase Programme
MW	Mega Watt
NDRC	National Development and Reform Commission
NEMA	National Environmental Management Act
NERSA	National Energy Regulator of South Africa
NewGen Regulations	Electricity Regulations on New Generation Capacity promulgated in August 2009
NFFO	Non-Fossil Fuel Obligation
OCGT	Open Cycle Gas Turbine
PPA	Power Purchase Agreement
PROINFA	Alternative Energy Sources Incentive Programme
PTC	Production Tax Credit
R&D	Research and Development
RE	Renewable energy
RE Law	Renewable Energy Law

REFIT	Renewable Energy Feed-in Tariff
REFIT Phase I	First phase of the REFIT Programme
REFIT Phase II	Second phase of the REFIT Programme
REFSO	Renewable Energy Finance and Subsidy Office
REMT	Renewable Energy Market Transformation
REPA	Renewable Energy Purchasing Agency
RFQ	Request For Prequalification
RFP	Request For Proposal
SABRE-Gen	South African Bulk Renewable Energy Generation project
SANERI	South African National Energy Research Institute
SAWEA	South African Wind Energy Association
SAWEP	South African Wind Energy Programme
SBO	Single Buyer Office
UNFCCC	United Nations Framework Convention on Climate Change
WASA	Wind Atlas of South Africa
WEF	Wind Energy Facility
WTM	Wind Turbine Manufacturer
ZDE	Wind Power Development Zone

1. Introduction

The development of wind energy in South Africa has been relatively limited to date and wind generation currently represents less than 0.1% of the total electricity generation in the country. The benefits of wind energy in South Africa are, however, becoming increasingly recognised, and in March 2009, the South African energy regulator implemented a Renewable Energy Feed-in Tariff ("REFIT") Programme to promote the development of renewable energy in the country.

The implementation of the REFIT Programme in South Africa has sparked significant interest from wind energy developers and investors in the wind energy industry and there are currently over 8,000MW of wind energy projects under varying stages of development in the country. However, no wind energy projects have yet been selected and awarded a power purchase agreement in the REFIT Programme. This paper identifies the key challenges facing the wind energy industry in South Africa and examines experience in other countries which have promoted wind energy in order to give insight into how South Africa might address these challenges and create an enabling environment to achieve a sustained and large-scale wind energy industry.

The paper firstly presents the case for a large-scale wind energy industry in South Africa by describing what a large-scale wind energy programme would look like and by assessing the outcome and benefits of such a large-scale wind energy industry in the country. The paper then provides an overview of the current status of wind energy development in South Africa and describes the policy and regulatory framework for wind energy. In Section 4, the paper identifies the key challenges facing the wind energy industry.

In Section 5, the paper provides an examination of experience in other countries which have encountered similar barriers to South Africa or which have overcome these barriers through various policy measures. The final section then discusses the main findings and conclusions of the paper and describes a possible set of measures based on the lessons learned from international experience which could be implemented in South Africa over the short, medium and long term to address the challenges to wind energy development and create an enabling environment to stimulate the development of a sustained and large-scale wind energy industry in South Africa.

2. The case for a large-scale wind energy industry in South Africa

In recognition of the benefits of renewable and wind energy in South Africa, including its contribution to local economic development, job creation, improving energy security and the government's energy policy objectives such as climate change mitigation, government's renewable energy target and private sector investment in the power sector, South Africa has set itself a renewable energy target of 10,000GWh to be achieved by 2013 through its White Paper on Energy (2003) and has implemented a REFIT Programme to promote renewable energy development in the country. In spite of these support measures, the deployment of wind energy in South Africa is extremely low.

The case for a large-scale wind energy industry in South Africa is demonstrated through an analysis of the outcome and benefits of a potential large-scale wind energy programme in South Africa. This section firstly provides an overview of the South African power sector and Eskom's capital expansion plan. It then discusses whether a large-scale wind energy industry would be technically feasible in the country, by considering South Africa's wind resource potential and grid capacity for wind energy. Thereafter, it discusses the modelling, outcome and benefits of a large-scale wind energy programme.

2.1. South African power sector

Although South Africa has excellent wind resource potential, the development of wind energy has been slow to take off (Edkins *et al*, 2010). More than 90% of electricity generation is currently derived from coal-fired power stations. South Africa's state owned utility, Eskom, has 27 operational power stations in the country, and net installed generation capacity of 40.1 GW (Eskom, 2009d). Additional generation capacity is from imports, municipal and private generators, taking total generation capacity in South Africa up to 43.4GW.

Eskom has historically supplied cheap electricity to consumers in South Africa largely due to overcapacity of coal-fired power stations from Eskom's optimistic build programme in the 1970's (Winkler, 2009). Until recently, Eskom's average electricity tariff was approximately R0.25/kWh on average or less (Edkins, 2010). However in 2008, electricity demand in the country outstripped supply, and Eskom had to resort to load shedding.

In order to alleviate the country's generation capacity shortfall, Eskom has proposed that an additional electricity generation capacity of 20 GW is required by 2020 and more than 40GW by 2030. Accordingly, Eskom has embarked upon a massive capital expenditure ("capex") plan which includes:

- 10GW of coal, by return to service mothballed coal-fired power stations[1], and construction of Medupi (4.4GW) and Kusile (4.3GW) coal-fired power stations;
- 1.3GW from Ingula pumped-storage station;
- 100MW from Eskom's Sere Wind Project; and
- 50MW from Eskom's Concentrated Solar Power ("CSP") Project in Upington (Eskom, 2009c).

[1] These include Grootvlei (950MW) and Komati (909MW) which will continue to re-commission generating units until 2011, and Camden coal-fired power station, which has already completed its re-commissioning programme.

South Africa's capex programme also includes new generation capacity from Independent Power Producers ("IPPs") through various IPP Programmes, including the Medium Term Power Purchase Programme ("MTPPP"), the Open Cycle Gas Turbine ("OCGT") Programme and the Renewable Energy Feed-in Tariff ("REFIT") Programme. New generation capacity from IPPs includes:

- 420MW of cogeneration power under the MTPPP;
- 1,020MW of OCGT under the Department of Energy's OCGT Programme;
- 725MW of renewable energy projects under the REFIT Programme, including 400MW of wind farms and 325MW of installed capacity from other renewable energy technologies (NERSA, 2009a).[2]

Eskom plans to spend R426 billion over the coming five years, from 2010 to 2015, increasing to a cumulative total of R693 billion by 2017 to fund its capex programme (Standard Bank, 2010). However, Eskom is facing a significant funding shortfall for its capex programme, which is estimated to be R111 billion over the next three years to 2012/13, and R190 billion over the next seven years through to 2016/17 (Eskom, 2010a).

According to Eskom (2009a), the price of electricity has not allowed Eskom to support its capex programme, nor recover all its costs incurred and build reserves sufficient to sustain its current asset base (Edkins *et al*, 2010). Since the commencement of Eskom's capex programme in 2008, electricity tariffs have consequently increased substantially. During 2009/10, electricity tariffs increased by 31.3%, resulting in an average electricity price of R0.33/kWh (including a 2c/kWh environmental levy), and an additional increase of 24.8% in 2010/11 has resulted in the prevailing electricity tariff of R0.42/kWh (NERSA, 2010b).

South Africa's National Energy Regulator ("NERSA") has further approved an additional 25% annual increase in the electricity tariff over the next three years, which will result in a tariff of R0.52/kWh in 2011 and R0.66/kWh in 2012 (NERSA, 2010b). Over the next three years, the NERSA's allowed revenue to Eskom includes an allocation of R2.3 billion, R4.3 billion and R5.8 billion for IPPs and cogeneration projects for the 2010/11, 2011/12 and 2012/13 financial years respectively. This is expected to cover the additional cost to Eskom of funding renewable energy and cogeneration capacity of 343MW in 2010, 518MW in 2011 and 284MW in 2012, as outlined in South Africa's Integrated Resource Plan ("IRP" which is currently IRP1).

The transition to renewable energy in South Africa has historically been viewed as an economic cost (Edkins *et al*, 2010). However, given that South Africa is facing a steadily rising electricity price environment and that the benefits of renewable energy are increasingly being recognised, policymakers are now becoming more willing to consider other criteria when planning the country's electricity system rather than just the least cost option.

2.2. Technically feasible wind energy industry in South Africa

The two main constraints in determining whether a large-scale wind energy programme in South Africa is technically feasible are the country's wind resource potential and the capacity of the grid to absorb large amounts of wind energy in South Africa. These constraints will be discussed below.

[2] These technologies include Concentrated Solar Power (CSP) trough without storage, Large scale grid connected PV systems (>1MW), Biomass solid, Biogas and CSP Tower with storage of 6hrs/day.

2.2.1. Wind Resource Potential

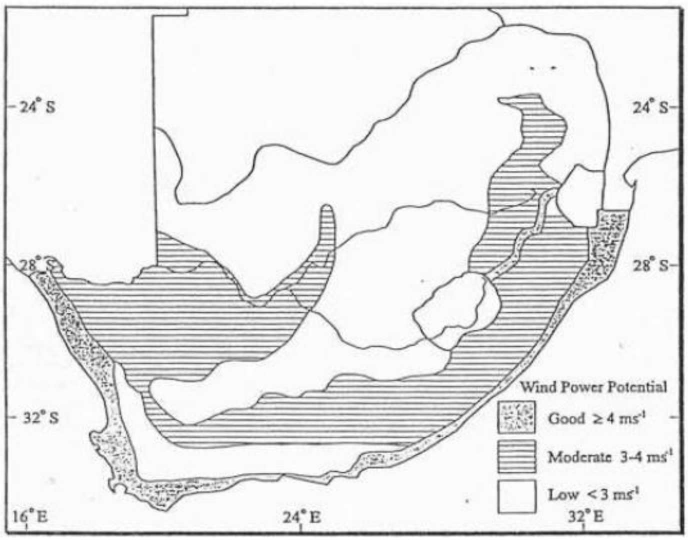
Wind resource prospecting in South Africa has until recently been in its relative infancy, and results from wind resource assessments conducted to date have been extremely varied due to the different methodologies employed. The three most frequency cited wind resource assessments are (a) the Diab Wind Atlas of South Africa (1995), (b) the Eskom SABRE-Gen project (2001) and (c) the Hagemann Mesoscale Wind Atlas of South Africa (2008).

(a) Diab Wind Atlas of South Africa (1995)

Diab's Wind Atlas of South Africa (1995) was prepared for the Department of Minerals and Energy ("DME") in 1995. The Wind Atlas was based on wind speed measurements at approximately 170 South African meteorological stations at heights of 2m, 5m and 10m above ground. Diab (1995) classified the country's wind resource potential into areas of good, moderate and low wind resource potential, and identified the coastal belt in the Western Cape, Eastern Cape and Kwa-Zulu Natal as well as escarpment areas as having a mean annual wind speed of greater than 4 m/s at 10m above ground (see Figure 1) (Hagemann, 2008; Karottki *et al*, 2001).

Diab (1995) proposed that the total wind generation potential in South Africa is approximately 7.9 TWh/year which equated to 2.4% of national electricity requirements in 2000.

Figure 1: Generalised map of wind power potential in South Africa after Diab (1995)

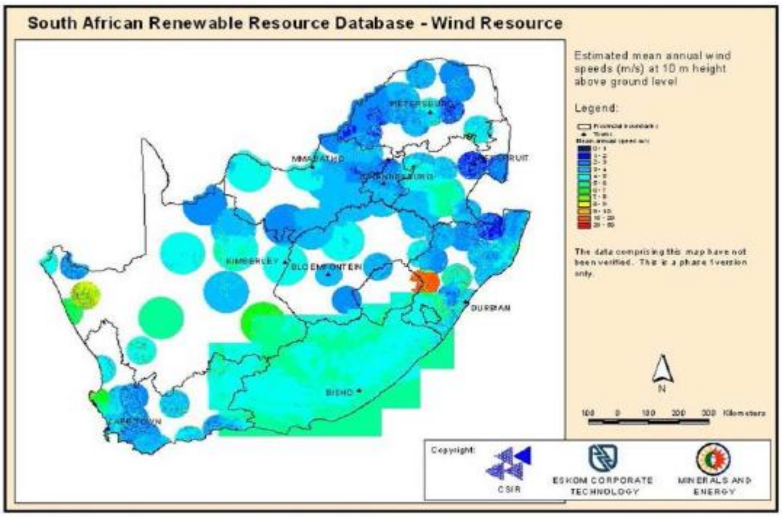


Source: Diab (1995)

(b) Eskom SABRE-Gen project (2001)

A revised wind resource assessment was prepared in 2001 as part of Eskom's South African Bulk Renewable Energy Generation project ("SABRE-Gen") and was jointly funded by Eskom, Council for Scientific and Industrial Research ("CSIR"), the DME and the Danish Co-operation for Environment and Development ("DANCED" now "DANIDA"). The SABRE-Gen results were generated through wind modelling and supported by wind data from South African weather stations similar to the Diab study. The Eskom Wind Atlas data suggests that the wind generation potential is significantly higher than the Diab Wind Atlas, at approximately 26 TWh/year. The map depicted in the figure below shows that the best wind resource is located in the Eastern Cape, Western Cape and Kwa-Zulu Natal.

Figure 2: Eskom revised Wind Atlas of 2001



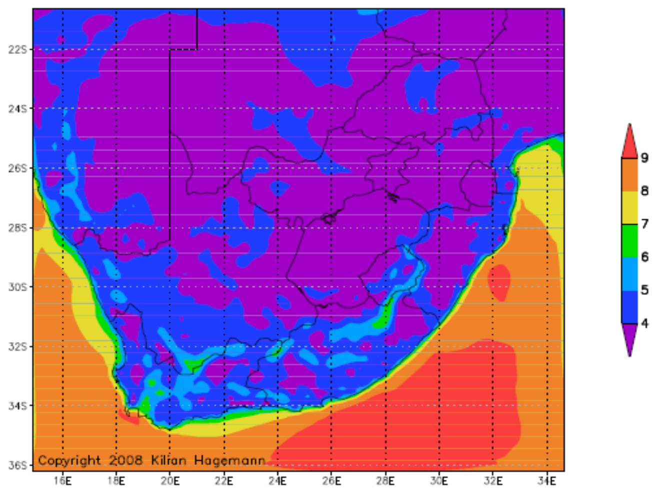
Source: Hagemann (2008)

However, the accuracy of the prediction of wind resource potential based on the Diab and SABRE-Gen wind atlases is poor, firstly, due to the location of the measuring masts which are close to buildings and other obstacles, and secondly, due to the low height of the wind measurements (Banks and Schaffler, 2006).

(c) Hagemann Wind Atlas of South Africa (2008)

The third wind resource assessment, Kilian Hagemann's Mesoscale Wind Atlas of South Africa, was conducted in 2008 as part of Kilian Hagemann's PhD thesis (Hagemann, 2008). The Mesoscale Wind Atlas was based on modelled wind speeds across the country at 10m above ground level and employed Geographic Information System ("GIS")-based scenario analysis to assess the feasibility of different wind power penetration levels (Hagemann, 2008). The GIS-based scenario analysis was based on proximity to existing infrastructure, assumed height of wind monitoring and minimum capacity factor of as outlined in Table 1 below. The Wind Atlas shown in Figure 3 provides a map of the average annual wind speeds at 10m above ground level for South Africa, which shows that wind resource potential is best within the Western Cape, Northern Cape and the Eastern Cape.

Figure 3: Average annual wind speeds at 10m above ground in ms^{-1}



Source: Kilian Hagemann's Mesoscale Wind Atlas of South Africa (2008)

The results below show that under conservative assumptions, there is approximately 6,000MW wind resource potential in the country, under moderate assumptions 26,000MW is available, and under optimistic assumptions as much as 56,000MW. This equates to 20 TWh/year under conservative assumptions ("Low Case"), 80 TWh/year under moderate assumptions ("Medium Case") and 157 TWh/year under optimistic assumptions ("High Case"). These assumptions are outlined in the table below.

Table 1: Kilian Hagemann's Wind Atlas Assumptions and Results

Scenario	Assumptions and Results	
Low Case	Distance from Existing Infrastructure	3km
	Assumed Hub-Height	60m
	Minimum Capacity Factor	35%
	Feasible annual electricity generation	20 TWh
	Installed Capacity	6,000 MW
Medium Case	Distance from Existing Infrastructure	4km
	Assumed Hub-Height	60m
	Minimum Capacity Factor	30%
	Feasible annual electricity generation	80 TWh
	Installed Capacity	26,000 MW
High Case	Distance from Existing Infrastructure	5km
	Assumed Hub-Height	100m
	Minimum Capacity Factor	25%
	Feasible annual electricity generation	157 TWh
	Installed Capacity	56,000 MW

Source: Hagemann (2008) Note: Minimum capacity factor relates to the minimum availability of output of the wind farm.

Based on the results of the three wind resource assessments conducted to date, the estimates for South Africa's wind resource potential vary from:

- 7.9 TWh/year or 3GW according to Diab (1995); to
- 20 TWh/year or 7.6GW based on conservative assumptions under the Hagemann (2008) Wind Atlas; to
- 26 TWh/year or 10GW based on the SABRE-Gen Project (2001); to
- 80 TWh/year or 30.4GW based on moderate assumptions under the Hagemann (2008) Wind Atlas; and to
- 157 TWh/year or 60GW based on optimistic assumptions under the Hagemann (2008) Wind Atlas.

Given the uncertainty and the variance in the results outlined above, it is difficult to accurately determine the availability of South Africa's wind resource potential. A revised wind resource assessment, known as the Wind Atlas of South Africa ("WASA") Project, is currently being prepared for the DOE by the South African National Energy Research Institute ("SANERI") in conjunction with partners, CSIR, University of Cape Town, the South African Weather Service and Riso DTU. When finalised in December 2012, the WASA Project will provide a more accurate assessment of the South Africa's wind resource potential, as it employs a numerical wind atlas method which uses a combination of microscale and mesoscale modelling with verification against wind measurements (Szewczuk *et al*, 2010).

However, prior to the finalisation of the WASA Project and based on the results of the existing wind resource assessments, the availability of South Africa's wind resource potential is unlikely to present a technical constraint to the deployment of a large-scale wind energy industry in South Africa.

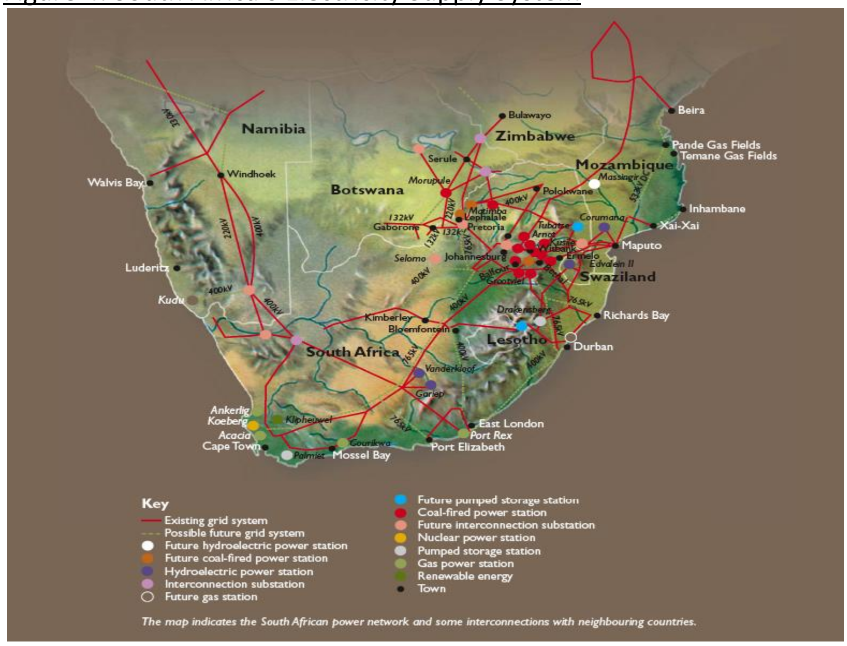
2.2.2. Grid Integration of wind energy

System-wide grid studies are required to examine the impacts of large amounts of wind energy on the grid, however, prior to the finalisation of grid integration studies in South Africa, it is possible to draw some high level conclusions based firstly, on the structure of South Africa's electricity supply system, secondly, on grid studies which have already been conducted in the Western Cape by the German Development Cooperation ("GTZ") in 2009 and thirdly, on grid integration studies conducted by the IEA Wind Task 25.

(a) Electricity Supply Industry in South Africa

South Africa's electricity supply system is characterised by a high concentration of coal-fired power stations located in the interior in the northeast, with approximately 28,000 km of transmission lines (over 132kV to 765kV) down to coastal areas (Newbery and Eberhard, 2008). Eskom generates approximately 95% of South Africa's electricity and has a total of 27 operational power stations, which are depicted in the figure below Eskom, 2009d).

Figure 4: South Africa's Electricity Supply System



Source: Eskom (2009d)

Eskom's power stations include the following:

- 13 coal-fired power stations: 11 out of 13 of its coal-fired power stations are located in Mpumalanga Province, with the other two located in Lephalale in Limpopo province and in Sasolburg.
- 6 hydro-electric power stations: South Africa's two major hydro stations, Gariep (240MW) and Vanderkloof (300MW) are located on the Orange River in the centre of the country. Other mini-hydro stations include Colley Wobbles, First Falls, Ncora and Second Falls (however these are relatively small).

- 1 nuclear power station: Eskom's nuclear power station, Koeberg (1,800MW) is located 30km north of Cape Town in the Western Cape.

- 4 gas fuel turbine stations: South Africa's gas turbines are located on the coast in the Eastern Cape, including Gourikwa (740MW) and Port Rex (171MW) and the Western Cape including Acacia (171MW) and Ankerlig (1,318MW) which are relatively small and used for emergence peak demand loads.

- 2 pumped-storage power stations: peak demand is supplied by the Palmiet pumped storage scheme in the Western Cape (400MW) and the Drakensberg pumped storage scheme in Mpumalanga Province (1,000MW).

- 1 wind energy power station: Eskom's Klipheuwel Wind Energy Demonstration Facility in the Western Cape has an installed capacity of 3.2 MW (Eskom, 2009d).

Based on the structure of South Africa's electricity supply system, it is likely that the grid is well-suited to support the integration of large amounts of wind energy into the grid given that:

- Geographical dispersion of wind energy generation in the Western Cape, Eastern Cape and Northern Cape provinces (where wind resource potential is the best) will substantially reduce power imports from the north-east along the transmission corridor and thereby substantially reduce power system losses and improve system stability; and that

- Gas fuel turbine stations located in the Western Cape and Eastern Cape would enable the system operator to balance variations in wind generation, especially during hours of peak demand, when security of electricity supply is crucial to maintain power system adequacy.

(b) Grid integration of wind energy in the Western Cape

The GTZ grid studies, conducted in 2009 in co-operation with DIgiSILENT and the Western Cape Department of Environmental Affairs and Development Planning ("DEA&D:P") investigated the feasibility of integrating up to 2,800MW of wind energy in the Western Cape. The results of the feasibility studies show that there is no considerable impact of up to 2,800 MW of wind generation in the Western Cape on the transmission grid, and that it is possible to integrate 2,800 MW of wind generation without any major network upgrades to the 400 kV transmission grid. However, sub-transmission and distribution grids would be limited and major network upgrades at lower voltage levels would likely be required (GTZ, 2009b).

(c) IEA Wind Task 25 (2009)

The IEA Wind Task 25 (2009) has conducted numerous studies internationally to assess the impact of large amounts of wind generation on the design and operation of power systems (Holttinen *et al*, 2009). There are already a number of countries which are successfully coping with large amounts of wind power, such as Denmark, Spain, Portugal and Ireland, which have integrated between 9-20% of wind generation into their power systems.

Experience in these countries has shown that up to 15% wind energy penetration can be achieved without any notable grid upgrades and power system changes. However, these countries have shown that in order to increase wind penetration levels it is crucial to manage the integration of wind energy through (i) proper power plant interconnection, (ii) integration of network planning, and (iii) generation forecasting.

In the South African context, this suggests that the power grid could immediately accommodate up to approximately 10GW of wind energy capacity without significant system upgrades. Over the longer term, 15% wind energy penetration translates into approximately 15,000MW of wind energy by 2020 and 28,000MW of wind energy by 2030. However, in order to assess the technical feasibility of integrating large amounts of wind energy into South Africa's power system, it is crucial that system-wide grid studies are first conducted.

Prior to the finalisation of system-wide grid integration studies and based on the conclusions drawn above, namely that:

- South Africa's electricity supply system is well-suited to support the integration of large amounts of wind energy into the grid;
- The integration of up to 2,800MW of wind generation is technically feasible in the Western Cape; and
- Up to 15% wind energy penetration can be achieved without significant system upgrades (Holttinen *et al*, 2009);

it is likely that the capacity of the South African electricity generation system to absorb up to 15% wind generation over the long term would not hindered by technical grid constraints. However, it would be essential to manage high penetration levels of wind energy through grid integration measures such as network planning and generation forecasting.

Considering the availability of South Africa's wind resource potential and the capacity of the grid, it is therefore unlikely that the development of a large-scale wind energy industry in South Africa would be hindered by technical constraints.

2.3. Modelling, outcome and benefits of a Wind Scenario

In order to explore the ramifications of a large-scale wind energy programme in South Africa, two scenarios were modelled: a Reference Scenario in which coal dominates the expansion plan, and a Wind Scenario. The two scenarios will be outlined below, followed by a comparison of the scenarios in terms of (i) electricity capacity and generation, (ii) levelised generation cost of electricity and investment requirement, (iii) GHG emissions and (iv) employment opportunities.

2.3.1. Scenarios modelled

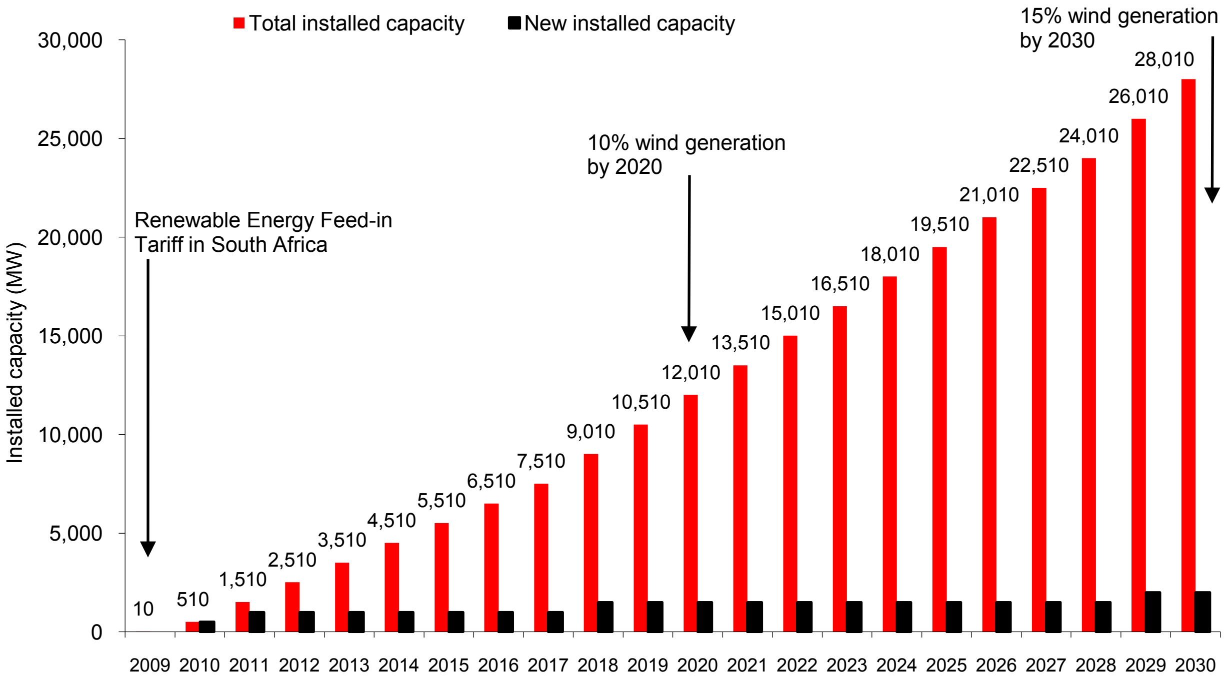
Reference Scenario: the Reference Scenario is based on Eskom's least-cost expansion plan outlined in Eskom's Draft Integrated Resource Plan for Electricity which was leaked to the public in September 2009 (Mail & Guardian, 2010).[3] This least-cost or Reference Scenario includes Eskom's committed capex programme (as outlined in Section 2.1). It further provides for the construction of coal-fired power stations to meet demand over the twenty year planning horizon, with OCGT power stations supplying electricity during peak demand (Eskom, 2009b).

[3] Eskom's Draft Integrated Resource Plan for Electricity (2009) is a leaked document and is not publicly endorsed, however, it provides the most up-to-date least-cost expansion plan conducted by Eskom.

Wind Scenario: the Wind Scenario includes Eskom's committed capex programme, although the construction of Kusile coal-fired power station is deferred by two years (i.e. first unit commissioned in 2015). Thereafter, the Wind Scenario is largely based on the Reference Scenario, however, it replaces some coal-fired generation with wind energy during the period from 2010 and 2030 whilst ensuring that electricity supply meets demand. It applies restrictions of new generation capacity deployment from wind energy based on the availability of South Africa's wind resource potential and capacity of the grid.

The Wind Scenario (depicted in Figure 5) assumes an annual installation of wind energy generation capacity of 500MW in 2010, and 1,000MW from 2011 to 2017. From 2018 until 2028, it assumes an annual installation of wind energy generation capacity of 1,500MW, and during the 2029 and 2030 it assumes an annual installation of 2,000MW of wind generation capacity. This results in total new installed capacity of 12,000MW during 2010 and 2020 (at an average plant availability of 30%), which implies that wind generation accounts for 10% of total electricity generation in 2020. Between 2020 and 2030, total new installed capacity of 16,000MW of wind farms are added to the power system (with an average plant availability of 25%) which implies that wind generation accounts for 15% of total electricity generation in 2030.[4]

Figure 5: Proposed cumulative and annual installed capacity of wind energy in the Wind Scenario



2.3.2. Electricity capacity and generation

In the Reference Scenario, new generation capacity from coal is 45.9GW during the period from 2010 and 2030 and only 500MW of wind energy (with 30% availability) comes online during 2010 to 2012 as outlined in IRP1. In the Wind Scenario, new generation capacity from coal is 38.7GW, and an additional 12GW of wind farms with an average availability of 30% and 16GW of wind farms with an average availability of 25% come online during the twenty year period. This implies that a total

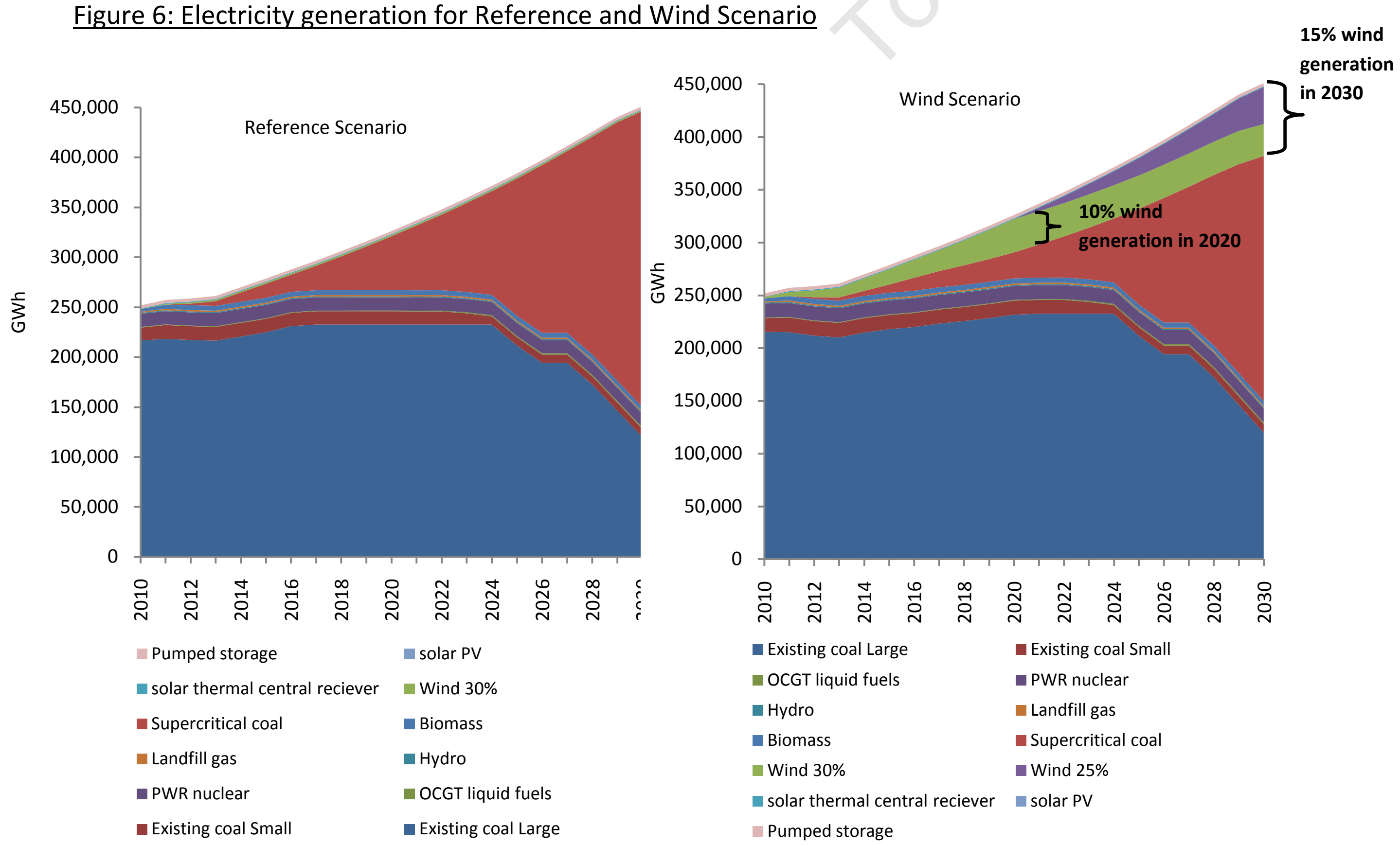
[4] The Wind Scenario assumes that there are two different average wind availabilities for wind farms in South Africa, including 25% and 30% availability.

installed capacity of 7.2GW of coal-fired power is replaced by 28GW of wind farms over the period in the Wind Scenario.

In the Reference Scenario, coal-fired power represents 93% and 95% of total electricity supply in 2020 and 2030 respectively and wind generation accounts for 0.4% and 0.3% in each of these years. In the Wind Scenario, coal-fired generation decreases from 92% (presently) to 83% in 2020 and to 80% in 2030 and wind generation accounts for 10% and 15% of total electricity generation in 2020 and 2030 respectively.

By replacing coal-fired generation with wind generation over the period, the Wind Scenario enables the government to actively pursue its energy policy objectives of energy security via diversification (as per the White Paper on Energy, 1998) and its renewable energy target of 10,000GWh by 2013 (as per the White Paper on Renewable Energy, 2003). The Wind Scenario further enables government to achieve (and exceed) its renewable energy target of 10,000GWh renewable energy contribution to final energy by 2013. According to the electricity generation plan in the Wind Scenario, renewable energy contributes over 17,000GWh to final energy supply by 2013 and the government's target of 10,000GWh is already met in 2011.

Figure 6: Electricity generation for Reference and Wind Scenario



It is important to note that although the Wind Scenario displaces 7.2GW of coal-fired power, it is designed to ensure that electricity generation capacity built meets the demand of the South African power system. The measure for ensuring that generation capacity is sufficient is the reserve margin. The reserve margin is a measure of the available generation capacity over and above the amount of generation capacity required to meet the system demand considering factors which might result in a loss of generation capacity such as generator breakdown, demand forecast uncertainty and transmission problems (Edkins *et al*, 2010).

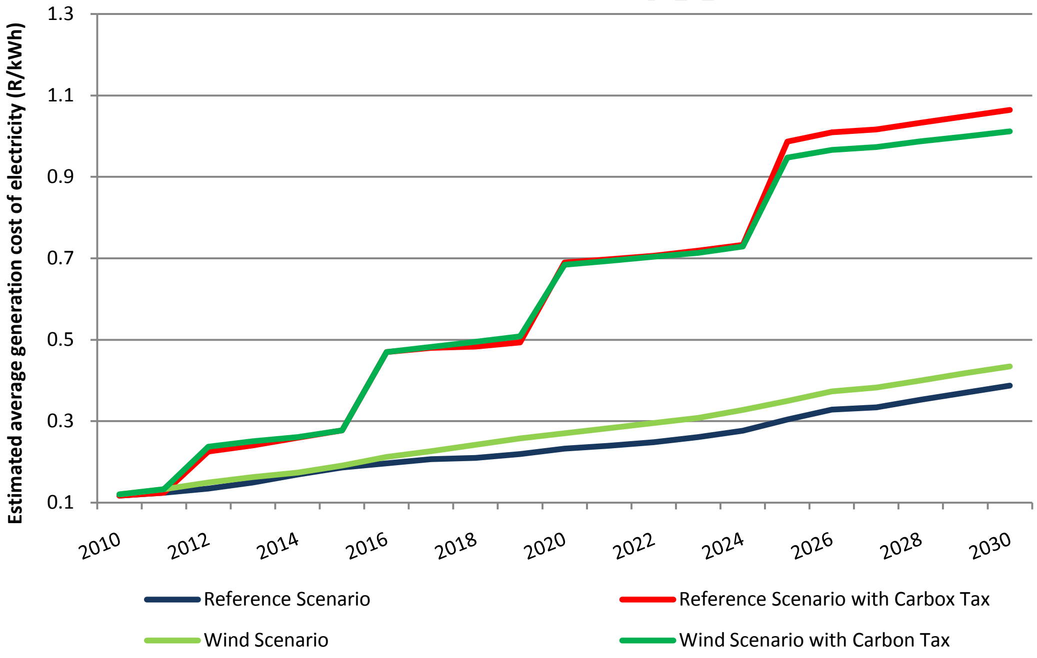
The Wind Scenario assumes a minimum reserve margin of 15% which is reasonable in the light of Eskom's recent statement that a reserve margin of between 15% and 25% is required to ensure the reliability of the system (Eskom, 2010b).

2.3.3. Levelised generation cost of electricity and Investment Requirement

The average generation cost of electricity per kWh is calculated from the total system costs, which include the sum of the annualised investment cost, the fixed cost, the variable cost and the fuel cost of each plant. Edkins *et al* (2010) note that this is not synonymous with the average electricity price which is set by the energy regulator, but rather, is indicative of the movements in price which might result from the two scenarios. Figure 7 illustrates that the average generation cost of electricity increases under the Reference and Wind Scenarios with and without a carbon tax (Edkins *et al*, 2010).

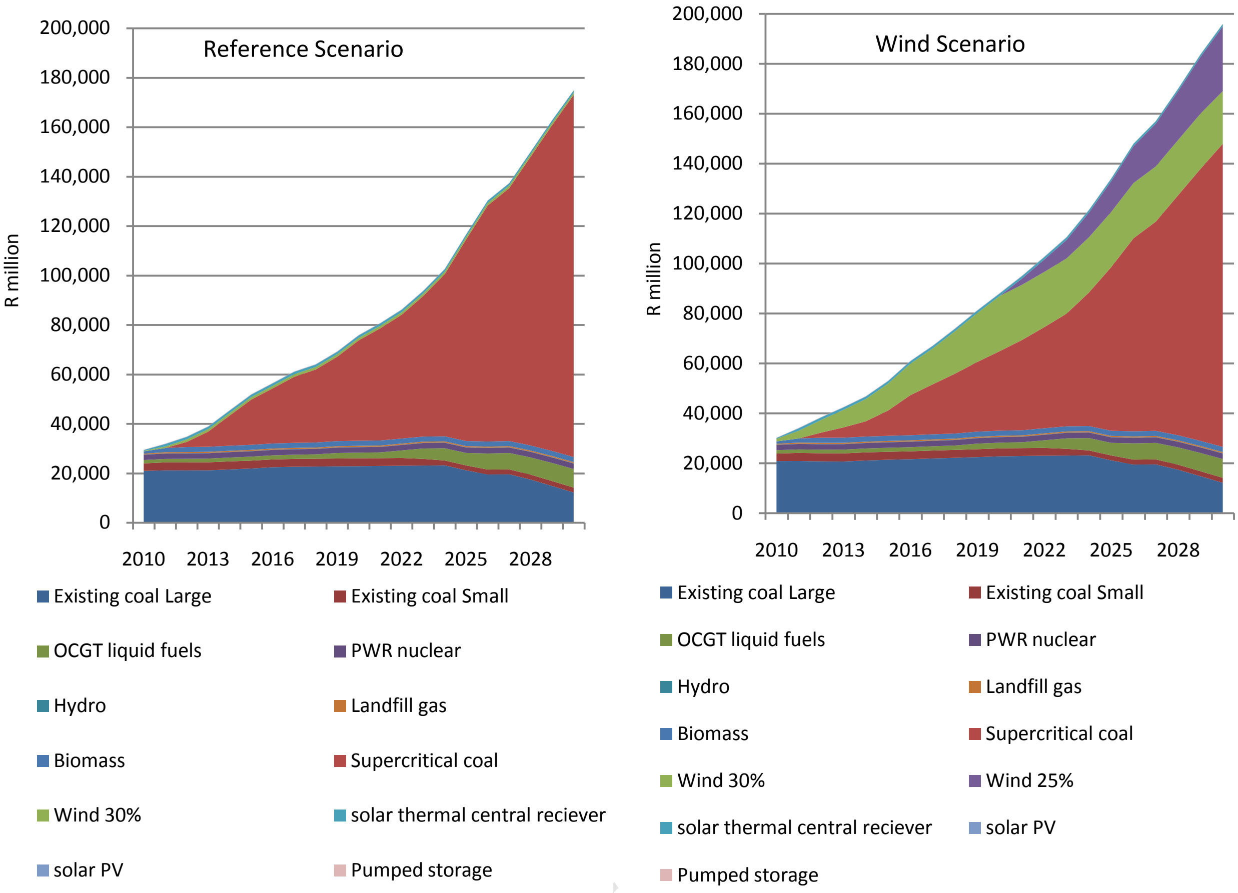
Under the Reference Scenario, the projected generation cost of electricity increases from R0.12/kWh in 2010 to R0.39/kWh in 2030. The average generation cost of electricity under the Wind Scenario increases from R0.12/kWh in 2010 to R0.43/kWh in 2030. The generation cost projections for the Wind Scenario are slightly higher than for the Reference Scenario, which illustrates that reaching 15% wind generation by 2030 will not have a significant impact on the average generation cost of electricity.

Figure 7: Projected average generation cost of electricity generated with and without a carbon tax



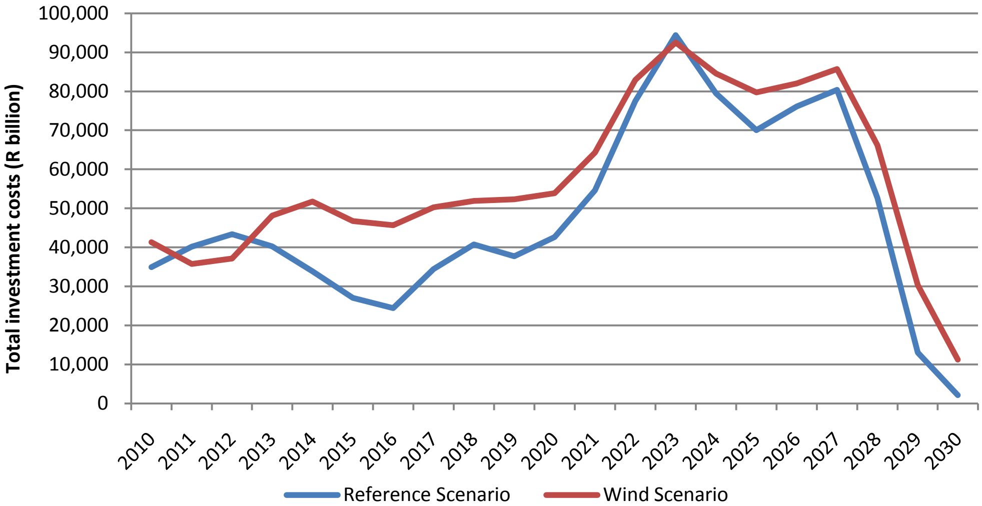
In contrast, if a carbon tax of R100 per tonne is applied from 2012, increasing to R500/tonne in 2020 and R750/tonne in 2030, then the average generation cost of electricity becomes higher under the Reference Scenario at R1.06/kWh in 2030 in comparison with R1.01/kWh in 2030 under the Wind Scenario. This implies that when considering the true cost of generation, by including the cost of emissions via a carbon tax, the average generation cost of electricity under the Wind Scenario is lower than the Reference Scenario over the long term.

Figure 8: Total system cost of Reference and Wind Scenario



The Reference Scenario results in a total system cost of approximately R175 billion by 2030 rising from a production cost of R30 billion in 2010. The Wind Scenario results in a total system cost of about R196 billion by 2030 rising from a production cost of just over R30 billion in 2010. The impact of the Wind Scenario on the total electricity system costs implied by these results is relatively modest, especially with the impact of a carbon tax, nevertheless a massive investment programme would be required to fund the Wind Scenario.

Figure 9: Total investment costs for the Reference and Wind Scenario



Under the Reference Scenario, annual investment requirements peak in 2023 at R94 billion and more than 95% of the investments go towards the construction of supercritical coal-fired power plants during the period from 2010 to 2030. Under the Wind Scenario, annual investment requirements also peak in 2023 however at a slightly lower amount of R92.5 billion. Under the Wind Scenario, only 68% of the investments go towards the construction of supercritical coal-fired power plants and 29% of the investments go towards the construction of wind farms during the period from 2010 to 2030.

The average annual investment costs under the Wind Scenario are about 20% higher under the Wind Scenario than under the Reference scenario over the period from 2010 to 2030. Therefore, the Wind Scenario requires sustained investment at a higher level over the period, as illustrated in Figure 9 above.

It is important to note, however, that although the investment requirement in the Wind Scenario is higher than the Reference Scenario, the investment required to fund the Wind Scenario can be provided by the private sector as opposed to Eskom. Given that Eskom is currently facing a funding shortfall of R111 billion for its capex programme over the next three years and R190 billion through to 2017, private sector investment provides one of the most realistic funding options of the required investment.

The benefits of private sector investment in wind IPPs are significant. Firstly, the incremental repayment of long-term debt finance occurs over the life of the asset, removing the need for Eskom to front-load electricity tariffs to fund new generation capacity (Hodge *et al*., 2009). Secondly, wind energy IPPs bear the risk of exceeding planned capital expenditure budgets during the construction period of the plant, removing the capex risk from Eskom or government.

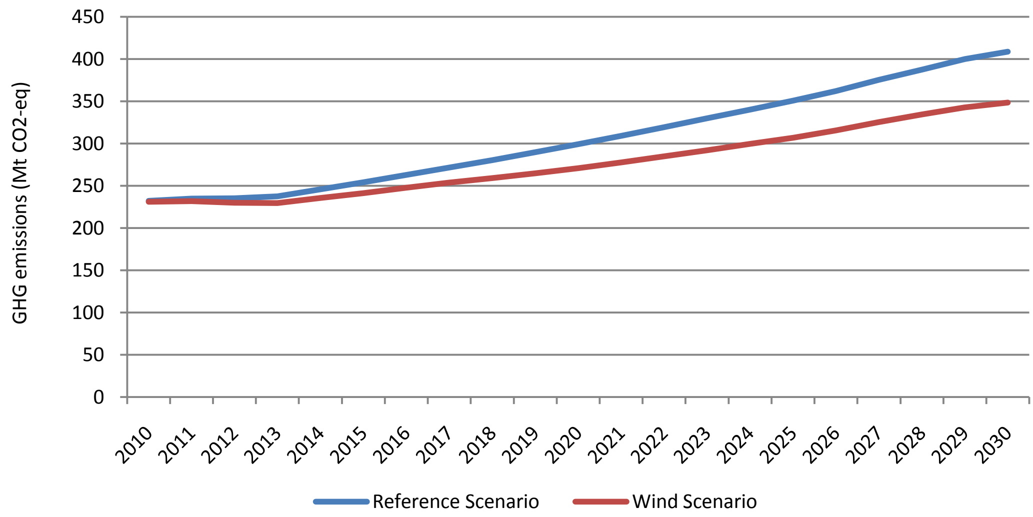
Thirdly, private sector investment in wind IPPs would enable South Africa to leverage forms of credit which would not necessarily have been made available, such as export credit agency ("ECA") funding, which is an internationally acceptable way of securing financing for renewable energy projects.[5] A significant proportion of IPP debt in South Africa could be funded by ECAs which would increase the overall Eskom-linked debt pool rather than cannibalising from Eskom's existing funders. Lastly, IPP debt may be funded through Development Finance Institution ("DFI") funding which has large-scale appetite for investment in renewable energy projects in Africa, whereas there is a limited interest in DFI funding of coal-fired power plants or nuclear projects.

2.3.4. GHG emissions

The Wind Scenario results in lower Greenhouse Gas ("GHG") emissions than the Reference Scenario, as depicted in Figure 10. Under the Wind Scenario, where 10% and 15% wind generation is achieved by 2020 and 2030 respectively, GHG emissions still increase over the twenty year period although at a lower rate than the Reference Scenario. GHG emissions increase to just under 350 Mt CO2-eq in 2030 in the Wind Scenario, whereas in the Reference Scenario emissions rise to about 410 Mt CO2-eq in 2030.

[5] ECAs are state-owned or state-controlled financial institutions which provide loans or insurance to risky markets (typically developing countries) to promote the exports of domestic industries.

Figure 10: GHG emissions projected for the Reference and Wind Scenario

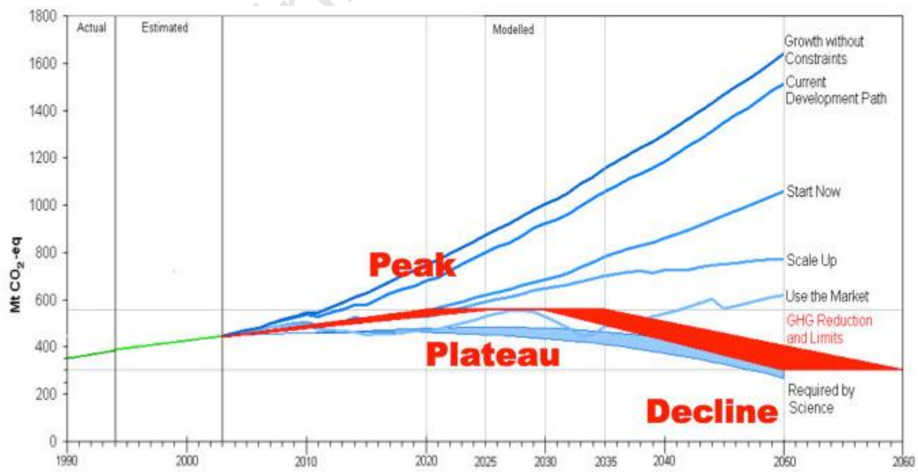


Note: These calculations are based on modelling undertaken for the Long Term Mitigation Scenarios by Energy Research Centre (2007).

As part of the South African government's climate mitigation policy, Cabinet has agreed that emissions will follow a "peak, plateau and decline" trajectory whereby emissions will peak between 2020 and 2025, plateau until 2030 and then decline (Tyler, 2009). The Long Term Mitigation Scenarios ("LTMS") emissions trajectory (depicted in Figure 11) provides the basis for South Africa's recent listing of its intention to reduce emissions to 34% below Business As Usual by 2020 and 42% by 2025 at the Copenhagen Conference of the Parties to the Kyoto Protocol (Tyler, 2009).

In order to achieve this emissions trajectory and a reduction from GHG emissions from between 2020 and 2025 onwards, it is unlikely that any additional coal-fired stations (with the exception of the Medupi and Kusile coal-fired power stations) will be allowed for inclusion in the new generation capacity plan (Tyler, 2009). As a result, the Wind Scenario is more closely aligned with government's climate mitigation policy in comparison to the Reference Scenario.

Figure 11: Cabinet's "peak, plateau and decline" emissions trajectory



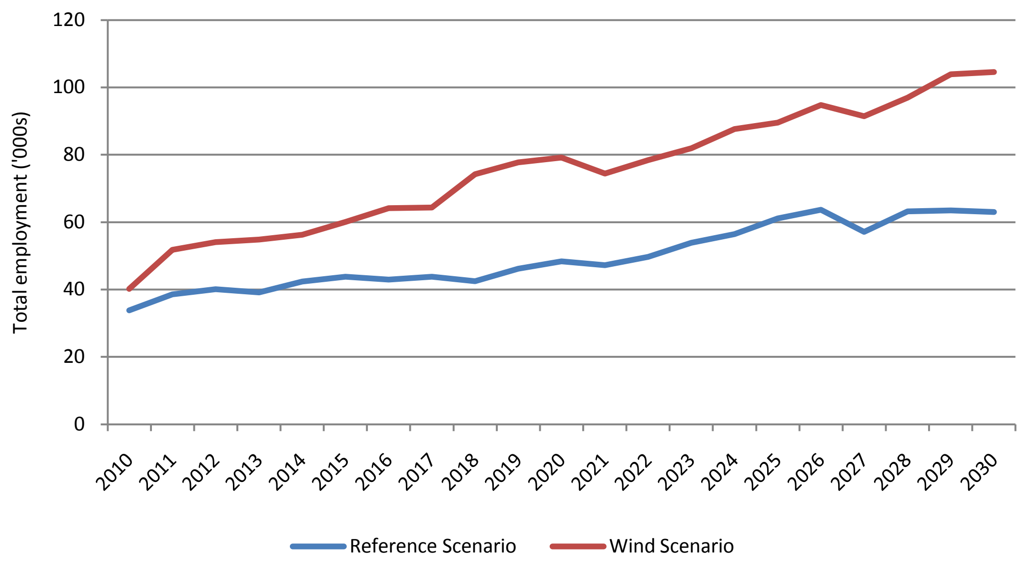
Source: Energy Research Centre (2007)

2.3.5. Employment potential

The Wind Scenario results in creating about 65% more jobs than the Reference Scenario at the end of the modelling period in 2030. In the Wind Scenario, the number of jobs created increases from

40,200 in 2010 to 79,100 in 2020 and 104,600 in 2030. In contrast, the number of jobs created in the Reference Scenario increases from 33,800 in 2010 to 48,400 in 2020 and 63,000 in 2030. This would imply that displacing 7.2GW of coal-fired generation with wind generation capacity is extremely favourable from an employment perspective.

Figure 12: Job creation for the Reference and Wind Scenario



Note: This calculation is based on the data employed by Edkins et al (2010). The assumptions for the job input values per technology are presented in Appendix 1.

The majority of jobs created in the Wind Scenario relate to the construction, manufacture and installation of wind turbines, and to a lesser extent, to the maintenance of wind farms (EWEA, 2009). Therefore, in order to provide these employment opportunities in South Africa, it will be essential to develop a local wind turbine manufacturing industry.

Studies conducted by Lewis and Wiser (2007) propose that the establishment of a local wind turbine manufacturing industry takes time to be established, and that it requires a stable and sizable domestic market for wind energy. Countries which have successfully stimulated a local manufacturing industry, such as Germany, Spain and China, have depicted annual demand for wind energy of a minimum of 500MW over a minimum period of three years (Lewis and Wiser, 2007).

Furthermore, Lewis and Wiser (2007) note that supportive policies to directly promote local wind manufacturing contribute significantly to the establishment of a domestic manufacturing industry. These policies can include local content requirements, financial and tax incentives, favourable customs duties, export credit assistance, quality certification and Research and Development ("R&D").

This implies that in order to ensure that wind energy contributes to local economic development and job creation in South Africa, it will be essential to establish a domestic wind turbine manufacturing industry. In order to do so, it will be crucial to stimulate a stable and sizeable domestic market for wind energy and to provide support policies such as local content requirements or tax incentives.

2.3.6. Benefits of a large-scale wind energy programme in South Africa

The outcome of the Wind Scenario shows that the development of a large-scale wind energy industry is desirable in South Africa as it will provide significant benefits to the country in terms of climate change mitigation, energy security via diversification and achieving the country's energy policy objectives for renewable energy and private sector investment in the power sector.

In addition, sizeable and stable demand for wind energy will enable South Africa to promote a local manufacturing industry, which will ensure that wind energy contributes to local economic development and job creation. Finally, the Wind Scenario illustrates that the investment required to fund a large-scale wind energy programme in South Africa will not place a significant burden on the economy, but rather that it can alleviate the burden on Eskom's balance sheet through private sector investment of wind generation.

3. Wind energy development in South Africa

Although the development of wind energy projects has been relatively limited in South Africa to date, this is set to increase substantially in the coming years. Since the implementation of the REFIT in South Africa in March 2009, there has been significant interest both locally and internationally from wind energy developers and investors to develop wind energy projects in South Africa. The feed-in tariff for wind power generators has been set at an attractive level of R1.25 per kWh guaranteed for a period of twenty years, providing the private sector with the financial incentive and price security needed to embark on wind farm project development in the country.

This section will provide a brief overview of the current status of wind energy development in the country and will then outline the policy and regulatory framework for wind energy in South Africa. This will provide the context for identifying and assessing the challenges that are currently hindering the development of wind energy in the country (which will be discussed in Section 4).

3.1. Current status of wind energy development in South Africa

To date, wind energy has formed a small part of South Africa's electricity mix, accounting for less than 0.1% of the country's electricity generation. Despite South Africa's renewable energy target and the significant potential contribution of wind energy towards the national energy mix, the actual progress in terms of MW of installed wind energy capacity has been extremely low.

The total installed capacity of wind energy is currently 10.4 MW and includes the 5.2 MW Darling Demonstration Wind Farm and the 3.2 MW Klipheuwel Wind Energy Demonstration Facility, the only grid-connected wind farms in the country (Raab, 2008). In addition, a single 2.0 MW turbine was installed near Coega in the Eastern Cape in May 2010 (Ratcliffe, 2009). Off-grid wind energy applications include rural mini grid (0.045MW), off-grid (0.510MW) and approximately 20,000 bore-hole windmills in the country (12 MW) (Karottki *et al*, 2001).

3.1.1. Wind energy projects in South Africa

(a) Darling Demonstration Wind Farm

The Darling Demonstration Wind Farm was developed by the Darling Independent Power Producer ("DARLIPP"), and after the wind farm's initial identification in 1996, was declared a national demonstration project by the government in 2000 (Raab, 2008). The first phase of the wind farm was completed in March 2008 and includes four 1.3MW turbines resulting in a total capacity of 5.2MW. The wind farm is located in the Western Cape, 12km north-west of Darling, and 75km north of Cape Town (Raab, 2008). Project funding totalled R75 million, including donor funding from DANCED and the Central Energy Fund ("CEF"), and a loan from the Development Bank of Southern Africa ("DBSA") (Raab, 2008).

The electricity generated by the 5.2MW project is sold to the City of Cape Town, with DARLIPP having a PPA in place for all of the electricity produced by the wind farm for a period of twenty years (Raab, 2008). DARLIPP has also entered into a wheeling agreement with Eskom to enable DARLIPP to supply electricity to the grid for transmission to the purchaser at no additional cost (Raab, 2008). Although Phase II of the Darling Wind Farm is not actively being developed, it is planned to comprise an additional six turbines which would result in a total installed capacity of 13MW (Raab, 2008).

(b) Klipheuwel Wind Energy Demonstration Facility

The Klipheuwel Wind Energy Demonstration Facility ("KWEDF") was developed by Eskom as a demonstration project in 2002/03 as part of the SABRE-GEN programme (Raab, 2008). The KWEDF is located in the Western Cape 50km north east of Cape Town, with the following three wind turbines installed (Raab, 2008):

- Vestas V47 with a capacity of 0.5MW;
- Vestas V66 with a capacity of 1.75MW; and
- Jeumont J48 with a capacity of 0.75MW.

The KWEDF is connected to the grid via 2.6km of 11kV overhead lines and cabling to the Klipheuwel substation (Raab, 2008). Total project cost was approximately R42 million (Raab, 2008).

(c) Coega Wind Farm

A Belgian developer, Electrawinds, has erected a single Vestas V90 2.0MW wind turbine on the proposed Coega Wind Farm located in the Coega Industrial Development Zone in the Eastern Cape. A feasibility study is currently underway for the proposed wind project which consists of 25 wind turbines that generate 2.3MW each (Ratcliffe, 2009). The remaining 24 turbines are scheduled for operation by the end of 2011 (Ratcliffe, 2009). The sale of renewable electricity from the project is proposed to be on a willing seller willing buyer basis.

3.1.2. Proposed wind energy projects in South Africa

There are currently over 8,000MW of wind energy projects under varying stages of development across the Western, Eastern and Northern Cape provinces of South Africa. Eskom has received grid connection applications from wind energy projects in the order of approximately 12,675MW as of June 2010 (Smit, Personal Interview, 2010). These grid applications are split into 5,825MW of wind generation capacity in the Eastern Cape, 2,962MW in the Northern Cape, 3,880MW in the Western Cape and 7.5MW in Kwa-Zulu Natal (Smit, Personal Interview, 2010).

There are five key stages in the project development process for a wind farm, including the Feasibility Stage, Development Stage, Pre-Construction Stage, Construction Phase and Commercial Operations Date, as outlined in the table below.

Table 2: Wind Farm Development Process

Wind Farm Development Process	Timeline	Development Activities
1. Feasibility Stage	0-6 months	Identifying Greenfield sites suitable for wind energy Securing commercial agreements for existing sites
2. Development Stage	12-24 months	Securing the land rights On-site wind measurements (minimum 12 months) Environmental, construction and generation permits Grid connection applications Project design and layout
3. Pre-Construction Stage	3-9 months	Completing civil, electrical and procurement contracts Approving a grid connection offer Agreeing to a Power Purchase Agreement Securing a generation license Securing the debt and equity funding for the project
4. Construction Stage	12-18 months	Site Management Contract Monitoring Stakeholder Management
5. Commercial Operations Date	End of Construction	Wind farm commissioning at end of construction period

Source: SAWEA (2010)

Based on publicly known or announced wind projects, approximately 8,000MW of wind farms are currently in the Development Stage in South Africa. This includes 733MW of wind farms which have already received environment authorisation (see Figure 13 and Table 3), and an additional 3,809MW of wind farms which are in advanced stages of the Environmental Impact Assessment ("EIA") process, or EIA Scoping Phase (see Figures 14 and 15 and Table 3).

Figure 13: Wind Energy Projects with Environmental Authorisation in South Africa

Figure 14: Wind Energy Projects in EIA Scoping Phase in WC and NC

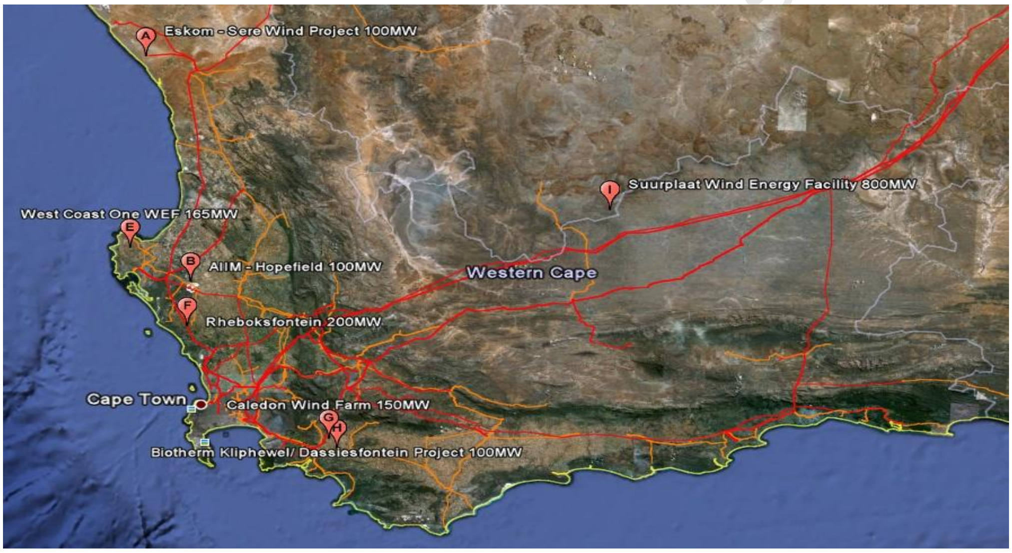


Figure 15: Wind Energy Projects in EIA Scoping Phase in the Eastern Cape

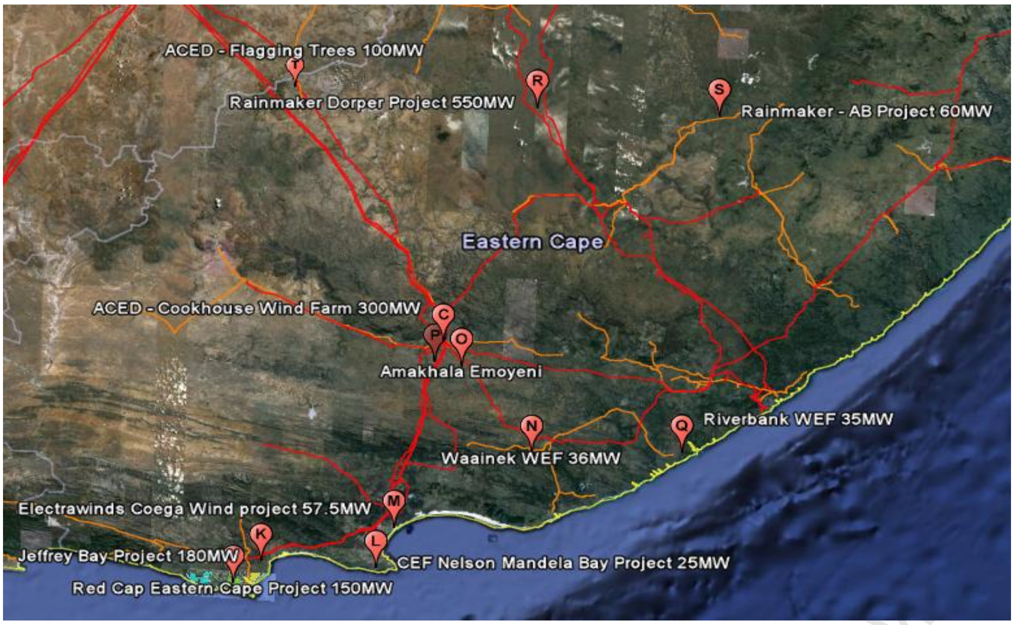


Table 3: Proposed Wind Energy Projects in South Africa

Key	Site	Province	Wind Energy Developer	MW	Status
A	Sere Wind Project	WC	Eskom	100 MW	EA
B	Hopefield	WC	AIIF2	101 MW	EA
C	Cookhouse WEF	EC	ACED	500 MW	EA
D	Kouga Wind Project	EC	Genesis Eco-Energy	32 MW	EA
Total wind farm capacity with Environmental Authorisation				**733 MW**	**EA**
E	West Coast One WEF	WC	Moyeng Energy	165 MW	EIA Scoping Phase
F	Rheboksfontein	WC	Moyeng Energy	200 MW	EIA Scoping Phase
G	Caledon Wind Farm	WC	Caledon Wind	300 MW	EIA Scoping Phase
H	Klipheuwel/ Dassiesfontein WEF	WC	Biotherm Energy	100 MW	EIA Scoping Phase
I	Suurplaat WEF	WC/NC	Moyeng Energy	800 MW	EIA Scoping Phase
J	Red Cap Eastern Cape Wind Project	EC	Red Cape Investments	150 MW	EIA Scoping Phase
K	Jeffry's Bay Wind Project	EC	Mainstream/Genesis Eco-Energy	180 MW	EIA Scoping Phase
L	CEF Nelson Mandela Bay Project	EC	Central Energy Fund	25 MW	EIA Scoping Phase
M	Coega Wind Farm	EC	Electrawinds	57.5 MW	EIA Scoping Phase
N	Waainek Wind Energy Project	EC	InnoWind	36 MW	EIA Scoping Phase
O	Amakhala Emoyeni Wind Project	EC	Windlab Systems	500 MW	EIA Scoping Phase
P	Cookhouse Wind Energy Project	EC	Terra Power	500 MW	EIA Scoping Phase
Q	Riverbank WEF	EC	Just Energy	35 MW	EIA Scoping Phase
R	Dorper Project	EC	Rainmaker Energy Projects	550 MW	EIA Scoping Phase
S	AB's Project	EC	Rainmaker Energy Projects	60 MW	EIA Scoping Phase
T	Flagging Trees	EC	ACED	150 MW	EIA Scoping Phase
Total wind farm capacity in EIA Scoping Phase				**3,809 MW**	**EIA Scoping Phase**

Sources: Savannah Environmental (2008); Savannah Environmental (2010a-j); Arcus Gibb (2009); Arcus Gibb (2010); CES (2009); CES (2010); CSIR (2010); Davenport (2010); Ratcliffe (2009). Note: EA – Environmental Authorisation; CEF – Central Energy Fund; WEF - Wind Energy Facility; ACED – African Clean Energy Developments; AIIF2 - African Infrastructure Investment Fund 2.

It is currently anticipated that up to 5,000MW of wind farms (listed in Table 3) will enter into the Pre-Construction Stage within the next 6 to 12 months (SAWEA, 2010). Once in the Pre-Construction Phase, it typically takes a wind developer between 3-9 months to obtain the necessary permits and licenses required to enter into the Construction Stage, although this varies depending on the authorisation timelines.

Considering publicly known or announced wind projects in the country (as a minimum), approximately 5,000MW of wind farms could be ready for construction during the next 12-24 months, subject to regulatory approvals. Therefore, it is estimated that up to 5,000MW of wind farms could be fully commissioned between 2013 and 2014. A further 3,000MW are presently continuing to be developed in the country, and could be fully commissioned between 2015 and 2018 (SAWEA, 2010).[6]

This demonstrates that although wind energy development has been extremely slow to take off in the country, South Africa's wind energy industry is set to expand rapidly over the next few years if the right conditions are created to support large-scale development of wind energy.

3.2. Policy and regulatory framework for wind energy in South Africa

Given the current low deployment of wind energy in South Africa, and given that the implementation of a large-scale wind energy programme is desirable in the country due to the significant benefits it will provide in terms of local economic development, job creation, climate change mitigation, energy security via diversification and achieving the country's energy policy objectives, it will be essential to create an enabling environment for the development of a sustained and large-scale wind energy industry and local manufacturing industries (Sawin, 2004).

3.2.1. Wind energy in the national energy policy

In recognition of the potential contribution of renewable energy resources in South Africa, particularly wind and solar, the South African government has actively pursued energy security via energy diversification through its White Paper on Energy (1998). The White Paper also acknowledges that renewable energy technologies are the least-cost energy alternative in many cases, especially when social and environmental costs are taken into account (Holm *et al*, 2008).

A renewable energy target of 10,000 GWh by 2013 was formally established through the White Paper on Renewable Energy, published in 2003. The renewable energy target equates to approximately 4% of projected electricity demand for 2013 and is to be produced mainly from biomass, wind, solar and small-scale hydro (DME, 2003c). It is to be utilised for both electricity generation and non-electric technologies such as solar water heating and biofuels (DME, 2003c).

3.2.2. Other support measures for wind energy

In order to address the key constraints for private developers of wind energy projects and create an enabling environment for the promotion of renewable energy, the government has identified four strategic areas which need to be addressed, including (i) financial and legal instruments, (ii) technology development and awareness raising, (iii) capacity building and (iv) education (Fakir and Nicol, 2008).

[6] These figures are based on publicly known or announced wind farms.

Given the significant upfront capital investment and technical expertise required for wind energy project development, the provision of financial and technical support is essential for stimulating interest among the private sector. A number of financing alternatives have consequently been established in order to make the required investment capital more easily available as well as to improve the financial feasibility of renewable energy projects. In addition, several organisations offer technical support to promote technology development, capacity building, education and awareness, which are outlined below.

- **REFSO:** in order to provide financial assistance to renewable energy projects, the Renewable Energy Finance and Subsidy Office ("REFSO") was established in 2005 by the DME (GTZ, 2009a). The role of the REFSO is to provide once-off capital subsidies (R1,000/kW with a maximum of 20% of total capital cost) to RE projects and to provide advice to RE project developers (GTZ, 2009a).

- **Financial incentives:** financial incentives have been enacted in support of RE projects, including accelerated depreciation and tax exemptions (GTZ, 2009a). Under the Income Tax Act, South African RE projects are entitled to income tax relief for the generation of renewable electricity (GTZ, 2009a). An accelerated write-off period (50% in year 1, 30% in year 2 and 20% in year 3) is applicable for the costs of machinery (GTZ, 2009a).

  Additionally, the sale of Certified Emission Reductions ("CERs") is exempt from income tax which improves the economics of accessing carbon finance for RE projects (GTZ, 2009a).

- **Clean Development Mechanism:** the South African government ratified the United Nations Framework Convention on Climate Change ("UNFCCC") in 1997, and acceded to the Kyoto Protocol in 2002. Consequently, wind energy projects in South Africa are eligible to gain carbon credits (through a reduction in GHG emissions) through the Clean Development Mechanism, which improves the financial viability of the projects (GTZ, 2009a).

- **Donor funding:** donor funding has been available from international donors in the South African energy sector, including DANIDA. DANIDA has provided assistance through the Capacity Building in Energy Efficiency and Renewable Energy ("CaBEERE") project during 2002 to 2005, through support in policy formulation, and through economic and technical assistance for RE demonstration projects including the Darling Wind Demonstration Project (GTZ, 2009a).

- **GTZ's TERNA Wind Energy Programme:** the GTZ has implemented the GTZ's TERNA Wind Energy Programme since 2008, which was conducted in cooperation with DEA&D:P and Eskom. This programme aims to promote wind energy by advising the DEA&D:P on improving the political framework conditions for wind energy, conducting a grid study, and carrying out capacity building measures (GTZ, 2009a).

- **REMT:** in order to remove the barriers to RE development, reduce the costs of RE technologies, and promote on-grid RE sources, the Renewable Energy Market Transformation ("REMT") Project was initiated November 2008 (GTZ, 2009a). REMT is a Global Environment Facility/World Bank funded project and is implemented through the DOE (GTZ, 2009a).

- **SAWEP:** the South African Wind Energy Programme ("SAWEP") was established by the DOE in order to stimulate wind energy development beyond the 5.2MW Darling Wind Demonstration project. SAWEP is a two year technical assistance project which was established in February 2008 by the United Nations Development Programme; its main objective is to prepare the development of up to 45MW of wind energy to be delivered by the private sector (GTZ, 2009a).

- **Clean Technology Fund:** in order to provide financing for a portfolio of low-carbon energy projects, South Africa's US$500 million Clean Technology Fund ("CTF") was endorsed in October 2009 under the International Clean Technology Fund, which is administered by the World Bank group. South Africa's current plan includes employing CTF financing for Eskom's 100MW Sere Wind Project, towards supporting the development of private sector wind projects of a further 100MW and towards creating a strong pipeline of large-scale wind projects in the country (van der Merwe, 2010a).

- **South Africa's Wind Grid Code:** South Africa's Draft Wind Grid Code was published in February 2010, however is currently under review (Mchunu, 2010). Wind grid codes provide the rules and regulations which specify the technical requirements from wind farms to ensure the safe, reliable and economic operation of the power system (Holttinen *et al*, 2009).

3.2.3. Renewable Energy Feed-in Tariff Programme

In order to create an enabling environment to achieve the country's renewable energy target of 10,000 GWh by 2013 and to contribute towards socio-economic and environmentally sustainable growth beyond this target, the NERSA implemented a renewable energy feed-in tariff in South Africa in March 2009.

In the REFIT Programme in South Africa, licensed wind energy generators are eligible to receive R1.25 per kWh of renewable electricity generated, and the Renewable Energy Purchasing Agency is obliged to purchase the electricity for a set period of 20 years. A favourable feed-in tariff guaranteed over the life of the wind energy project ensures a reasonable rate of return for investors. This is essential to create a level playing field with conventional electricity generation, and attract significant investment into the wind energy sector.

The objective of this section is to provide an in-depth examination of the REFIT Programme in South Africa. The following aspects of the REFIT Programme are addressed:

(a) REFIT Phase I;

(b) REFIT Phase II;

(c) Stakeholders in the REFIT Programme;

(d) Regulatory Processes; and

(e) The REFIT Procurement Process.

(a) REFIT Phase I

The renewable energy technologies which qualify for the feed-in tariff in South Africa were announced during the first and second phases of the REFIT Programme ("REFIT Phase I" and "REFIT

Phase II"). Under REFIT Phase I, the qualifying technologies include wind energy, small-scale hydro, land-fill gas and CSP. The feed-in tariff levels are differentiated according to the specific technologies (see Table 4). The feed in tariff applicable to eligible wind energy generators is R1.25 per kWh, which will be adjusted annually for inflation. This effectively guarantees a sufficient return on investment for eligible wind generators over a fixed twenty year period, which will create an incentive for wind energy developers to participate in the REFIT Programme.

Table 4: REFIT Phase I – 2009

Technology	Unit	Tariff
Wind	R/kWh	1.25
Small-scale Hydro	R/kWh	0.94
Land-fill Gas (LFG)	R/kWh	0.90
Concentrated Solar Power (CSP)	R/kWh	2.10

Source: NERSA (2009a) Note: REFIT Phase I tariff levels are real as at March 2009.

(b) REFIT Phase II

The technologies qualifying for the feed-in tariff under REFIT Phase II (which was announced in July 2009), include CSP without storage, Biomass (solid), Biogas, Photovoltaic Systems (large ground- or roof-mounted) and CSP central tower. The technology-specific tariffs for eligible technologies in REFIT Phase II are outlined in Table 5.

Table 5: REFIT Phase II Tariffs

Technology	Unit	REFIT
Concentrated Solar Power (CSP) trough without storage	R/kWh	3.14
Large scale grid connected PV systems (>1MW)	R/kWh	3.94
Biomass solid	R/kWh	1.18
Biogas	R/kWh	0.96
CSP Tower with storage of 6hrs/day	R/kWh	2.31

Source: NERSA (2009c) Note: REFIT Phase II tariff levels are real as at October 2009.

According to the NERSA (2009a), the feed-in tariff levels will be reviewed every year for first five years after the initial implementation of the REFIT, and every three years thereafter. Projects which are approved in the REFIT Programme are guaranteed the fixed tariff (adjusted for inflation) for a period of 20 years. Projects which are not approved prior to the first revision to the tariffs run the risk of receiving a lower tariff in future due to future revisions of the REFIT. RE developers are therefore incentivised to be first-movers in the REFIT Programme, because there is no guarantee that the tariff level will remain at the same level after future tariff revisions.

(c) Stakeholders in the REFIT Programme

There are a number of different stakeholders in the REFIT Programme, however some stakeholders have more clearly defined roles than others. It is critical that the role and function of each stakeholder in the REFIT Programme is clearly defined in order to ensure a streamlined and efficient procurement of RE projects.

(i) Renewable Energy Purchasing Agency

The Renewable Energy Purchasing Agency ("REPA") is responsible for buying the renewable electricity procured in the REFIT Programme. As the buyer in the REFIT Programme, the REPA is obliged to enter into a power purchase agreement with RE projects which have been selected, and which have been awarded a generation license by the Regulator. RE projects also have the option to sell electricity procured in the REFIT Programme to a buyer other than the REPA if they choose (NERSA, 2009a).

The REPA is entitled to pass the cost of buying the renewable electricity on to consumers through its cost recovery mechanism. This means that electricity consumers bear the burden of financing the subsidy required to finance the additional cost of electricity in the REFIT Programme.

Eskom's Single Buyer Office ("SBO") has been appointed as the REPA in the REFIT Programme. However, the DOE has proposed that an Independent System Market Operator ("ISMO") will be established as a separate entity from Eskom to buy power from private generators. Should an ISMO be established then it would be likely to replace the SBO as purchaser of renewable electricity from RE generators in the REFIT Programme.

(ii) Energy Regulator

The responsibilities of the NERSA in the REFIT Programme are fourfold. Firstly, the NERSA is responsible for the overall administration of the REFIT Programme. Secondly, the NERSA has to ensure that the REPA will adopt the power purchase agreement with selected RE projects. Thirdly, the NERSA is required to issue generation licenses (in accordance with the Electricity Regulation Act 2006) to selected RE projects in the REFIT Programme. Finally, the regulator plays an important role in the REFIT Programme, as it is responsible for developing the rules related to the REFIT selection criteria, which will provide the basis selecting RE projects in the REFIT Programme.

(iii) System Operator

The system operator plays an integral role in the REFIT Programme, as it is responsible for running the procurement process (in consultation with the REPA), and for selecting the preferred RE projects. Secondly, the system operator is responsible for negotiating the PPA with the preferred RE projects. Finally, the system operator is responsible for developing South Africa's IRP, in consultation with the DOE and the regulator.

Although there is no clarity in the REFIT legislation regarding which entity will act as the system operator, it is likely that Eskom's system operator is the only entity capable of acting as the system operator for REFIT purposes (Pickering, 2010a). In the eventuality of an ISMO being established as a separate and independent entity, it is likely that the ISMO would be the system operator in the REFIT Programme.

(iv) Department of Energy

The Department of Energy ("DOE" formerly "DME") is responsible for procuring and contracting new generation capacity from RE IPPs, and for directing the NERSA to grant generation licenses to IPPs. The DOE is also responsible for approving the IRP, insofar as the IRP meets government policy objectives. The Minister of Energy and the Minister of Finance are responsible for allocating the new generation capacity between Eskom and IPPs. The DOE therefore plays a fundamental role in shaping South Africa's future energy mix.

(v) Inter-Ministerial Committee on Energy

An Inter-Ministerial Committee on Energy ("IMC") has been established to develop South Africa's long term Integrated Resource Plan ("IRP2010") for new generation capacity over the next twenty years. The IMC therefore plays an important role in determining South Africa's electricity generation mix over the long term. The IMC includes the Minister of Energy, the Finance Minister, Economic Development Minister and the Minister in the Presidency Responsible for the National Planning Commission.

(d) Regulatory Processes in the REFIT Programme

Wind energy projects need to obtain a number of permits and licenses in order to generate electricity in the REFIT Programme, including for (i) land use, (ii) environmental impact, (iii) grid connection, (iv) a power purchase agreement and (v) electricity generation. In order to promote cost-effective and streamlined development of wind energy projects, it is necessary that regulatory processes facilitate increased generation in a timely, clear and efficient way (UNDP, 2008).

(i) Land Use Planning

Wind energy developers are required to secure ownership or lease of the land for the proposed wind energy project. There is also a requirement to obtain rezoning permission for sub-division of land and change of land use if this is necessary for the wind energy project. The main cause for delay in the permitting process is that an environmental impact assessment must be undertaken prior to obtaining rezoning permission.

(ii) Environmental Impact Assessment

Under the National Environmental Management Act ("NEMA") regulations, all wind energy facilities (greater than 20MW) are required to undergo an environmental authorisation process, which includes a full Scoping Report and an Environment Impact Report (GTZ, 2009a). The environmental authorisation process typically takes between 10 – 12 months in South Africa, which is largely in line with international practice (Jodas, Personal Interview, 2010).[7] The National Department of Water and Environmental Affairs is the entity responsible for granting environmental authorisations to energy-related projects in the country (GTZ, 2009a).

(iii) Grid Connection

A wind energy facility requires a grid connection license from Eskom in order to connect to the grid, however, grid connection procedures have not yet been formalised in the REFIT Programme. Secondly, RE generators are guaranteed access to the transmission and distribution grid in the REFIT Programme, however, there is uncertainty in the REFIT legislation regarding how this will be achieved. Finally, there is no certainty what cost allocation method Eskom will apply to RE generators in the REFIT Programme.

(iv) Standardised Power Purchase Agreement

RE developers are required to enter into a Standardised Power Purchase Agreement ("PPA") with the REPA in the REFIT Programme. The PPA provides the contract that will bind the off-taker to purchase the electricity output of the wind energy facility at an agreed price per kWh for the

[7] Additionally, a wind project which needs to erect a wind monitoring mast has historically required a Basic Assessment approval which takes up to 6 months to complete, however, under the new NEMA regulations, effective as of 1 August 2010, this is no longer the case, which should serve to expedite the regulatory processes for wind projects (Jodas, 2010)

duration of the PPA. The duration of the contract will usually cover the majority of the wind energy facility's expected economic life, which for a wind farm is typically 20 years.

(v) Generation License

Wind energy developers are required to obtain a generation license from the regulator according to the Electricity Regulation Act, 2006. In order to do so, RE developers must submit an application to the NERSA, who is responsible for the generation licensing procedure. The NERSA is allowed to publish the license application for public comment for a period specified by the NERSA. Prior to considering a license application, the regulator is obliged to inform the RE developer of any objections in order to allow the developer to respond to the objections (GTZ, 2009a).

Thereafter, the regulator has to make a decision within 120 days after the expiration of the period for public comment if no objections have been received or within 120 days after receiving the response to the objections from the RE developer (GTZ, 2009a). Finally, the regulator is obliged to provide the RE developer with a copy of its decision and the reasons for the decision.

(e) REFIT Procurement Process

The procurement process in the REFIT Programme is consistent with a competitive bidding process, according to the Electricity Regulations on New Generation Capacity ("NewGen Regulations"), which was promulgated in August 2009. The competitive bidding process will be run in three stages including:

(i) Stage 1: Request For Prequalification ("RFQ");

(ii) Stage 2: Request For Proposals ("RFP"); and

(iii) Stage 3: Negotiation of the power purchase agreement with the preferred bidder.

The selection of RE projects will be conducted by the system operator and the basis for selection of RE projects will be the REFIT Selection Criteria, which will be published by the NERSA.

The NERSA published the draft REFIT selection criteria in February 2010, based upon the following ten criteria:

1. Compliance with South Africa's Integrated Resource Plan;
2. Acceptance of the Standardised Power Purchase Agreement;
3. Preference for a RE plant which contributes to grid stabilisation and mitigates against transmission losses;
4. Preference for RE projects which contribute to local economic development;
5. Compliance with legislation regarding the advancement of historically disadvantaged individuals;
6. Preference for projects with viable network integration requirements;
7. Preference for projects with advanced environmental approvals;
8. Preference for projects demonstrating the ability to raise finance;

9. Preference for small distributed RE generators over centralized RE generators;
10. Preference for projects which can be commissioned in the shortest time (NERSA, 2010a).

One of the (draft) REFIT selection criteria refers to an RE generator's compliance with the country's IRP. The implications of this are that all RE projects which are selected in the REFIT Programme also have to be reflected in IRP. The country's IRP (which is currently IRP1) therefore plays an integral role in determining how much wind energy will be procured in the REFIT Programme. As a result, the IRP has the effect of a market cap on the quantum of megawatts allocated to wind energy projects. Based on IRP1, a maximum of 400MW of capacity from wind energy projects can be selected in the REFIT Programme from 2010 to 2013.

In a competitive bidding process, it is crucial that the selection criteria provide a fair, equitable and transparent basis for selecting RE projects in order to reduce the risk for RE developers in participating in the bidding process. In the REFIT Programme, RE projects will be evaluated and selected against a combination of gatekeeper criteria (pass or fail) and point-based weightings which are outlined in an evaluation matrix in Appendix 2.

The two main concerns cited by wind energy developers and investors are firstly, that there is no certainty as to when the final selection criteria will be published, and secondly, that there is no visibility on what the final selection criteria will actually be. The implications are twofold. Firstly, a delay in publishing the final selection criteria will lead to further delay in the REFIT procurement process, which substantially increases the risk and transaction costs for developers. Secondly, without any visibility on what the final selection criteria will be, developers run the risk of not meeting the REFIT selection criteria in the procurement process.

4. Challenges facing the wind energy industry in South Africa

The implementation of the REFIT Programme in March 2009 has been welcomed as a key tool to promote wind energy in South Africa, however, no wind energy projects have yet been selected and awarded a PPA in the REFIT Programme. The current low deployment of wind energy in South Africa highlights a lack of implementation and policymaking at the government level and is largely attributable to a number of policy, regulatory, legal and institutional challenges. These challenges, which will be discussed below, are hindering the successful deployment of wind energy in the country.

In order to create an enabling environment to facilitate the development of a large-scale wind energy industry in South Africa, it will be essential to identify and address these key challenges which are frustrating efforts to achieve this objective.

4.1. Hybrid REFIT-tender scheme

In a pure feed-in tariff scheme, licenses are typically granted on a 'first-come first-served' basis to eligible renewable energy generators. This encourages timely and efficient development of renewable energy projects, as RE developers are incentivised to be first-movers in the feed-in tariff scheme. The REFIT Programme in South Africa has not adopted a pure feed-in tariff approach, but rather has adopted a hybrid approach between a feed-in tariff and a competitive bidding process.

Tender processes are typically employed to procure and contract electricity from RE projects offering the lowest price in the competitive bidding process. Under a feed-in tariff, on the other hand, the price of electricity is guaranteed to all eligible RE generators for a set period of time. In the REFIT Programme in South Africa, the price of electricity is fixed for preferred RE projects, which means that projects will be selected against a set of non-price related evaluation criteria. The draft selection criteria were published in February 2010, however, at this stage in the REFIT Programme there is still no certainty regarding what the final selection criteria will be. The implication is that project developers still have no visibility on what basis RE projects will be selected in the REFIT Programme.

The final selection criteria, when published, will clearly outline the basis upon which RE projects will be selected in the REFIT Programme. Prior to the finalisation of these criteria, however, developers face huge investment risk as there is no guarantee that the selection criteria will be favourable towards their wind project. Due to the perceived risk of participating in the REFIT Programme, project developers will be unwilling to put large amounts of capital at risk, which will slow down the project development process, and impede the pace of wind energy development in South Africa.

4.1.1. Delay in finalisation of Selection Criteria in the REFIT Programme

The delay in finalising and publishing the REFIT selection criteria, which provide the basis for selection of RE projects in the REFIT Programme, has created two key problems for RE developers and investors. Firstly, without certainty that the selection criteria will provide a fair, equitable, transparent and rigorous framework with which to evaluate and assess projects, participants in the REFIT Programme have no certainty and security that they will be successful in the procurement process. Whilst the draft selection criteria have already been published in February 2010, numerous important issues still require clarification in order to provide the required transparency and certainty to RE developers. These issues include the following:

(i) What are the technology preferences or technology caps? Investors require visibility and certainty on the capacity of wind energy projects that will be awarded contracts in the REFIT Programme.

(ii) There is a stated preference for a minimum project size, but what (if any) is the preference for maximum project size? If the final selection criteria impose a limit on project size, it could limit the potential of the REFIT to stimulate large amounts of wind energy development.

(iii) What is the proposed timing of the initial REFIT procurement process and successive phases in the REFIT Programme? Without clear timelines and guidelines, investors are unable to plan project development efficiently.

(iv) Some of the criteria are forward-looking, such as the number of jobs created per MW by the wind farm. How will these criteria firstly be evaluated in the evaluation process and secondly be monitored on an ongoing basis?

(v) Is there a requirement to meet grid connection costs “in full up front”? There is no clarity at this stage in the REFIT Programme regarding what cost-allocation method will be applied for grid connection.

(vi) Is there a preference for projects with fully underwritten debt or equity financing? Project developers and investors require clear guidelines in advance in order to adequately prepare and plan for the competitive bidding process.

(vii) Is there a preference for projects that can achieve Date of Commissioning (“COD”) 10 months after being awarded a power purchase agreement? There is currently no clarity as to what the preferred construction timeline will be for RE projects.

These outstanding issues will need to be addressed by the final REFIT selection criteria in order to ensure that the selection criteria provide a robust, equitable and transparent mechanism for the selection of RE projects.

Secondly, since the implementation of the draft selection criteria there has been a delay of over six months in finalising the final REFIT selection criteria, and there is still no visibility regarding the timing of its publication. This delay and uncertainty increases transaction costs for project developers, and means that developers will have to delay project development decisions until greater transparency is obtained on the final REFIT selection criteria.

The delay in the publication of the finalised REFIT selection criteria has reduced investment certainty and security in the REFIT Programme, which has undermined investor confidence and the perceived credibility in the REFIT scheme. As a result, the absence of a clear and transparent procurement framework, which stipulates the specific selection criteria and their relative weightings, will hinder the development of wind energy projects in South Africa.

4.1.2. Uncertainty regarding timing of the REFIT procurement process

It is currently anticipated by developers and investors that the procurement process in the REFIT Programme will include three main phases, an RFQ, RFP and a negotiation phase for a PPA. However, there is no clarity around when these three phases will be launched, and what the timelines for each phase will be. Without visibility on these timelines, wind energy developers and investors are unable to plan accordingly, which increases the risk that projects will not be successful in meeting the final REFIT selection criteria.

A lack of visibility regarding the process timelines and what the actual REFIT selection criteria will be creates a disincentive to project developers to invest large amounts of capital in advance of the procurement process. Furthermore, there is no clarity regarding when and/or whether successive bidding processes will be held in future. This creates a further disincentive from making a long term investment in the wind energy industry in South Africa, which effectively undermines the long term success of the REFIT scheme.

4.2. Lack of price security in the REFIT Programme

A lack of clarity on the timing of revisions to the feed-in tariff level for wind energy IPPs in the REFIT Programme effectively undermines the price security and certainty inherent in the REFIT mechanism. According to the REFIT Guidelines, the feed-in tariff level will be reviewed every year for the first five years and every three years thereafter. Based on international trends in technology prices and market conditions, it is likely that any tariff revisions would result in a decrease in the tariff level to reflect market changes. However, more than a year and a half has passed since the initial publication of the REFIT without any tariff revisions being made, and there is presently no indication from the NERSA as to when such revisions will be made.

There is no apparent risk to wind energy IPPs of tariff revisions prior to REFIT Phase 1. However, given Eskom's significant funding shortfall over the next three to seven year period, and the limited allocation to wind energy IPPs in Eskom's approved tariff for the next three years, it would seem logical for Eskom to lower the tariff and accordingly raise the installed capacity allocation for wind generators. Hence there is a possible risk to wind energy developers and investors that the existing tariff of R1.25/kWh could be revised downwards in its first review period prior to the very first allocation to wind energy projects in REFIT Phase I.

Since no certainty exists around the future pricing of the feed-in tariff level as well as the timing of the pricing adjustments, project developers and investors are exposed to increased risk in their long term revenue forecasts, which in turn reduces the attractiveness of their projects and undermines wind energy development in the country.

4.3. Market cap for wind energy

According to the NewGen Regulations and the REFIT legislation, South Africa's IRP has the effect of placing a market cap on the total size of the wind energy market, which creates a disincentive for project developers to participate in the REFIT Programme. If the wind energy market size is limited, project developers which are unsuccessful in being awarded a PPA in the first phase of the REFIT will have no certainty that they would receive an allocation in successive bidding rounds if the market cap had already been fully subscribed.

In the short term, therefore, the scale of South Africa's wind energy market is constrained by the capacity allocation in the country's IRP, currently IRP1. The installed capacity currently allocated to wind energy projects under IRP1 is 400MW from 2010 through to 2013, split into 200MW in 2011 and 200MW in 2012. The result is a market cap of 400MW for wind energy projects from the private sector in the short term.

This short term market cap of 400MW is insufficient to kick-start the development of wind energy in South Africa as only a finite number of wind energy projects will be awarded PPAs in the REFIT Programme. An oversubscription to the REFIT would lead to numerous wind energy projects being rejected, which substantially increases the risk of participation in the REFIT programme for project developers and consequently acts as a disincentive to short term investment in the wind energy industry.

4.3.1. Absence of a finalised Integrated Resource Plan 2010

The outcome of IRP2010 will determine South Africa's energy mix for the next twenty years and will provide investors with a clear signal of the government's commitment (or lack thereof) to wind energy over the long term. The absence of a finalised IRP2010 is thus a major constraint to wind energy development in South Africa, as there is no certainty regarding the capacity allocation to wind energy projects beyond 2013. Wind energy developers will generally not be prepared to incur the significant investment costs required during the project development phase until clarity exists around capacity allocation over the long term. Accordingly, until the IRP2010 is finalised and published, wind developers will hold back on investing in the development of any wind energy projects for the long term.

IRP2010 is currently being drafted, and when finalised, will clearly outline the country's energy mix for the next twenty years. Its publication will therefore provide visibility on the allocation to wind energy projects over the medium to long term. However, prior to the finalisation of IRP2010, there are three major outstanding issues which introduce policy uncertainty for RE developers and investors.

Firstly, it is uncertain what the allocation to wind energy projects will be over the medium to long term in IRP2010. If (similarly to IRP1), the allocation to wind energy projects is relatively limited, then this would have the effect of placing a market cap on wind projects over the medium to long term which would serve to hinder the development of wind energy projects over the longer term.

Secondly, there has been significant delay in the IRP2010 process, and there is still no clarity around when it will be finalised and published. Further delay in its publication will prevent project developers from taking a long term perspective in wind project development in the country and will serve to hinder the process of project development in the near term. Lastly, when IRP2010 is eventually published, there is uncertainty as to whether IRP2010 will supersede IRP1 for the period from 2010 to 2013. This uncertainty, even in the short term, significantly constrains developers from investing any funds at all in wind development in South Africa.

4.4. Absence of medium and long term renewable energy targets

One of the main concerns cited by project developers in the wind energy industry is the absence of medium and long term renewable energy targets. Without the long term stability and policy certainty which renewable energy targets provide, investors are unable to gauge the future size of the wind industry and are unable to make a long term investment in the wind industry. The absence of renewable energy targets will therefore undermine investment in the wind energy sector which will constrain sustained growth in the wind energy market over the long term.

South Africa currently has a relatively modest short term renewable energy target by international standards of 10,000 GWh (or circa 4% of electricity generation) by 2013. The DOE is currently in the process of reviewing its 2003 White Paper on Renewable Energy, which when published in March 2011, is expected to make a provision for medium and long-term targets for renewable energy. In the absence of a revised White Paper on Renewable Energy, however, there are a number of uncertainties which increase the risk perception in the South African wind energy market.

Firstly, there is uncertainty regarding the medium and long term capacity allocation to wind energy in the revised White Paper. Without visibility on the government's long term commitment towards wind energy in South Africa, wind energy developers will be unwilling to invest in the wind industry. Secondly, there is no visibility regarding the timing of publication of the revised White Paper. If the White Paper is finalised and published after IRP2010 is gazetted in November 2010, it seems likely that the proposed generation mix and renewable energy targets will be required to mirror those stipulated in IRP2010. This creates investment risk for developers, as there is no certainty that IRP2010 will necessarily have renewable energy targets which are sufficiently high to warrant investing in the wind energy industry over the medium to long term.

Finally, there is no certainty whether the renewable energy targets stipulated in the revised White Paper will supersede the country's 2013 target set out in the 2003 White Paper on Renewable Energy. If that were the case, then there would be little visibility on the size of the wind energy market even in the short term through to 2013, which would undermine the policy certainty inherent in the country's short term renewable energy target.

4.5. Renewable Energy Purchasing Agency in the REFIT Programme

One of the main obstacles to wind energy development in the REFIT programme is the absence of clarity on the identity, composition and mandate of the entity that will buy renewable electricity from IPPs (van der Merwe, 2010b). The NERSA Guidelines and Draft PPA state that Eskom's Single Buyer Office will be the purchaser of renewable electricity or the REPA in the REFIT Programme.

However, the NewGen Regulations define the buyer of electricity as *any person or entity designated by the Minister in terms of Section 34(1)(c) and (d) of the [Electricity Regulation] Act and authorised under a License* (DOE, 2009b:4). Pursuant to the publication of the NewGen Regulations in August 2009, no buyer has yet been appointed by the Minister of Energy.

4.5.1. Eskom's Single Buyer Office

Should Eskom's SBO act as the REPA in the REFIT Programme, this will be an issue of contention for project developers and investors, because Eskom's incentives as single buyer and seller of renewable electricity are likely to differ.

As the single buyer of renewable electricity, Eskom would be incentivised to buy the minimum amount of renewable electricity from RE IPPs, as the fixed tariffs for renewable electricity are likely to be higher than Eskom's avoided cost of electricity. On the other hand, in Eskom's capacity as seller of renewable electricity (currently through its Sere Wind Project and CSP Project) Eskom's priority would be to sell the renewable electricity produced from its own RE projects. Eskom would therefore have an incentive to focus on its own new build programme, including renewable energy projects, rather than contract new generation capacity from other RE IPPs.

Given the perceived conflict of interest with Eskom as single buyer and seller of renewable electricity, Eskom's role as the REPA would be a major impediment to private sector investment into South Africa's power market.

4.5.2. Independent System Market Operator

Subsequent to the publication of the REFIT legislation, government has stated its intention to establish an Independent System Market Operator as a separate entity from Eskom to facilitate buying arrangements with IPPs in the South African power sector. If a fully ring-fenced ISMO is established as a separate entity from Eskom, then it is likely that the ISMO will replace the SBO as the REPA in the REFIT Programme.

The establishment of the ISMO is viewed as an important mechanism to ensure adequate private sector investment in new generation capacity, attract IPPs into the power sector and facilitate growth of renewable energy in the country (Pickering, 2010b). However, there are a number of outstanding issues which indicate that the establishment of the ISMO may hinder the expeditious procurement of wind energy projects in South Africa.

(a) Timing for the establishment of the ISMO

Firstly, there is no clarity around timing for the establishment of the ISMO, which is likely to cause further delay in the REFIT procurement process. The DOE had proposed that an interim arrangement would be established as soon as March 2010, and that that the establishment of a fully ring-fenced ISMO could take up to a year to finalise from March 2010 (Enslin-Payne, 2009). Eskom, on the other hand, had proposed that a fully ring-fenced ISMO entity would be established within Eskom's Systems Operations and Planning division by the end of August 2010 (van der Merwe, 2010b). However, as of the end of August 2010, there is still no clarity regarding timing on the establishment of the interim ISMO arrangement, let alone any visibility on the establishment of a fully ring-fenced ISMO in early 2011.

(b) Interim buyer in the REFIT Programme

Secondly, in the interim period prior to the establishment of the fully ring-fenced ISMO, it is unclear who will be the PPA- counterparty and buyer of electricity from RE IPPs; will it be Eskom's SBO? If not Eskom, this could mean further delays and investment uncertainty in the REFIT procurement process.

(c) Independence of the ISMO

Finally, the independence and impartiality of the ISMO has been called into question. In the eventuality of a fully ring-fenced ISMO entity being established as a subsidiary of Eskom, it is uncertain whether the ISMO would be truly independent of Eskom. Although the establishment of the ISMO may serve to improve transparency in the procurement of power from IPPs, it is unlikely that the ISMO would realistically meet the criteria of being truly independent (Pickering, Personal Interview, 2010).

4.6. Absence of a "bankable" Standardised Power Purchase Agreement

The Standardised PPA plays an integral role in the REFIT Programme, because it is the key contract that binds the off-taker to purchase the electricity from the wind generators at a fixed price over a set period of time. The PPA thereby provides the contract through which the project lenders and developers will recoup their investment and generate financial returns in the REFIT Programme.

In order to obtain private sector funding for a project, a PPA must provide suitable terms and conditions for project lenders (i.e. the PPA must be "bankable"). The absence of a "bankable" PPA that has a balanced risk allocation between the producer of electricity (the IPP) and purchaser of electricity (the off-taker) would act as a constraint to the development of wind energy projects in the REFIT Programme (Brodsky, 2010).

The two main concerns regarding the PPA are firstly, that there is significant uncertainty regarding the form of the finalised Standardised PPA as the draft PPA does not adequately share risk between the off-taker and IPP, and secondly, that the delay in publishing the finalised PPA has created further uncertainty for project developers.

4.6.1. Draft PPA

The draft PPA was released for public comment in August 2009, and the main concern cited by developers and investors is that the PPA guidelines provide greater security and limited risk to Eskom in comparison to that for RE IPPs, which impacts significantly on the "bankability" of the PPA (Brodsky, 2010). This risk imbalance is seen as a key constraint to the finalisation of wind energy projects.

4.6.2. Delay in publication of the Standardised PPA

The absence of a finalised Standardised PPA, at this stage in the REFIT Programme, acts as a constraint to investment in the wind energy sector in South Africa. A delay of over 12 months in finalising the Standardised PPA has resulted in significant transaction costs for participants in the REFIT Programme and there is still no visibility on the form of the finalised PPA and of the date of its publication. Additional delays in its publication will further delay the REFIT procurement process as project lenders will not commit to providing project financing to any wind energy projects until the Standardised PPA is finalised and is guaranteed to be "bankable".

4.7. Legal and regulatory issues

Some of the biggest hurdles and most time-consuming activities in wind project development in South Africa relate to inadequate legal and regulatory procedures. Legal and regulatory procedures include grid-related issues, such as grid connection procedures and grid connection costs, as well as licensing and permitting regulations. The absence of clear guidelines for grid connection and permitting and licensing procedures has created an administrative burden to project developers. This has increased the risks and costs for project developers, which has hindered timely and efficient authorisation procedures of wind energy projects in South Africa.

4.7.1. Grid-related Issues

(a) Grid Connection

While wind energy generators are guaranteed access to the transmission and distribution grid in the REFIT Programme, there is nevertheless a lack of clarity in the REFIT documentation as to how this will be achieved. According to Brodsky (2010), there is no clarity on which parties are responsible for the various aspects of grid connection, such as grid strengthening and local connection. The draft REFIT selection criteria state that the grid connection cost must be financed "in full up front" by the project sponsor prior to COD, however the quantum of this cost is unclear as the system operator (in consultation with the network service provider) is responsible for determining the grid connection costs for each wind energy facility.

There is also no certainty for project developers that compensation will be made available to the wind generator for delays in connecting the wind energy facility to the grid. Any delays in making extensions or reinforcements to the grid would substantially increase the cost of wind project development which would undermine the project's profitability (Brodsky, 2010).

Finally, project developers have cited concerns regarding how Eskom will prioritise the grid connection of projects in the REFIT programme. A total capacity of 12,675MW of wind projects have submitted grid applications to Eskom as of June 2010, however Eskom is yet to provide grid connection cost quotations or any clarity on timing to any wind energy developers participating in the REFIT Programme. Without visibility on the timing and cost of the grid connection application process, wind developers are unable to plan efficiently.

(b) Grid Integration

The absence of system-wide grid impact studies having been conducted to assess the technical feasibility of integrating large amounts of wind energy into the grid, acts as a constraint to large-scale wind energy development in the country. Prior to the finalisation of such studies, it is difficult for stakeholders involved in the energy planning and investment decision-making processes to accurately determine the scale of wind energy that is technically viable in the country. Historically, this has resulted in investment plans employing overly conservative assumptions regarding what scale of wind energy development in South Africa is technically feasible, which has served to constrain the level of wind energy deployment in the country.

4.7.2. Licensing

The absence of clear authorisation procedures for securing a generation license, grid connection license and a PPA for the procurement of new generation capacity creates a major barrier to wind energy development in the REFIT Programme. There are currently no clear rules, parameters, processes, milestones and time intervals for licensing procedures in the REFIT Programme which creates significant uncertainty for developers and investors.

In theory, the processes for securing a generation license, grid connection license, and a PPA should be distinct from one another, however, in practice these three processes are closely linked in the South African context (GTZ, 2009c). Given that the REPA is obliged to purchase the electricity from wind energy projects licensed by the NERSA, the primary regulatory step for a renewable energy developer would seem to be to secure a generation license from the NERSA. This is because a secured generation license would then oblige the REPA to enter into a PPA with the renewable energy developer (GTZ, 2009c).

However, in practice, a project developer is unlikely to be granted a generation license by the NERSA without some certainty from Eskom that the generation capacity from the proposed wind project can viably be connected to and integrated with the electricity grid. On the other hand, Eskom is unlikely to address the grid connection requirements of the proposed wind generator unless there is some certainty that the generator will be granted a generation license and a PPA.

Given that the system operator is responsible for running the REFIT procurement process and for selecting the preferred wind energy IPPs in the REFIT Programme, it is seems likely that only those preferred wind energy IPPs which will have been selected by the system operator and which will have negotiated and concluded a PPA, will then apply for a generation license from the NERSA and secure its grid connection license from Eskom. This creates uncertainty for RE developers as there is no clarity for RE developers regarding which licensing process should be pursued first.

4.7.3. Permitting

The main constraints identified in the regulatory permitting processes are firstly, that although the environmental authorisation process itself is relatively streamlined by international standards, the requirement to apply for environmental authorisation prior to rezoning approval causes further delays in the project development process and hence additional cost. Secondly, the disconnect between national and local government in running environmental and rezoning approvals causes additional delays and costs in the permitting process.

4.8. Lack of institutional capacity in the ESI

A key constraint to private sector investment in the South African wind energy industry is the issue of institutional capacity in the Electricity Supply Industry ("ESI"). Idasa (2010) proposes that a lack of clarity regarding the institutional roles and responsibilities in the electricity sector has weakened the government's institutional capacity in the power sector. As a result, policy processes and regulations in the electricity sector have been incoherent, inconsistent and uncoordinated.

In theory, the DOE is responsible for electricity sector policy and investment decision-making in the ESI. However, in practice, electricity sector policy decisions are driven by a number of other entities as well, including Eskom, the NERSA, Treasury, the IMC on Energy and the Department of Public Enterprises. It is thus not always clear which government department or agency is responsible for making electricity sector policy and for decision-making in the ESI.

4.8.1. Lack of clear roles of institutions

A lack of clarity regarding the roles of institutions in the ESI has served to undermine the government's functioning in the power sector (Idasa, 2010). The publication of the NewGen Regulations has clarified (to an extent) the roles of these institutions; however there is still a lack of clarity regarding who is responsible for the main functions for the procurement of power from IPPs in the ESI, including (a) energy planning, (b) allocation of new generation capacity, (c) procurement of power from IPPs and (d) buying power from IPPs in the ESI.

(a) Energy planning

Although the DOE is responsible for energy planning through its role in approving the country's IRP (insofar as the IRP meets specific government objectives), the system operator is still the entity responsible for the actual development of the IRP which is the key determinant of the country's new generation capacity plan.

Due to a lack of capacity and information within the DOE and the NERSA to adequately analyse Eskom's preferred investment plan for new generation capacity, the ability of the DOE to have a significant impact on the outcome of the finalised IRP is relatively limited (Newbery and Eberhard, 2008). Eskom has consequently driven the energy planning process and investment plans in new generation capacity in South Africa, which has enabled it to maintain its dominant market position in the ESI, resulting in limited participation of IPPs, including wind energy IPPs (Newbery and Eberhard, 2008).

The IMC on Energy has recently assumed a major role in the planning process for IRP2010, as it is responsible for approving IPR2010 prior to its submission to Cabinet. The inclusion of the IMC on Energy in the energy planning process has served (to an extent) to enhance the level of transparency and accountability in the national energy planning processes.

(b) Allocation of new generation capacity

In theory, on completion of the IRP, the system operator runs feasibility studies to determine whether the procurement of new generation capacity should be undertaken by Eskom or an IPP (DOE, 2009b). The feasibility study is required to take into account (i) the affordability of the generation capacity, (ii) the proposed risk allocation between the buyer and the IPP, (iii) demonstration of value for money of the IPP, and (iv) the capacity of the buyer to enter into project agreements with the IPP (DOE, 2009b:8). The Ministers of Energy and Finance are then responsible for allocating new generation capacity between Eskom and IPPs (Brodsky, 2010).

However, as Eskom is the system operator, there is a conflict of interest with Eskom being responsible for this role. Given that the new generation capacity from IPPs in the REFIT Programme may have a higher cost due to the regulated tariff and higher infrastructure costs, it is unclear how the criteria will be used to compare REFIT projects and other new generation capacity which might have a lower cost (Brodsky, 2010). It is thus questionable whether this process is conducted in a transparent and equitable way and begs the question of whether the DOE and Treasury are responsible for capacity allocation in practice, or whether Eskom is actually driving this process itself.

(c) Procurement of power from IPPs

In theory, the DOE is responsible for procuring and contracting new generation capacity from IPPs, however, the system operator is the entity which actually runs the procurement process, and which selects the preferred IPPs and negotiates the PPA with them. It is therefore uncertain to what extent the DOE plays a role in procuring and contracting new generation capacity from IPPs.

Additionally, the NERSA is responsible for developing the selection criteria which must be applied by the system operator in the procurement of IPPs in the REFIT Programme. However, it is uncertain whether the NERSA has the capacity to ensure that the system operator abides by these selection criteria in the selection Process for RE IPPs in the REFIT Programme.

(d) Buying of power from IPPs

The role of the buyer of power from IPPs or the REPA in the case of the REFIT Programme has been allocated to Eskom's SBO. However in the eventuality of a fully ring-fenced ISMO being established as a separate entity from Eskom, the ISMO would replace the SBO as buyer of power or REPA for RE generators in the REFIT Programme. Given that the time required to establish the ISMO is likely to be at least a year, it is anticipated that Eskom's SBO will be the interim buyer.

The NERSA is responsible for ensuring that the REPA adopts the PPA with the preferred RE IPPs in the REFIT Programme. However given that the NERSA has limited institutional capacity, it is uncertain whether it will be able to guarantee that the REPA will adopt the PPA with the preferred IPPs.

4.8.2. Lack of institutional capacity in the ESI

The government has introduced legislation to support IPPs, however, weak institutional capacity and unclear roles of institutions have created a barrier for IPPs to participate in the ESI (Newbery and Eberhard, 2008). The government first stated its intention to achieve gradual liberalisation of the power sector through its White Paper on Energy in 1998. In 2001, the Cabinet announced that IPPs would account for 30% of generation capacity and in early 2009, the energy regulator announced attractive feed-in tariffs for renewable energy IPPs. Eberhard and Pickering (2010) note, however, that in spite the government's intentions, progress has been painfully slow.

Tendering processes to procure power from IPPs have been delayed and postponed, standardised power purchase agreements have not been finalised and concluded and there has been significant uncertainty regarding grid access for IPPs. Importantly, more than 18 months since the implementation of the REFIT Programme in South Africa, not a single renewable energy IPP has been awarded a PPA.

Eskom has recently approved six PPAs with IPPs for up to 215MW of cogeneration power under the MTPPP (Creamer, 2010).[8] That said, the procurement process has taken approximately five years to achieve this, and the 215MW contracted under the MTPPP represents a relatively limited capacity in comparison with Eskom's build programme of 20GW over the next ten years (Eberhard and Pickering, 2010).

The government's proposed ISMO, which will be established as a ring-fenced entity within Eskom's system operations and planning division, is viewed as an important mechanism to provide a more equitable base for procuring private power and thereby unlocking private sector investment in the power sector. However, Eberhard and Pickering (2010) propose that Eskom's concept of the ISMO (i.e. within Eskom's system operations and planning division) as an interim arrangement to procure power from IPPs has created a diversion from the central issue, this being that it is an immediate priority to procure power from IPPs.

There are currently a number of uncertainties facing wind energy IPPs which would need to be addressed in the immediate term to create an enabling environment for IPPs to participate in the REFIT Programme. Should a wind IPP enter into the REFIT procurement process and be short-listed under the REFIT, it would need certainty that:

(i) the system operator will apply the REFIT Selection Criteria in the procurement process in a transparent, fair and equitable way;
(ii) it will be able to conclude a binding power purchase agreement with the REPA;
(iii) it will receive a generation license from the NERSA; and
(iv) there is a guaranteed buyer for all renewable power procured in the REFIT Programme (and clarity regarding who the buyer will be) (Pickering, 2010b).

Due to the limitations of the DOE and the NERSA, namely that they suffer from a lack of institutional capacity and expertise, and their responsibilities in the ESI are unclear, it is questionable whether they have the ability to provide the certainty required by RE IPPs (Newbery and Eberhard, 2008). Without this certainty, wind energy IPPs would not be incentivised to participate in the REFIT Programme. A lack of institutional capacity in the ESI and resulting uncertainty facing IPPs has therefore created a barrier to participation in the REFIT Programme.

4.9. Policy and regulatory framework for wind energy

Significant progress has been made by the NERSA and the DOE in finalising the legislation in the REFIT Programme since its publication in March 2009. However, one of the main hurdles facing the wind energy industry in South Africa is the absence of a coherent and clear policy and regulatory framework governing the ESI and the lack of a consistent long term vision for the power sector.

Without a clear policy and regulatory framework and a clear long term vision for the power sector, the government has not successfully encouraged new generation capacity from IPPs to date. The government has introduced legislation to promote private sector investment in the ESI, however, a number of investment challenges have arisen (Gratwick and Eberhard, 2008).

(i) Investment and generation planning

[8] Power purchase agreements have been concluded with Sasol, Ipsa, Sappi and Tangent (Creamer, 2010).

Without an enabling policy and regulatory environment for wind energy IPPs, firstly, there is no clear framework within which to establish long term goals and targets for wind energy. Without clear and progressive medium and long term targets for wind energy, there are no clear energy policy objectives to shape and inform integrated resource planning processes in the country.

(ii) Allocation of investment opportunities between Eskom and IPPs

Due to an inadequate regulatory framework in support for private sector participation in the ESI, there are no clear terms for allocating public and private sector investments, which has undermined the ability of the Ministers of Energy and Finance to allocate investment opportunities efficiently between the public and private sector.

(iii) Timely implementation of competitive bidding processes

Without a clear and transparent regulatory framework, competitive bidding processes to contract power from RE IPPs cannot be implemented in a timely and efficient way.

(iv) Institutional responsibility and capacity for procuring and contracting in a transparent and fair dispatch arrangement

The market structure and roles of stakeholders and institutions in the ESI are not clearly defined, which undermines the transparency, equity and effectiveness in the procurement of RE IPPs.

Without a clear and consistent policy and regulatory framework, there is no basis for addressing the key challenges and uncertainties currently facing the wind energy industry. At this stage in the REFIT process, there is still no visibility for RE IPPs regarding when key pieces of legislation will be enacted, such as the Standardised PPA and the REFIT Selection Criteria, which undermines investor confidence in the REFIT Programme.

Furthermore, the absence of a clear policy and regulatory framework undermines the long term policy certainty and stability inherent in the REFIT Programme. It is unlikely that such an environment would provide the impetus for achieving the development of a large-scale wind energy industry in South Africa over the medium to long term, let alone for achieving the government's short term renewable energy target of 10,000GWh by 2013.

5. Lessons learned from international experience in promoting wind energy

There are a number of challenges facing the wind energy industry in South Africa which have prevented the successful deployment of wind projects in the REFIT Programme to date. In order to create an enabling environment to achieve the development of a large-scale wind energy industry in South Africa, it will be essential to address these. An examination of the experience and lessons learned in other countries which have encountered similar barriers to wind energy development or which have overcome these barriers through various policy measures will provide useful guidelines for addressing the challenges facing South Africa's wind energy industry.

A number of countries have successfully managed to overcome the barriers to wind energy development and create an enabling environment for large-scale development of wind energy, which has allowed for sustained growth of wind energy markets over the past decade. These countries have shown that if the right combination of policies is adopted and the barriers to wind energy development are adequately addressed, then a sustained wind energy industry can be developed quickly and efficiently (Sawin, 2004). The lessons learned in promoting wind energy in these countries provide useful guidelines for other countries to adopt (Sawin, 2004).

5.1. A clear and consistent policy and regulatory framework creates policy certainty

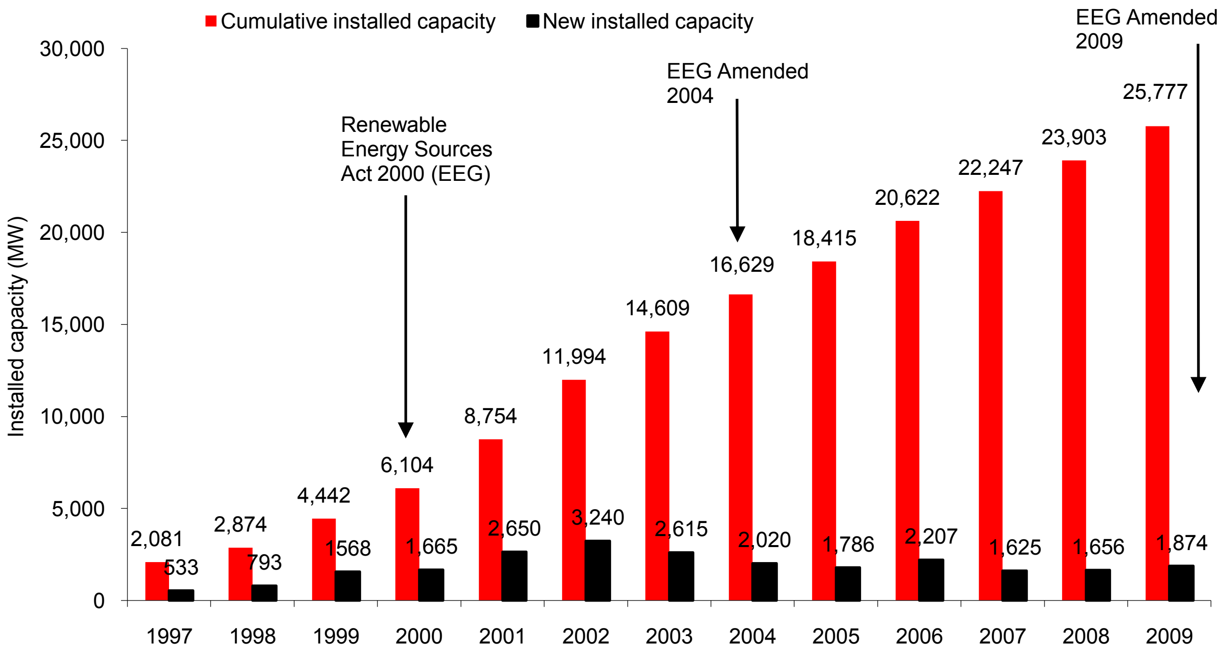
One the main barriers facing the South African wind energy industry is the absence of a clear and consistent policy and regulatory framework governing the ESI and the lack of a long term vision for the power sector, which has undermined the long term policy certainty and stability in the REFIT Programme. Countries such as Germany and China have shown that a clear and consistent policy and regulatory framework, and government commitment for renewable energy are necessary to create an enabling environment for the development of a sustained and large-scale wind energy industry. These countries (among others) have set long term renewable energy targets, and regulations and guidelines to ensure that these targets are met (UNDP, 2008).

5.1.1. Germany's Renewable Energy Sources Act

Germany has been one of the most successful countries in developing a sustained and large-scale wind energy industry. This is largely attributable to Germany's strong government commitment to renewable energy over the long term, and a clear and stable policy and regulatory framework for renewable energy. This has been critical to provide an attractive investment climate and create an enabling environment for steady growth in wind power development over the past decade. Germany's Renewable Energy Sources Act ("Erneuerbare Energien Gesetz" or "EEG") is regarded as one of the most successful policies in supporting the development of wind energy. The EEG was initially implemented in 2000 and provided the overarching policy framework for wind energy which has created policy certainty and stability for investors over the long term.

Key features of the EEG included a fixed feed-in tariff for wind generators over a twenty year period, guaranteed grid access for wind generators, a stepped design of the feed-in tariffs, and an annual tariff degression of 1% to incentivise turbine manufacturers to reduce production costs and increase efficiency (Held *et al*, 2007). The stepped nature of the feed-in tariffs meant that investors at sites with a higher energy yield would receive a lower tariff and vice versa, which created a disincentive to develop wind farms with good wind conditions and promoted wind farm sites with less advantageous wind conditions. This served to reduce the producer profit and lower the transfer costs of wind energy for society. (Held *et al*, 2007).

Figure 16: Cumulative and annual installed capacity of wind energy in Germany



Source: GWEC (2010)

The EEG provided extremely favourable grid access conditions for wind generators, firstly, by granting priority access to the grid, secondly, by obliging the transmission system operator located closest to the wind power plant to connect the plant to the grid and thirdly, by imposing a purchase obligation on the transmission system operator to purchase and pay the guaranteed tariff for all electricity produced by the plant (CMS, 2008). These measures were fundamental in attracting investment into the wind energy sector and in kick-starting large-scale deployment of wind energy in Germany.

The feed-in tariffs were set to be reviewed every two years, first in 2002, and every four years thereafter, allowing for changes in pricing in the light of technological innovation (Held *et al*, 2007). Regular reviews of the tariff levels successfully enabled the government to determine the desired level of wind generation and revise the tariff levels to incentivise wind energy development accordingly.

The first few years of the EEG enabled a "learning by doing" process, and amendments to the EEG were implemented in 2002 (effective as of 2004) to enhance the long-term stability and policy certainty inherent in the EEG. These revisions included the implementation of medium and long term renewable energy targets of 12.5% by 2010 and 20% by 2020, which provided a clear signal to investors of the future wind market size (Held *et al*, 2007).

Secondly, grid operators and wind farm operators were incentivised to participate in the management of wind farms in order to improve integration of renewable electricity plants into the electricity system (Held *et al*, 2007). Thirdly, the feed-in tariff support level for wind energy was reduced for wind generators, and the annual tariff degression rates were increased to 2% for wind energy in order to stimulate and incentivise rapid technological progress (Held *et al*, 2007).

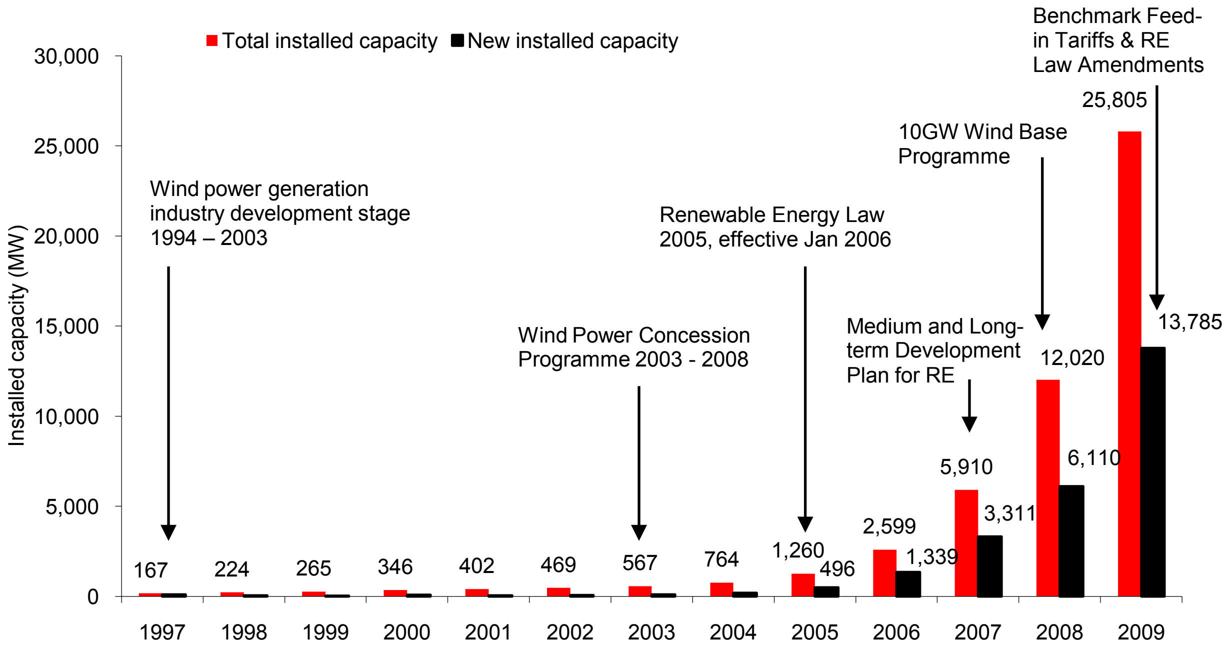
The EEG was amended again in 2009 and included an increase in the feed-in tariff level and a reduction in the annual tariff degression from 2% to 1% to increase the incentive for wind generators to develop wind farms in order to achieve Germany's renewable energy target of 12.5% by 2010 (Held *et al*, 2007). The amendments also included an obligation on grid operators to extend, optimise and enhance the existing grid, which aimed to improve grid management and integration of wind generation onto the grid to achieve higher wind penetration levels (GWEC, 2010).

Experience with the EEG in Germany has demonstrated that a clear policy and regulatory environment is fundamental to support stable and consistent growth of wind energy. Strong government commitment for renewable energy and clear medium and long term targets have been instrumental in driving steady growth in wind energy over the past decade. Furthermore, successive revisions to the EEG in 2002 and again in 2009 have enabled the government to enhance the transparency and stability of the feed-in tariff scheme. This has been essential in creating the impetus not only for strong growth in wind installations over the past decade, but also for the development of a sustained and large-scale wind energy industry.

5.1.2. China's Renewable Energy Law

China's emergence as the second largest wind energy industry globally in 2009 is attributable to the government's clear and long-term commitment to the wind energy industry. China's Renewable Energy Law, which was implemented in 2005, has provided the overarching framework of renewable energy policies and regulations in China and has been instrumental in driving the rapid growth in wind energy development over the past five years (as depicted in Figure 17). The Renewable Energy Law ("RE Law") has subsequently been implemented through multiple ministerial-level regulations and provincial implementation rules (Zeppezauer *et al*, 2010).

Figure 17: Cumulative and annual installed capacity of wind energy in China



Source: GWEC (2010)

The RE Law guarantees a fixed price for renewable electricity and imposes a purchase obligation on grid companies to purchase all renewable electricity (Junfeng *et al*, 2007). Grid companies are also responsible for investment in the construction of transmission lines and the connection between wind farms and the closest network, and grid companies must provide grid-connection services and related technical support (Zeppezauer *et al*, 2010). The RE Law further provides for the setting of medium and long term targets for renewable (which were implemented in 2007) and identifies a feed-in tariff scheme (which was later implemented in 2009) (UNDP, 2008; REN21, 2009). Furthermore, the RE Law established a development fund which was to be financed by the state under the RE Law in order to extend grants and loans to renewable energy developers (Zeppezauer *et al*, 2010).

In 2007, the Chinese government set out its long term commitment to renewable energy by implementing a national renewable energy target of 10% renewable energy in total primary energy consumption by 2015 and 15% by 2020 (GWEC, 2010). For wind energy, the government set initial targets of 5GW by 2010 and 30GW by 2020, however the 2010 target was already exceeded by 2007. The target was consequently revised upwards to 10GW, although again this target was achieved two years early in 2008 (GWEC, 2010).

In 2009, the government set an aggressive initial target of 100GW of wind power installed capacity by 2020, which has now been revised upwards to 150GW of wind capacity by 2020 (GWEC, 2010). This equates to annual capacity additions of 10-20GW per annum in order to reach 150GW by 2020, which clearly demonstrates the government's long term commitment to large-scale development of wind power.

In 2009, the government promulgated a revision of China's RE Law to address the grid capacity constraints which have resulted from the huge growth of wind energy in China over the past four years (Zeppezauer *et al*, 2010). These amendments include an obligation imposed on grid companies to strengthen the construction of power grids and enable more central government supervision of the grid companies and also include a renewable energy quota requiring grid operators to purchase a fixed amount of renewable energy, with penalties for non-compliance (GWEC, 2010).

Finally, the RE Law amendments provide for the establishment of a new renewable energy development fund, whereby, in addition to the funds allocated by the state, a renewable energy surcharge will be levied on electricity sold in the country to assist the funding of the development fund. The development fund can be used to subsidise grid companies in the construction of power grids for renewable energy projects or the purchase of renewable electricity if necessary (GWEC, 2010; Zeppezauer *et al*, 2010).

China's RE Law and the implementing regulations and amendments which have subsequently been promulgated, have provided a clear and consistent policy and regulatory framework for wind energy over the past five years. This has been fundamental in creating long term policy certainty and an attractive investment climate in the Chinese wind energy industry. Strong government commitment through the establishment of aggressive medium and long term wind energy targets has been a key driver of the unprecedented growth of wind energy in China over the past five years.

5.2. Lack of institutional capacity hinders private sector investment in the wind energy industry

A major constraint to private sector investment in the South African wind energy industry is the lack of institutional capacity and lack of clarity regarding the institutional roles and responsibilities in the ESI, which has resulted in incoherent, inconsistent and uncoordinated policy processes and regulations.

Experience in other developing countries which have followed a similar path of power sector reform to South Africa, such as India and China, has shown that the co-existence of private and public investment in the power sector, which is referred to as a "hybrid power market" by Gratwick and Eberhard (2008), often leads to an array of power sector challenges. These challenges often include a lack of institutional capacity to contract power from IPPs, and the absence of clear roles for institutions in the ESI, particularly in investment planning.

Gratwick and Eberhard (2008) further note that there is evidence in the power sectors of most developing countries of inconsistent and uncoordinated policy processes and a lack of institutional capacity. This arises due to the fact that, in spite of the promulgation of power sector reform in these jurisdictions, the incumbent utility has managed to retain its dominant market position and that IPPs have also been promoted, yet with relatively little support from the incumbent.

Experience in Kenya, which provides an example of a hybrid power market in sub-Saharan Africa, has shown that it is critical that there is adequate institutional capacity to procure and contract power from IPPs. Additionally, the roles of institutions need to be clearly defined in order to ensure that all institutions function properly in the ESI, and that the incumbent, as the off-taker of power from wind energy IPPs, does not undermine the process of timely and efficient private sector investment (Gratwick and Eberhard, 2008).

5.2.1. Kenya's Independent System and Transmission Operator

Kenya currently has five operating IPPs, has recently tendered for an additional three IPPs and is presently negotiating the off-take agreement for the biggest wind farm in Africa, Lake Turkana, which is planned to have an installed capacity of 300MW (Eberhard and Pickering, 2010).

In 1997, Kenya unbundled its national utility into a separate generation company (known as Kengen) and grid company (known as KPLC). KPLC was responsible for system operations, for preparing long-term generation planning (in consultation with the regulator), and for procuring and contracting new generation capacity from either Kengen or IPPs (Eberhard and Pickering, 2010). KPLC has successfully become an independent entity capable of running international tendering processes and negotiating contracts with preferred IPPs (Eberhard and Pickering, 2010).

5.3. Uncertainty in the procurement process impedes wind energy development

One of the biggest obstacles facing the wind energy industry in South Africa is that there is currently no certainty on what basis RE projects will be selected in the REFIT Programme. The procurement of wind energy projects in the South African REFIT Programme differs from a pure feed-in tariff scheme (which awards contracts to all eligible RE generators on a first-come first-served basis) as it is based on a competitive bidding process, such that projects will be selected against a set of selection criteria. At this stage in the REFIT Programme, however, there is no clarity on what basis projects will be selected.

Prior to the finalisation of the REFIT selection criteria in South Africa, an examination of the experience in the UK, China and Brazil, which have implemented similar (although varying) procurement processes to procure and contract power from RE generators, gives insight into what barriers have been encountered in these markets, and provides useful lessons on how these might be overcome.

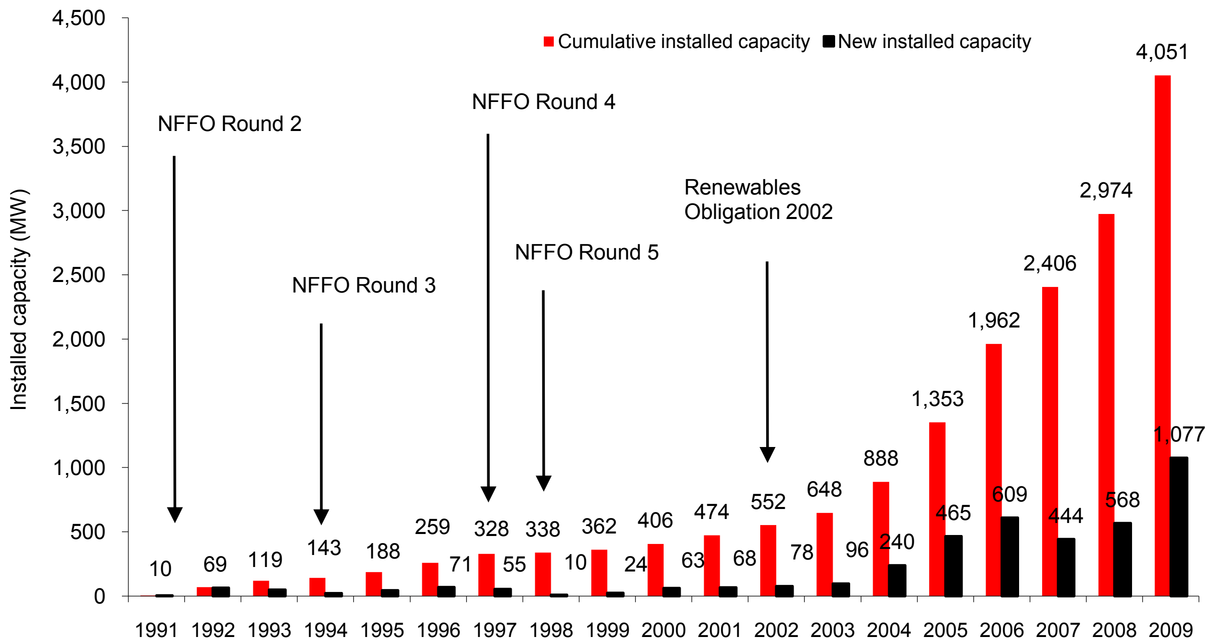
5.3.1. UK's Non-Fossil Fuel Obligation

Between 1990 and 1998, the UK adopted a competitive tendering system known as the Non-Fossil Fuel Obligation ("NFFO") to support renewable energy. At the outset of each bidding round, the government set the desired level of generation, the growth rates from each RE resource and the criteria for evaluation of RE projects. The criterion for evaluation of RE projects in each of the five NFFO bidding rounds was the lowest bidding price (Sawin, 2004).

The results of the NFFO bidding rounds were below expectations and only 39% of wind projects contracted in the five bidding rounds reached completion (Agnolucci, 2007). This was due to a number of drawbacks of the NFFO. Firstly, the fact that projects were selected on the basis of the lowest bidding price meant that developers were incentivised to submit unrealistically low bids in order to be awarded a contract, which compromised the profitability of the projects (Lipp, 2007). As a result, many of the projects which received awarded contracts did not materialise, and RE projects failed to meet expected capacity (Haas *et al*, 2007).

Figure 18 illustrates that installed capacity of wind energy remained relatively low during the NFFO bidding rounds, increasing from 10MW in 1991 to only 552MW in 2002 (GWEC, 2010).

Figure 18: Cumulative and annual installed capacity of wind energy in the UK



Source: GWEC (2010)

The key lesson learned from the low success rate for project completion under the NFFO, is that tendering schemes require penalties for non-compliance and project non-completion. Penalties create a disincentive for project developers to submit unrealistic bids, and thereby ensure that projects which are awarded contracts will reach completion. Penalties can therefore provide a useful mechanism to ensure that wind energy projects meet the required target RE capacity.

Secondly, the NFFO failed to provide long-term visibility on pricing and quantities for wind energy projects due to the intermittency in the bidding rounds, which undermined investment security in the UK wind market (Connor & Mitchell, 2004). Clear timelines and guidelines on future bidding rounds provide project developers with long-term visibility on the market and thus investment certainty, which enables them to make a long term investment in the market.

Finally, the NFFO bidding rounds were bureaucratic, complex and time-consuming, which resulted in excessive costs for project developers during the procurement processes (Sawin, 2004). This creates a disincentive for project developers to participate in the procurement process, and impedes the pace of wind energy development. The establishment of transparent guidelines in the procurement process can serve to address this by minimizing the administrative burden for project developers.

5.3.2. China's Wind Power Concession Programme

Prior to 2003, the Chinese wind energy industry developed slowly due to the high cost of wind energy and lack of policy support (Junfeng *et al*, 2007). In order to expand the rate of wind energy development, the government implemented the Wind Power Concession Programme in 2003, which was a series of five wind concession tendering programmes. The Wind Power Concession Programme has played a fundamental role in promoting wind energy and domestic production of wind turbines in China.

Investors were selected in the Concession Programme via public tendering by the government. In the first two bidding rounds, investors were selected on the basis of the lowest bidding price. In the third bidding round, the criteria were revised such that the electricity price was granted 40% weighting in the bid evaluation procedure, and additional non-price criteria were introduced including financial viability, high local content and more sophisticated wind turbine equipment (Dalbem and Gomes, 2009; Junfeng *et al*, 2007). In the fourth round of bidding, the weighting of the electricity price was further reduced to 25% and in the fifth round of bidding, the winning criterion was set as the bid closest to the average bidding price (Junfeng *et al*, 2007).

During the Wind Power Concession Programme, a total of 49 wind farms with an installed capacity of 3.4GW were awarded with development rights, however one of the main criticisms of the concession programme was that in practice, the main criterion became the lowest bidding price, which resulted in low profitability of projects and high investment risk for domestic and international developers and investors (Junfeng *et al*, 2007).

During the first two rounds of bidding, the winning bid price was typically so low that there was no guarantee for a reasonable profit, resulting in a decrease in the quality of equipment installed (Junfeng *et al*, 2007). In spite of the introduction of non-price criteria in the third and fourth bidding rounds, the lowest bidding price won the bid in almost all cases, and hence the lowest bidding price was still the main selection criteria (Dalbem and Gomes, 2009).

The unwritten rule that the lowest bidding price wins the bid created an investment barrier for private and public companies and undermined the investment security and certainty in the market, because there was no guarantee that investors would make a reasonable profit. However, other incentives were implemented in the Chinese Concession Programme in order to improve investment security, including 25 year concession agreements, long term power purchase agreements and a purchase obligation on the provincial grid company (Junfeng *et al*, 2007).

The fifth bidding round in the Concession Programme served to address some of the major pricing problems experienced in the previous four rounds, as the weight of the bidding price was still 25% but those bidders closest to the average bidding price scored the highest (Junfeng *et al*, 2007). As a result, the winning bid price increased in the fifth bidding round and the new price evaluation method successfully discouraged bidders from bidding an unrealistically low price to win the bid.

This demonstrates that constant revisions to the selection criteria in successive biddings rounds can improve and enhance the effectiveness of the procurement process of projects. It is important, however, that the selection criteria are clearly specified sufficiently in advance of the bidding round to create a transparent procurement framework and enable developers to plan accordingly.

The Chinese Concession Programme further demonstrates that the introduction of non-price evaluation criteria successfully enabled the government to promote the development of a domestic wind turbine manufacturing industry. An increase in the minimum local content requirement from 50% in 2003 to 70% in 2004 in conjunction with the Concession Programme bidding rounds contributed significantly towards the increased share of domestic wind turbines from 1.2% in 1999 to 6.4% in 2001 and 74.8% in 2008 (Morgan Stanley Research, 2009).

However, by including non-price criteria in the evaluation procedure, the task for government of ensuring project compliance with bid submissions became far more complex. In order to ensure that projects comply with non-price evaluation criteria after the award of a contract, and to create a disincentive for project developers to submit unrealistic bids, tendering systems need to have in place adequate regulations to monitor the projects with penalties for non-compliance (Lipp, 2007).

5.3.3. China's Benchmark system for Feed-in Tariffs

In response to the pricing problems experienced with the bidding rounds in the Chinese Wind Power Concession Programme, in July 2009 the National Development and Reform Commission ("NDRC") introduced a benchmark system for feed-in tariffs for wind power applicable to onshore wind projects approved after 1 August 2009 (Zeppezauer *et al*, 2010). The implementation of the benchmark wind tariffs has effectively replaced the Concession Programme biddings, and wind energy capacity will be allocated based on negotiations between wind developers and local governments, with final approval by the NDRC (Morgan Stanley Research, 2010).

The feed-in tariff is applicable for the entire operational period of a wind farm, which is 20 years (GWEC, 2010). There are four different categories of tariffs depending on the region's wind resources ranging from 0.51 RMB/kWh for wind power projects in regions with high wind resources such as Inner Mongolia to 0.61 RMB/kWh for regions with low wind resources (Zeppezauer *et al*, 2010).

The four tariff levels have been set according to the bidding results from the five bidding rounds from the Concession Programme, in conjunction with the tariffs approved by provincial governments (Morgan Stanley Research, 2009). Whilst the tariffs are set in line with 80-90% of approved projects, they are generally higher than the Wind Power Concession project tariffs. The government has stated that the wind power tariff levels reflect local wind resources, market-driven cost and a reasonable return for developers (Morgan Stanley Research, 2009).

The new benchmark tariff system should encourage wind developers to lower costs and improve efficiency in order to raise profitability (Morgan Stanley Research, 2009). By removing the price variable in the selection of wind farm developers, the bidding process reduces the uncertainty in pricing and future revenues and assists developers in assessing potential projects (Zeppezauer *et al*, 2010).

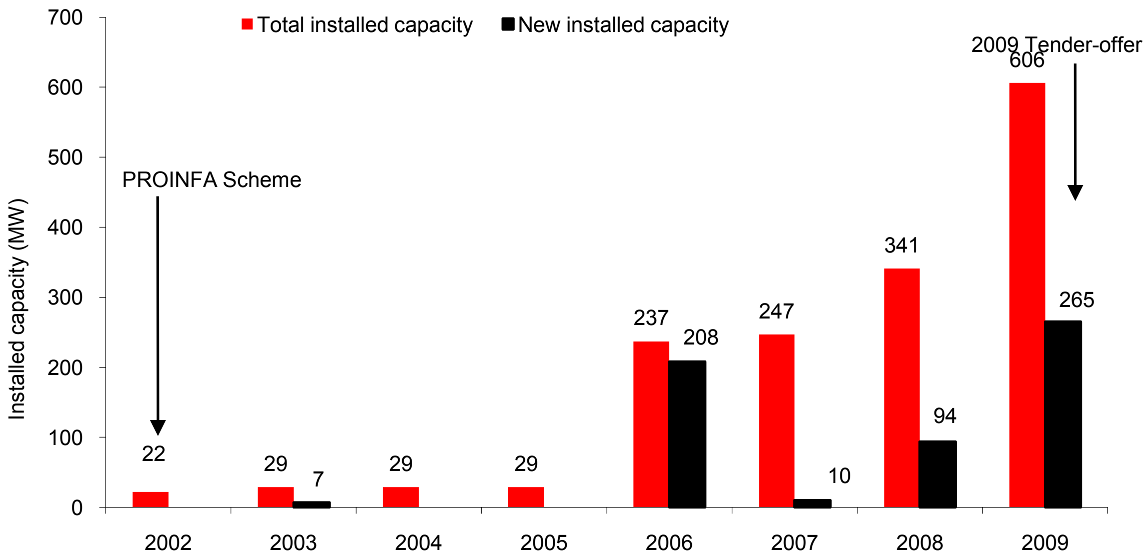
5.3.4. Brazil's PROINFA

Brazil launched a renewable energy incentive programme called the Alternative Energy Sources Incentive Programme ("PROINFA") in 2002 to achieve 3.3GW from wind energy, biomass and hydro energy, including 1.1GW from wind energy. RE projects were selected in the PROINFA on the basis of the following regulations:

(i) RE producers were required to sell all electricity at fixed tariffs (adjusted for inflation) to Electrobràs through 20-year contracts. The tariffs were set at levels sufficient to guarantee the financial viability of the projects;
(ii) Projects were required to start operation prior to December 2006;
(iii) Projects required 60% local content;
(iv) Generation, transmission and distribution companies were not included in the programme;
(v) BNDES, the governmental development bank, financed 70% of wind project investments for 10 years;
(vi) BNB, a regional bank for the development of Brazil's Northeastern region, provided 20-year financing at subsidised rates and with a 2-year grace period for capital repayments;
(vii) During the life of the debt, Electrobràs guaranteed 70% of forecasted revenues from the wind project;
(viii) Wind farms did not need to provide or meet generation forecasts;
(ix) Wind projects benefited from an infrastructure incentive programme and were provided with tax exemptions on imports and services (Dalbem and Gomes, 2009).

A total capacity of 1,422MW of wind energy spread across 54 projects was contracted in PROINFA by 2004, however by the end of 2006, only 4 projects were ready and the deadline for PROINFA was postponed to the end of 2008 (Dalbem and Gomes, 2009). By the end of 2009, 14 wind projects were still being built and 17 had not yet even started construction. Hence only 27% of wind energy projects contracted in 2004 were operational by 2009 (more than three years after the originally set deadline).

Figure 19: Cumulative and annual installed capacity of wind energy in Brazil



Source: GWEC (2010)

There were a number of shortcomings of the PROINFA which caused significant delays and limited success of the PROINFA wind projects. Firstly, the application and contractual process took longer than expected and RE developers faced difficulties in meeting the requirements under the PROINFA regulations. In particular, the requirement to meet a minimum of 60% local content was difficult to meet, given that the maximum domestic equipment production capacity was 250MW per annum (Dalbem and Gomes, 2009). Additionally, regulatory uncertainties in the PROINFA programme did not stimulate the entry of new turbine manufacturers (Dalbem and Gomes, 2009).

Secondly, the selected projects under PROINFA were those that had been awarded the environmental permits, and not those projects with the best technical and efficiency conditions. Furthermore, environmental permitting processes at the national level were slow which prevented projects from being selected in PRIONFA. Thirdly, there were difficulties for RE developers in connecting to the grid, particularly in the Centre-western and North-eastern regions in Brazil, and finally, the extension of deadlines to PROINFA required extensions of contracts and added to the bureaucracy of the procurement process (Dalbem and Gomes, 2009).

Some of the key lessons learned from PROINFA are firstly that delays in the procurement and contracting processes serve to hinder the development of wind energy projects. Secondly, successive extensions of deadlines result in additional complexities in the procurement process and ultimately in the loss of credibility in the programme. In order to address these issues, tendering systems need to have clear guidelines and timelines for the procurement process in order to reduce delays and complexities in the bidding process and thereby minimise transaction costs for bidders.

Thirdly, it is critical for RE developers that the selection criteria (especially if they are non-price based) are transparent and are clearly defined in order to provide visibility on the project requirements in advance of the procurement process. Although the introduction of non-price criteria can assist governments in promoting public interests, it is critical that the selection criteria provide a robust and equitable mechanism for selecting wind projects with the best technical and efficiency characteristics.

Fourthly, it is crucial that RE developers have the capacity to meet non-price criteria in the bidding process. For example, a criterion such as 60% local manufacturing in Brazil, considering that the capacity of domestic turbine manufacturers at the time was insufficient to support the level of demand, clearly jeopardized the ability for project developers to meet the criteria, which hindered the development of wind projects in PROINFA. Furthermore, it is important that non-price criteria are adequately regulated to ensure compliance by RE developers after the award of a contract.

Finally, legal and regulatory issues such as difficulties in grid connection and in environmental permitting result in additional delays for wind projects. This results in increases transaction costs for developers and further hinders developers in meeting project requirements in the procurement process. An adequate legal and regulatory framework is crucial to expedite permitting and licensing procedures and minimise transaction costs for RE developers in the procurement process.

5.3.5. Brazil's 2009 tender-offer

As a result of the problems experienced with Brazil's PROINFA programme, the Ministry of Energy opted for a new tendering system approach for wind energy projects in 2009. The 2009 tendering scheme introduced a number of different regulations, as outlined below:

(i) Local content is no longer a direct requirement for wind projects, however the government bank, BNDES-Finame, only provides subsidised financing for wind projects with a minimum of 60% local content hence there is an indirect local content requirement;

(ii) The energy price contracted is to be determined through an auction (explained below), and will be adjusted annually by inflation;

(iii) Wind projects incur the risk of not generating the committed amount of energy, however, the risk is mitigated through the follow mechanisms:

→ Energy output may be within a band of 30% lower or up to 10% higher than the contracted amount without suffering penalties. The energy output contracted is valid for a 4 year period, at which point the energy contracted is reviewed and adjusted to the actual output generated in the previous four year period; and

(iv) Projects have to undertake the costs of grid connection, transmission and distribution and energy losses (Dalbem and Gomes, 2009).

Notwithstanding the fact that the new regulations lowered the tariffs for wind generation through price competition in the tendering scheme, the new regulations managed to attract RE developers representing a total of 14GW across 449 projects against an expected 1 – 2GW (Dalbem and Gomes, 2009). Only a few days prior to the tender offer, however, were the technical and financial requirements disclosed to the bidders, including a ceiling price, restrictions on capital thresholds of RE developers, the requirement to pay bid bonds, and the requirement to disclose wind data, which served to reduce the interested developers by more than 50% (Dalbem and Gomes, 2009).

The structure of the 2009 tender offer was a reverse auction with a ceiling price of R$189/MWh (US$109/MWh) (Dalbem and Gomes, 2009). Each bidder had the option to stay in the auction in subsequent rounds by accepting a fixed price reduction, or leave the auction. When bidding projects reached a predetermined threshold, and prices were at R$152/MWh, the auction launched a new phase, which allowed bidders to submit their lowest and final bid (Dalbem and Gomes, 2009). According to Dalbem and Gomes (2009), the electronic auction evolved as follows:

14GW (449 applications) → 10GW (339 were certified) → 6GW (217 placed bids) → 1.8GW (71 won)

The final prices yielded in the tender process were extremely low, between R$131-153/MWh. At this stage, it is difficult to determine the results of the tender-offer as the winning bidders are currently going through financial processes and seeking capital or BNDES financing, though Dalbem and Gomes (2009) suggest that it is highly questionable whether the low tariff projects will actually materialise.

Judging from the sharp decline in the level of appetite prior to Brazil's tender-offer and after disclosure of the technical and financial project requirements as well as price ceiling and bid bond requirements, it is evident that it is crucial that the project requirements are clearly defined and made transparent in advance of the procurement process. Additionally, such non-price criteria must provide a transparent and equitable mechanism to select renewable energy projects.

Finally, due to the fact that RE developers face regulatory risk as there is no clear signal from government that the current regulations are permanent, nor of how much energy is be contracted in future, nor of how often the tenders will occur, it is critical that RE developers and investors have visibility on timing of future tender processes and of the amounts of energy to be contracted over the medium to long term.

5.4. Price insecurity undermines stability of RE support scheme

A lack of clarity regarding the timing of revisions to the feed-in tariff level for wind energy has been cited by project developers and investors as a concern in the REFIT Programme. A revision to the tariff level prior to the award of a single contract to a wind project in the REFIT Programme would severely undermine the long term price security inherent in the feed-in tariff scheme and the credibility of the REFIT Programme.

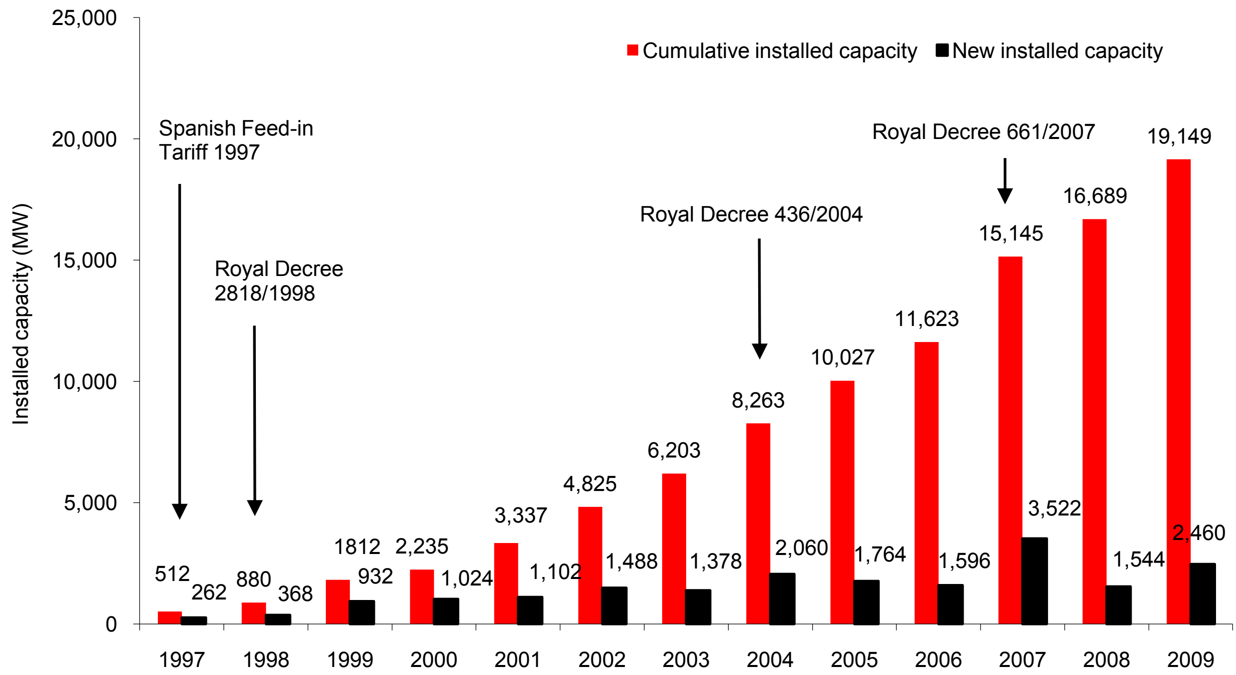
Countries such as Spain and Germany have demonstrated that price security resulting from guaranteed price support over a sufficiently long time period is fundamental to the successful development of a large-scale wind energy industry. Similarly, the US has demonstrated that pricing uncertainty in the short term can undermine investment certainty and stability in the market, which can destabilise growth of wind energy.

Experience of wind energy development in Spain, the US and Germany demonstrates the importance of long term price security in driving stable and consistent growth of wind energy, and an examination of the policies in these countries gives an understanding of the requirements for achieving long term price security.

5.4.1. Spain's Feed-in Tariff

Spain has been one of the most successful countries in promoting wind energy globally, as the feed-in tariff system has provided a clear signal of price security and stability for investors, which has been fundamental in supporting long-term investment in large-scale wind energy development over the past decade. Several reforms to the Spanish feed-in tariff implemented over the past few years have increased the transparency in setting the feed-in tariff level and have enhanced the stability, predictability and security of the tariff levels providing a clear pricing signal to investors of the range of possible support levels.

Figure 20: Cumulative and annual installed capacity of wind energy in Spain



Source: GWEC (2009)

The Spanish feed-in tariff was implemented in 1997 and provides a framework whereby each kWh of renewable power is paid to the producer at a special price which is higher than the market price. For the first year of electricity generation, an RE producer can select between a fixed feed-in tariff or a premium added to the price negotiated in the market. At the end of each year, the RE producer can choose to maintain the existing tariff structure or opt for the alternative structure (Held *et al*, 2007).

This "double option" has served to encourage the gradual participation of RE generators in the electricity market whilst simultaneously mitigating the risk for RE generators by ensuring a minimum support level (del Rio González, 2008: 2924).

Modifications to the feed-in tariff under the Royal Decree 436/2004 included two payment options for RE producers:

(i) Sale to the distributor at a regulated tariff, set as a % of the Annual Electricity Tariff ("AET"); or
(ii) Sale on the open market through either a bidding system, a bilateral contracting system or a forward contracting system, whereby the RE producer receives the market price, plus an incentive to participate in the market system plus a premium (as a % of AET) (del Rio González, 2008: 2920).

Under both payment options, the support level was tied to the AET, decreasing over the lifetime of the project and guaranteed over this period. This increased the transparency and stability of the mechanism for setting the support level, which resulted in a clear price signal for RE producers.

In 2007, the enactment of Royal Decree 661/2007 introduced a reference premium which is bound by cap and floor prices in order to minimise windfall profits to RE producers. The reference premium is updated annually in line with inflation, and will be reduced by 0.25% until 2012, whereafter it will be reduced by 0.5% (del Rio González, 2008). This revised mechanism for determining the reference premium guarantees a minimum remuneration level for RE producers, which provides investment certainty and also minimises windfall profits for RE producers.

In April 2010, however, the Spanish government stated its intention to pass new legislation regarding a retroactive cut to the feed-in tariff rates for wind generation (McKenna, 2010). If the legislation is passed, this would mean that there would be no price security and certainty for RE producers who are currently eligible for feed-in tariffs for wind generation. While the legislation has not yet been passed, it has still created significant pricing risk and investment uncertainty for wind producers and investors.

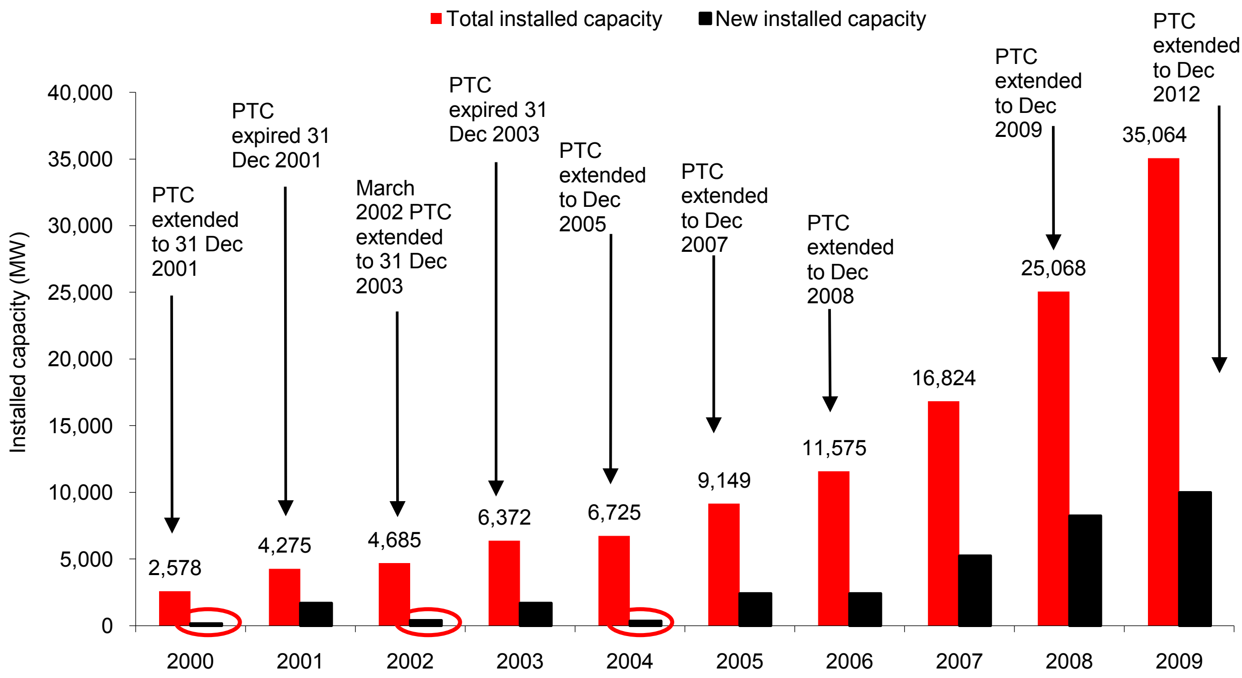
The key lessons learned from the Spanish feed-in tariff and recent developments in the wind energy market are firstly that long term pricing stability and security is fundamental to support stable growth in wind energy development. Secondly, unpredictable changes in the feed-in tariff level due to political interventions are likely to undermine investor confidence and result in a flight of capital (Couture *et al*, 2010). Thirdly, tariffs must be guaranteed over a sufficiently long time period to ensure a high rate of return for RE producers. Finally, it is important to enhance the stability, predictability and security of the tariff revisions as this provides investment certainty to investors. In order to do so, any revisions or adjustments made to the tariff must be transparent and predictable to ensure market stability for investors.

5.4.2. Production Tax Credit in the United States

The Renewable Energy Production Tax Credit ("PTC") has played a major role in driving wind energy development in the US with over 35GW of wind capacity installed since its inception in 1992. However, the US Congress has typically been unable to extend the tenor of the PTC for more than one or two years, which has resulted in frequent expiration of the PTC.

The failure to extend the PTC before its expiration has had negative consequences for the development of wind energy in the US as it has led to "boom-and-bust" cycles of wind energy development. In 1999, the PTC was allowed to expire for the first time, resulting in a 93% decline in wind energy development during 2000 (Mendonça *et al*, 2009). Similarly, the PTC was allowed to expire in 2001 and again in 2003, which led to a decline in wind energy development of 70% in 2002 and 2004, as depicted in Figure 21 (Mendonça *et al*, 2009).

<u>Figure 21: Cumulative and annual installed capacity of wind energy in the US</u>



Source: GWEC (2010)

The frequent expiration of the PTC and short term extension cycles have undermined long term price security and investment certainty in the market, which has effectively slowed down wind energy development in the US. Even in the years where the PTC has been certain, the uncertainty of possible short-term revisions of the PTC has undermined planning and development leading to lower levels of wind energy capacity additions (Wiser *et al*, 2007).

Currently, the US Congress has extended the PTC by three years through to 2012, providing greater stability to the wind energy industry over the short term. Although this PTC extension is the longest single extension to date and serves to enhance stability and investor confidence in the wind industry, there is still major uncertainty regarding the future of the PTC post-2012 (Wiser *et al*, 2007). Experience with the PTC in the US clearly demonstrates that the absence of price security over the long term has destabilised growth in wind energy development and created a boom-and-bust growth cycle. In order to address this, investors require longer term visibility on pricing and policy certainty over the long term.

5.4.3. Germany's Feed-in Tariff

The wind energy sector in Germany has been underpinned by a stable and consistent feed-in tariff system since the implementation of the Electricity Feed-in Act in 1991 and subsequently by the Renewable Energy Sources Act in 2000. The German feed-in tariff mechanism has provided long term price security which has resulted in a stable investment climate and stable growth of wind power over the past two decades.

Important features of the German feed-in tariff which have contributed to long term pricing security of the system include the following:

(i) The feed-in tariff is guaranteed over a sufficiently long time period of 20 years (Held *et al*, 2007). This creates a stable investment climate as it enables project developers to obtain financing from banks and investors;

(i) The tariff level is reduced according to an annual tariff degression in order to incentivise efficiency improvements and cost reductions for new installations of wind power;

(ii) Tariffs are stepped in order to promote wind farms with less advantageous wind conditions, reducing the producer profit and lowering transfer costs for society;

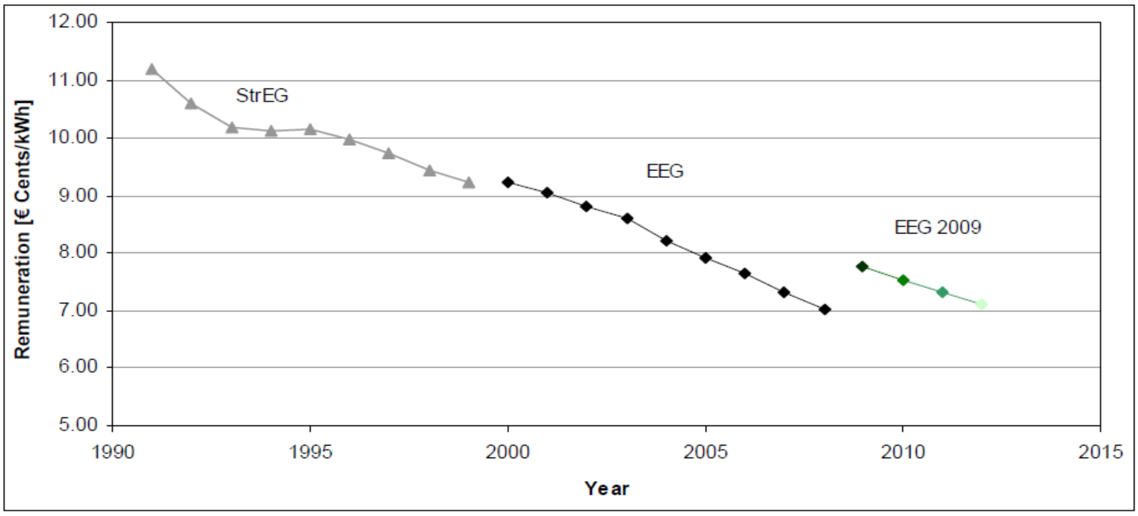
   a. Investors in wind power at sites with a high energy yield receive a lower basic tariff commencing after 5 years after installation;
   b. Wind farm sites with a lower energy yield have a prolonged time period for the higher feed-in tariff (Held *et al*, 2007);

(iii) The feed-in tariffs are set to be reviewed after the first two years, and every four years thereafter in order to take into account changes in pricing in the light of technological innovation (Held *et al*, 2007);

(iv) The transmission system operator located closest to the wind power plant is obliged to connect the plant to the grid and to purchase and pay the guaranteed tariff for all electricity produced by the plant (CMS, 2008);

(v) Regular adjustments to the German feed-in tariff level in combination with the tariff degression mechanism have resulted in steady tariff reductions since the initial implementation of the feed-in tariff in 1991 (as depicted in Figure 22). Wind tariffs in Germany have decreased from 9.95 eurocents/kWh in 1991 to 7.65 eurocents/kWh in 2005, although the tariff was increased to 9.2 eurocent/kWh in 2009 in order to stimulate wind market growth in support of the achievement of Germany's RE target by 2010 (Klein *et al*, 2008).

Figure 22: Development of the remuneration of electricity from onshore wind energy in Germany



Source: Klein et al (2008) Note: Prices have been inflation-adjusted to 2005 values.

In summary, the German feed-in tariff scheme demonstrates that a transparent, stable and predictable pricing mechanism can successfully provide long term price security and certainty for RE producers and investors. Key features of the Germany feed-in tariff, including a fixed payment over 20 years, regular and predictable tariff revisions, and the tariff degression mechanism, have contributed to its price security and stability over the long term. An important lesson learned from the German feed-in tariff is that tariff revisions need to be regular and predictable in order to create investment certainty and stability over the long term.

5.5. Market caps limit wind market growth

One of the barriers to wind energy development in South Africa is that the IRP has the effect of placing a market cap on the wind market size, and therefore that the wind market is constrained to 400MW in the short term. Additionally, because South Africa's (relatively limited) renewable energy target of 10,000GWh is set to be achieved by 2013, there is no visibility regarding the government's level of commitment towards renewable energy beyond 2013.

Experience with market caps in a number of countries, including France and Germany, has shown that market caps generally introduce a number of problems for RE development. Firstly, if market caps are set too low then this can create significant uncertainty for developers and investors, as they are unlikely to know how quickly these caps will be met and whether their specific project will make the cut before the cap is fully subscribed (Couture *et al*, 2010).

Secondly, market caps can result in "queuing" of RE projects as the projects attempt to receive an allocation before the market cap is met. This could incentivise project developers to enter speculative bids to secure their place in the queue, which could lead to the project-development pipeline being filled with unviable wind energy projects (Couture *et al*, 2010).

Finally, fixed market caps can limit the amount of renewable energy development that can occur, which reduces the potential for market growth and creates a disincentive for investors and developers from investing in the market, as well as for manufacturers to establish local manufacturing facilities. As a result, market caps can jeopardise the chances that renewable energy targets will be met on schedule (Couture *et al*, 2010).

Experience with market caps in Germany and France has shown that it is critical that market caps are set high enough relative to the market size in order to reduce uncertainty and provide a clear signal to investors, project developers and manufacturers about the extent of future market growth. The experience in Germany and France has further shown that market caps have been less efficient at stimulating wind energy development in comparison with renewable energy targets. Both of these countries have replaced the market caps with aggressive renewable energy targets in order to provide a clear signal to investors regarding the level of wind energy development over the medium and long term.

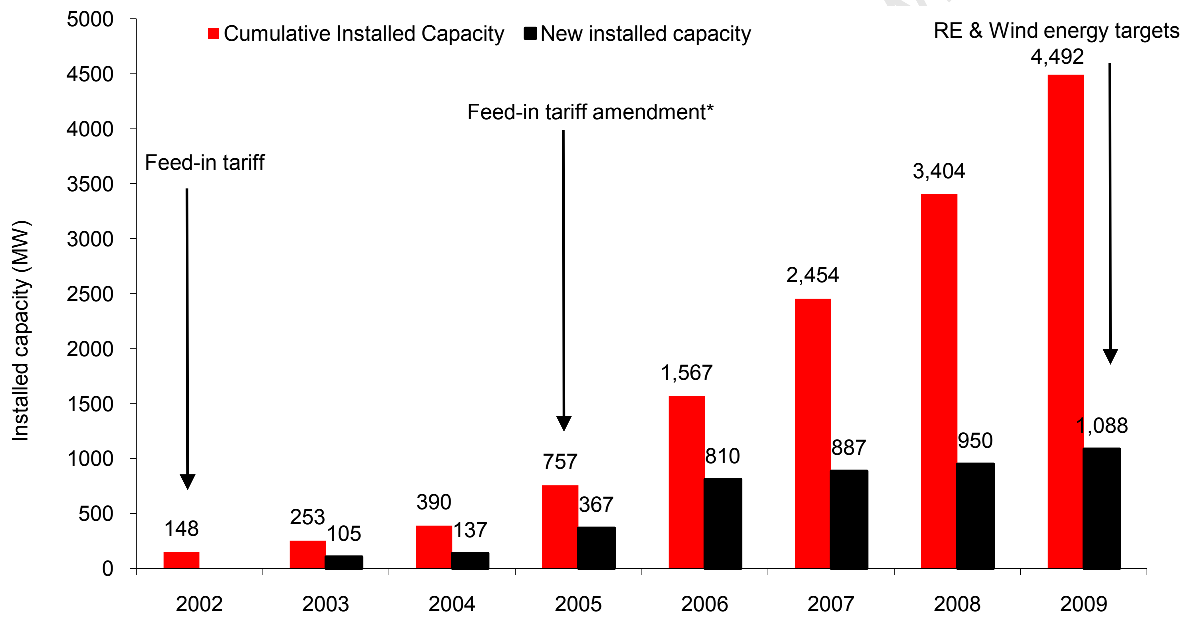
5.5.1. Germany's renewable energy cap

Germany's feed-in tariff, which was initially enforced in 1991, imposed a 5% share of electricity from renewable energy for grid operators which meant that grid operators were required to buy renewable electricity until the share of electricity from renewable energy sources reached 5% (Held *et al*, 2007). However, growth of wind energy in Germany during the 1990s was relatively modest, and in order to stimulate market growth and meet Germany's renewable energy targets, this 5% cap was later removed and replaced by a renewable energy target of 12.5% by 2010 and 20% by 2020 after the Renewable Energy Sources Act replaced the Electricity Feed-in Act in 2000 (Held *et al*, 2007).

5.5.2. Market caps in France

France used to have a market cap for wind energy of 17,000MW as well as a market cap for other renewable energy technologies including biomass and hydropower (2,000MW each) and photovoltaic (500MW) (Couture *et al*, 2010). However, due to the relatively limited development of wind energy, the market caps were replaced by the French government in December 2009, with a short term target of 11,500MW of installed wind energy capacity by 2012 (1,500MW of which should be offshore wind capacity) and a long term target of 20,000MW installed wind capacity by 2020 (including 6,000MW offshore wind capacity) (GWEC, 2010). These renewable energy targets have had the effect of creating goals for developing wind energy projects rather than imposing a market cap which limits the development of each technology in the FIT scheme (Couture *et al*, 2010).

Figure 23: Cumulative and annual installed capacity in France



*Source: GWEC (2010) *The feed-in tariff was amended in July 2005 such that wind farms had to be built in special Wind Power Development Zones in order to be eligible for the feed-in tariff (GWEC, 2010).*

The main lesson learned from experience with market caps in both Germany and France is that market caps, if they are not set high enough relative to the market size, can limit the amount of renewable energy development. Renewable energy targets, on the other hand, provide a valuable signal to investors regarding the potential for future market growth, which serves to encourage large-scale development of wind energy.

5.6. Renewable energy targets create policy certainty

The absence of medium term and long term renewable energy targets has created a barrier to investment in the South African wind energy industry as the lack of visibility on the wind market size beyond 2013 has created a disincentive for developers to invest in the wind market.

Countries such as China and Germany, which have successfully promoted sustainable and large-scale wind energy industries, have shown that long term, clear government commitment towards renewable energy creates investment certainty and facilitates sustained and efficient growth of wind energy. In addition, the establishment of medium and long term targets for wind energy are fundamental in creating policy certainty and stability over the long term, which is key to attracting investment in the wind energy sector and in providing the policy framework for RE developers and investors to make a long term investment in the wind energy market.

Experience in promoting the development of large-scale wind energy industries in China and Germany illustrates that the establishment of medium and long term targets for renewable and wind energy are crucial in creating such policy certainty and stability.

5.6.1. China's aggressive renewable energy targets

Clear and progressive medium and long term targets for wind energy have been key drivers of the unprecedented growth of wind power achieved in China over the past five years. Since the implementation of the Renewable Energy Law in 2005, which provided the framework for establishing medium and long term RE targets, the Chinese wind market has produced annual growth in excess of 100%. This has resulted in China's current position as the second largest wind energy market globally after the United States, with an installed capacity of 25.8GW in 2009 (GWEC, 2010).

China's Medium and Long-Term Development Plan for Renewable Energy was published in 2007, and set out the government's long term commitment to renewable energy through to 2020. The Plan set a national renewable energy target of 10% renewable energy in total primary energy consumption by 2015 and 15% by 2020 and further stipulated priority sectors, policies and measures for implementation.

National wind energy targets were initially stipulated as 5GW by 2010 and 30GW by 2020, however the cumulative wind installed capacity had already exceeded 5GW by as early as 2007 (NDRC, 2007). As a result, policymakers revised the 2010 wind energy target upwards to 10GW. Even this revised target was already exceeded two years in advance as total installed capacity reached 12GW by the end of 2008 (Qiang, 2009).

China has among the most aggressive wind energy targets in the world. As a result of the unprecedented growth of wind power development in China since the implementation of the RE Law, the government revised its 2020 wind energy target to 100GW and has recently revised its wind energy target of 100GW by 2020 to 150GW. This equates to an impressive annual target for new installed wind energy capacity of between 10GW to 20GW and has provided investors with a clear signal of the government's commitment to large-scale development of wind power over the long term (Zeppezauer *et al*, 2010). These aggressive wind energy targets have provided long term policy certainty and stability for investors of the future scale of wind energy development which has been fundamental in driving strong and stable growth of wind energy in China.

5.6.2. Germany's medium and long term renewable energy targets

The establishment of medium and long term renewable energy targets in Germany has successfully underpinned the long term stability of the feed-in tariff and has been a key driver in the strong and consistent growth of wind energy development in Germany over the past decade. This has resulted in Germany being the third largest wind energy market globally and the leading wind energy market in Europe with a total installed capacity of 25.7GW in 2009 (GWEC, 2010).

The German government implemented medium and long term renewable energy targets target of 12.5% of total electricity generation by 2010 and at least 20% by 2020 during the first revision period of the Renewable Energy Sources Act in 2002. This provided investors with long term policy certainty and investment security which enabled investors to make a long term investment in the German wind market.

Experience in China and Germany has shown that the establishment of medium and long term targets for wind energy can provide a valuable signal to investors regarding the government's long term commitment to renewable energy. This can provide investors with long term policy certainty and investment security which are crucial in supporting large-scale development of wind energy.

5.7. Guaranteed buyer is fundamental to investment certainty

There is currently no clarity regarding who will be the buyer of renewable electricity from IPPs in the South African REFIT Programme. It seems likely that Eskom's SBO will act as the REPA in the interim period prior to the establishment of the ISMO, and that the ISMO will act as the REPA once it is established as a fully ring-fenced entity separate from Eskom.

Experience in a number of countries, particular in the EU, has shown that policies that oblige the off-taker to buy the all electricity produced by RE IPPs (through a purchase obligation), increase the level of investment certainty and reduce counterparty risk for RE producers and investors. Under the REFIT legislation, there is a purchase obligation on the REPA to buy all electricity contracted in the REFIT Programme. Hence the challenge facing wind energy IPPs and investors in South Africa is not whether the renewable electricity will be bought, but rather who the actual buyer will be in the REFIT Programme.

This challenge is therefore unique to South Africa, and is likely to be resolved once there is further clarity around which entity will act as the REPA and PPA-counterparty in the REFIT Programme.

5.8. Long term "bankable" Power Purchase Agreements create a stable investment climate

There are two main concerns regarding the Standardised PPA in the South African REFIT Programme, firstly, that there is uncertainty as to whether the finalised PPA will adequately reflect a risk balance between the off-taker and the IPP and hence be "bankable", and secondly, that further delay in publishing the finalised PPA will increase the risk of participation in the REFIT Programme.

Experience across a number of jurisdictions has shown that the structure and tenor of the power purchase agreement can have a significant impact on investment security and in turn on the success of a policy in supporting wind energy development. Experience in China demonstrates that a "bankable" long term PPA, which adequately reflects a balanced risk allocation between the producer and buyer of renewable electricity, is critical to reduce investment uncertainty and provide market stability and thereby attract investors into the wind energy industry.

5.8.1. China's long term power purchase agreement

In the Chinese Wind Power Concession Programme (during 2003 to 2008), the power grid companies were obliged to sign a long-term power purchase agreement with wind energy IPPs and to purchase the electricity generated by the projects (Junfeng *et al*, 2007). The duration of the power purchase agreement covered the operational period of the wind farm, which was 20 years, which minimised the investment uncertainty for investors (Junfeng *et al*, 2007).

Provincial governments were responsible for signing concession agreements with the investors that won the bids, providing the guarantee for the power purchase agreement. The concession agreement and the long term power purchase agreement sufficiently protected the interests of wind energy IPPs and investors (including foreign investors) which provided an incentive to invest in the Chinese wind energy market (Junfeng *et al*, 2007). Accordingly, market risk and the risk premium required to invest in wind projects were reduced, which served to stimulate the development of wind projects in China.

5.9. Enabling legal and regulatory environment is critical to expedite wind energy development

Inadequate legal and regulatory procedures, such as grid connection and permitting and licensing regulations have created an administrative barrier to wind energy development in South Africa. Experience particularly in EU member countries has shown that an enabling legal and regulatory framework is required to reduce risks and excessive costs for wind energy developers and to streamline and expedite wind energy development. Grid-related issues and licensing and permitting (discussed below) are major areas where adequate legislation needs to be implemented in order to provide an enabling legal and regulatory environment.

5.9.1. Grid Access

Wind energy generators are guaranteed access to the grid in South Africa, however there is a lack of clarity in the REFIT documentation as to how this will be achieved. EU member countries are required to offer guaranteed, non-discriminatory access to the grid for all RE generators, which provides great protection and security to wind generators, increases investor confidence in the market and helps to reduce administrative barriers to wind energy development (Couture *et al*, 2010).

EU member countries are additionally obliged to provide priority access to the grid. This ensures that when multiple projects are competing for access to grid capacity, the electricity generated by the RE producers must be given first priority (Couture *et al*, 2010). This has served to accelerate the development of wind energy across a number of EU member countries. The UK, on the other hand, has not prioritised renewable electricity generation, and it is only fed into the grid if there is sufficient transport capacity. If there is insufficient transport capacity, a first-come first-serve approach is applied (Burgers *et al*, 2009).

5.9.2. Grid Connection

(a) Cost allocation of grid connection

There is presently no clarity in the REFIT legislation in South Africa regarding who is responsible for the cost of grid connection, and what cost allocation methods will be used. Experience in the EU has shown that it is critical that there are transparent regulations for the bearing and sharing of grid connection and grid investment costs to minimise the administrative burden and ensure streamlined grid connection procedures. These regulations should not place an excessive burden on RE producers, but rather should take into account the benefits of distributed generation (UNDP, 2008).

A number of EU member countries, including Germany and Spain, employ a "shallow" cost approach whereby project developers bear the cost of direct grid connection costs, and the cost related to the grid extension or reinforcements are borne by grid operators and these costs are passed on to consumers through the grid tariffs (UNDP, 2008). This grid connection cost approach is considered best for small RE developers as there is a limited financial burden and a higher degree of transparency concerning grid connection costs (Couture *et al*, 2010). However, there is no incentive to RE developers to locate their wind energy facilities in a way to optimise the existing grid (Couture *et al*, 2010).

The second approach is the “deep” connection approach, whereby the RE generator has to bear all costs related to connecting the wind energy facility to the grid, including direct costs for linking the facility to the grid and any transmission grid upgrades required to accommodate the wind energy facility on the grid (Couture *et al*, 2010). Under deep connection charging, as formerly applied in the UK, RE developers are incentivised to choose sites which will be efficient for the power system. However, the additional cost for RE generators tends to create a barrier to wind energy development (Couture *et al*, 2010).

The third approach is the “mixed” connection approach, whereby the RE generator has to pay for connecting the facility to the grid, and the costs related to grid upgrades are shared between the RE generator and grid operator (Couture *et al*, 2010). According to Burgers *et al* (2009), the UK has recently adopted this mixed approach, as project developers are required to pay for network investment costs necessary for connection to the grid and for the costs for distribution network upgrades, whereas costs for transmission upgrades are borne equally by electricity consumers.

The mixed connection approach strikes a middle ground between the shallow and deep connection approaches, because there is still an incentive for RE developers to choose the lower-cost interconnection point, and the RE developer is also obliged to pay a portion of the grid upgrades required (Couture *et al*, 2010).

(b) Grid connection applications

There is currently no clarity regarding how Eskom is processing the grid connection applications in the REFIT Programme (which currently stand at 12,675MW as of June 2010) (Smit, Personal Interview, 2010). Without clear procedures for grid connection approvals, speculative queuing of grid connection applications tends to occur, especially in markets which have imposed a market cap as RE developers are incentivised to reserve their place in the queue. The less streamlined the process for grid connection approvals, the longer the wait times and delays for project developers and the higher the administrative costs. Furthermore, these speculative projects may block other projects (which might have a greater chance of being successful) from receiving their grid connection approvals (Couture *et al*, 2010).

The introduction of an obligatory financial commitment with the grid connection application has been an effective way to reduce speculative queuing and to improve the likelihood of successful development of wind projects across a number of EU member countries (Couture *et al*, 2010). Spain and the UK, for example, apply fees for processing connection applications in order to avoid non-serious grid applications.

(c) Delays in grid connection

There is currently no certainty for wind developers in South Africa that compensation will be made available in the case of delay in connecting the wind energy facility to the grid. International experience has shown that it is important to clarify cost-allocation protocols in advance to reduce the uncertainty and risk for project developers in the event of delay of connecting the wind farm to the grid. Germany, for example, provides an incentive for grid operators to reduce the delay in connecting wind farms to the grid (Burgers *et al*, 2009).

According to the Renewable Energy Sources Act which was implemented in Germany in 2000, in addition to the obligation on grid system operators to provide priority access to the grid for RE generators, in the case of any delays, the network company was obliged to bear the cost of delays and had to explain to the regulator the cause for such delays (Burgers *et al*, 2009). The additional cost of delays to the network operators creates an incentive for the network operator to process grid applications as quickly as possible.

5.9.3. Grid Integration

South Africa has not yet conducted system-wide grid integration studies to assess the technical feasibility of large amounts of wind energy onto the grid and hence the capacity of wind generation that can viably be integrated into the grid without having a negative impact on grid stability is unknown. In order to assist grid operators in balancing the supply on the power system and thereby manage high penetration levels of wind energy, some jurisdictions have imposed a forecast obligation on RE generators. Generation forecasting can also serve to improve grid management and achieve higher wind energy penetration levels and more progressive renewable energy targets (Couture *et al*, 2010).

The integration of wind generation into the Spanish power grid and stability of the grid have been improved through a system of forecast obligation which requires RE generators (greater than 10MW) to predict the amount of electricity they plan to feed into the grid at least 30 hours prior to the commencement of each day (Burgers *et al*, 2009). It is possible to revise the predicted amount of wind generation up until one hour before an hourly interval starts, and if the electricity generation differs by more than 20%, penalties for deviation of 10% of the annual electricity tariff are applicable for each kWh deviation (Held *et al*, 2007; Klein *et al*, 2008).

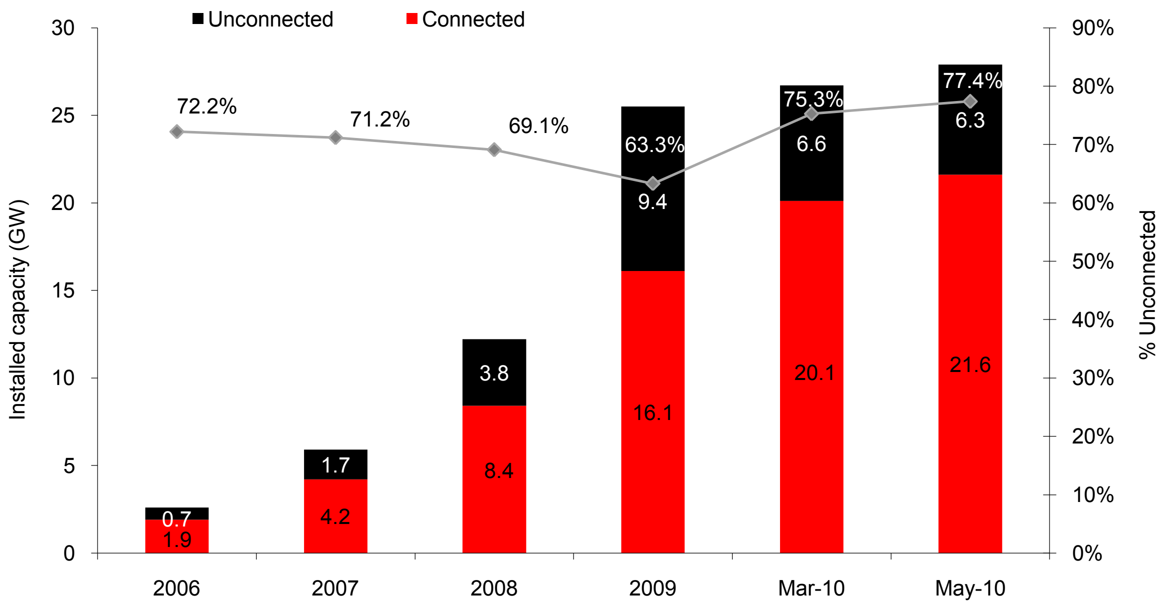
The forecast obligation in Spain has successfully enabled the country to balance the integration of large amounts of wind energy onto the grid, which has effectively enabled the country to achieve penetration of 14.3% wind generation in 2009 (REN21, 2010).

5.9.4. Network Planning

International experience has shown that there is considerable discrepancy between the time required to get new transmission planned, permitted and constructed, which typically takes 5-10 years, in comparison to building a wind farm, which can take between 12-24 months (Couture *et al*, 2010). Considering the delay required to make the necessary grid reinforcements for wind energy projects, experience has shown that wind energy development plans urgently need to be integrated with network planning (Couture *et al*, 2010). This is demonstrated in China, where 23% of wind farms are currently not connected to the grid due to inadequate power grid planning (Bloomberg New Energy Finance, 2010).

One of the key issues currently impeding wind energy development in China is the physical constraints of grid capacity, which has been unable to keep pace with the construction of wind farms (Zeppezauer *et al*, 2010). Approximately 23% (or 6.3GW) of China's wind energy turbines are currently not generating electricity because they are not yet connected to the power grid (Bloomberg New Energy Finance, 2010). This is because the majority of China's wind farms are located in Inner Mongolia, Gansu and Xinjiang in the north-west where the existing grid infrastructure is weak whereas the cities and towns consuming the most energy are located thousands of kilometres away on the east coast (GWEC, 2010; Zeppezauer *et al*, 2010).

Figure 24: Cumulative grid connected project capacity versus cumulative installed capacity



Source: Bloomberg New Energy Finance (2010)

The power grid bottleneck in China is exacerbated due to the fact that planning of wind farms occurs ahead of power grid planning and that there is a coordination issue between timing of commissioning and related power connection. The average delay in power grid interconnection is 3-6 months (Morgan Stanley Research, 2009). This clearly demonstrates the importance of integrating wind energy development planning with network planning.

5.9.5. Permitting & Licensing

The absence of clear authorisation procedures for obtaining the necessary licenses has created an administrative burden for project developers in the REFIT Programme in South Africa. Additionally, the disconnect between environmental authorisation and rezoning procedures has resulted in time delays and excessive costs for RE developers.

A number of EU member countries have demonstrated that project developers and investors can be deterred and project profitability can be jeopardised if permitting and licensing procedures are complex, costly and unclear (UNDP, 2008). In order to support cost-effective development of wind energy, it is critical to create permitting and licensing procedures that will facilitate increased generation in a simple and timely way (UNDP, 2008). Clear guidelines for authorisation procedures, obligatory response periods and clear roles for the relevant authorities are ways in which to simplify and streamline licensing and permitting approval processes.

Experience in the UK has shown that clear guidelines on environmental impact assessments and planning are crucial to foster public support for wind farms. According to Butler and Neuhoff (2004), the biggest obstacles to wind energy development in the UK have been planning restrictions, delays in obtaining permitting approvals, and the associated costs and delays for developers.

Local and regional planners, which are responsible for processing the planning and licensing of wind projects, have typically placed more emphasis on local environmental factors rather than national renewable energy targets. Wind energy projects which were successful at obtaining contracts were generally also located at sites with good wind resources, and were often in exposed locations, which made it difficult to obtain planning approval. As a result, a lack of planning capacity at the local and regional level, combined with the lack of awareness of the benefits of renewable energy, has contributed to major opposition to wind energy projects in the UK.

Similarly, experience in France has shown that streamlined licensing and authorisation procedures are required to expedite the development process and minimise administrative barriers for developers. Additionally, adequate grid connection capacity is required to increase the pace of wind energy development in the country. Despite the high wind resource potential in France, there are a number of barriers that remain and which have hindered wind energy development in the country (GWEC, 2010). These include the slow authorisation procedures for Wind Power Development Zones and individual wind projects and inadequate grid connection capacity (GWEC, 2010).

A feed-in tariff was introduced in France in 2002, which guaranteed a fixed tariff over a period of ten years, and then declined over the next five years. In order to be eligible for the feed-in tariff, wind farms had to be smaller than 12 MW (GWEC, 2010). In 2005, the feed-in tariff was amended to stipulate that in order to be eligible for the feed-in tariff, wind projects had to be located in predetermined Wind Power Development Zones ("ZDE") and that there was no longer a size limit on individual wind farms (GWEC, 2010).

In spite of these revisions, the ZDE law has hampered growth of wind energy in France, as it has resulted in more time-consuming and complex administrative and grid connection procedures (GWEC, 2010). In addition, inadequate grid connection capacity has been problematic in some areas in the country, which has further impeded growth of wind energy in the country.

5.10. Stable and sizeable domestic wind market stimulates local manufacturing

Experience in a number of countries, such as Spain, Germany, China and Denmark (in the 1990s), has shown that it takes time to establish a local wind turbine manufacturing industry. Experience has also shown that a stable and sizable domestic market for wind energy is a prerequisite to stimulate a local manufacturing industry. Countries which have successfully stimulated a local manufacturing industry have generally depicted annual demand for wind energy of a minimum of 500MW over a minimum period of three years (Lewis and Wiser, 2007).

Furthermore, Lewis and Wiser (2007) note that supportive policies to directly promote local wind manufacturing contribute significantly to the establishment of a domestic manufacturing industry; these policies can include local content requirements, financial and tax incentives, favourable customs duties, export credit assistance, quality certification and R&D. Experience in Germany and China has shown that continuous growth and stability in the wind energy market over a sufficiently long time period, in combination with direct support policies for local manufacturing have contributed significantly to the establishment of local wind turbine manufacturing industries.

5.10.1. Germany's domestic manufacturing industry

A consistent and sizeable market for wind power in Germany since the early 1990s has created an enabling environment for the development of a local manufacturing industry (Lewis and Wiser, 2005). The government has also provided strong support for local manufacturing through a combination of R&D programmes, soft loans and export credit assistance (Lewis and Wiser, 2005).

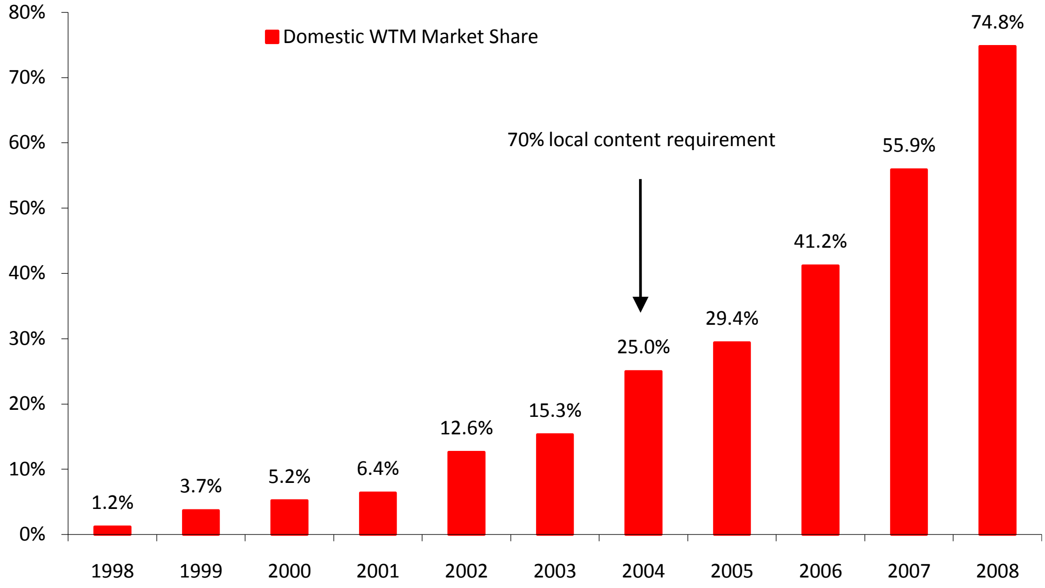
This has resulted in Germany being home to a number of large Wind Turbine Manufacturers ("WTMs") including Enercon, which is the leading domestic WTM with a market share of 60.4%, followed by Vestas (19.5%) and REPower Systems (8.8%) (GWEC, 2010). Currently, approximately

30% of the world's wind turbines are manufactured by German companies (GWEC, 2010). Furthermore, the local WTM industry is responsible for the creation of approximately 38,000 direct jobs in Germany in 2009 (EWEA, 2009).

5.10.2. China's domestic manufacturing industry

The Chinese government has been extremely successful at fostering a domestic manufacturing industry due to the strong and stable demand for wind energy since the implementation of the RE Law in 2005, and to strong government support for the domestic manufacturing sector through policies such as local content requirement, sharing the burden of extra costs related to wind power, and by setting a mandatory market share for big utilities (GWEC, 2010). By the end of 2009, there were up to 80 wind turbine manufacturers and the share of domestic wind turbines in total China installations totalled 74.8% in 2008, as depicted in Figure 25 (Morgan Stanley Research,2009).

Figure 25: Rising Share of Domestic Wind Turbines in Total China Installations



Source: Morgan Stanley Research, 2009

The 70% local content requirement of wind turbines in China was implemented in 2004, however this law was repealed in early 2010 as China's wind turbine manufacturing industry is now the world's largest and no longer requires support policies (GWEC, 2010; Zeppezauer *et al*, 2010). Total wind turbine production is expected to exceed 20GW during 2010, potentially resulting in overcapacity of domestic wind turbines in China (Morgan Stanley Research, 2009).

China's wind energy industry has attracted large domestic wind turbine manufacturers such as Goldwind, Sinovel and Dongfang as well as international manufacturers, including companies such as GE Energy, Vestas, Gamesa and Siemens (REN21, 2010).

6. Main findings and conclusions

The objective of this paper was to evaluate how South Africa can address the challenges facing the wind energy industry and create an enabling environment to support the development of a large-scale wind energy industry. This paper has identified and analysed the key challenges facing the wind energy industry in South Africa and has examined experience in other countries which have encountered similar barriers to wind energy development or have overcome these barriers through various policy measures. This has provided useful guidelines for South Africa in addressing the challenges facing the wind energy industry and in creating an enabling environment for the development of a large-scale wind energy industry in the country. This section discusses the main findings and conclusions from this paper.

6.1. Coherent policy and regulatory framework creates long term policy certainty

The implementation of a clear and coherent policy and regulatory framework for wind energy, such as the Renewable Energy Sources Act in Germany and the Renewable Energy Law in China, is fundamental in creating long term policy certainty and stability in the wind market. This is required to attract investment and kick-start a nascent wind energy market and to ensure strong and consistent growth of wind energy over the long term.

The outcome of experience in Germany with the EEG and China with the RE Law has shown that the implementation of a clear policy and regulatory framework has provided an overarching framework for government to prioritise certain objectives in the short, medium and long term and implement the policy measures required to achieve these objectives. Under both the EEG and the RE Law, the barriers to wind energy development were addressed in the short term to provide policy certainty and to create an attractive investment climate which is necessary to kick-start wind energy development in the early stages of a new wind market.

Medium and long term renewable energy targets were implemented after a few years in order to provide a clear signal to investors of the government's long term commitment to renewable energy. The implementation of a clear policy and regulatory framework further enabled both the Chinese and German government to make amendments or revisions to the regulations to enhance the stability of the support mechanism over the medium to long term.

The evidence from experience in Germany and China suggests that implementing a clear and consistent policy and regulatory framework in South Africa would provide policy certainty and stability in the South African wind market, which would create an attractive investment climate to kick-start growth in the wind energy industry. Furthermore, the evidence from Germany and China suggests that implementing a coherent policy and regulatory framework would provide an overarching framework for government to prioritise certain objectives and implement policy measures over the short, medium and long term.

This would allow the government to address the key challenges currently facing the wind energy industry in South Africa and kick-start wind energy development in the immediate term. After the first few years of the REFIT Programme in South Africa, the government could demonstrate its commitment to wind energy by setting progressive medium and long term targets for renewable energy which would create long term policy certainty and stability for investors and would support stable and strong growth of wind energy over the medium to long term. Finally, a coherent policy and regulatory framework would enable the government to make amendments or revisions to the regulations over the coming years to enhance the stability and transparency of the REFIT Programme and ensure consistent growth of wind energy over the long term.

6.2. Adequate institutional capacity facilitates private sector investment

Adequate institutional capacity and clearly defined roles of institutions in the power sector, particularly in hybrid power markets, is required to facilitate efficient and timely procurement of power from the private sector. The outcome of private sector investment in Kenya's power sector has shown that adequate institutional capacity to procure and contract power from RE IPPs is fundamental in attracting private sector investment in the power sector (Eberhard and Pickering, 2010). Furthermore, clearly defined roles of institutions within Kenya's power sector have ensured that institutions function properly and that the incumbent does not undermine the process of timely and efficient private sector investment (Eberhard and Pickering, 2010).

The evidence of private sector investment in Kenya's power sector suggests that adequate institutional capacity in the South African power sector would be required to kick-start private sector investment in the REFIT Programme. Wind energy IPPs entering into and being short-listed in the REFIT procurement process would therefore need certainty that the relevant institutions have the capacity to ensure that the system operator will apply the REFIT selection criteria in a transparent and fair way and that IPPs will be able to conclude a binding PPA with the REPA. Additionally, the roles of institutions in the South African power sector would need to be clearly defined in order to create an attractive investment climate for wind energy IPPs and facilitate private sector investment in the wind market.

6.3. Uncertainty in the procurement process impedes wind energy development

Clear and transparent guidelines and timelines for the procurement of wind energy projects can reduce policy uncertainty for investors, expedite procurement processes and increase the pace of wind energy development in a country (Connor & Mitchell, 2004). The evidence from previous experience with procurement processes in the UK, China and Brazil suggests that there are a number of measures (discussed below) which need to be implemented to ensure that large-scale deployment of wind energy occurs in a streamlined and efficient way.

6.3.1. REFIT Selection Criteria

The outcome of Brazil's PROINFA and 2009 tender-offer has shown that the selection criteria need to be published sufficiently in advance of the procurement process in order to provide visibility to wind energy IPPs on what basis projects will be selected and to reduce participation risk for Re developers. The case of the Brazil's 2009 tender offer has shown that there are stringent bid requirements such as a bid bond or price ceiling, investors require visibility on the submission requirements sufficiently in advance to ensure that they can meet the requirements and thereby reduce the participation risk.

Secondly, evidence from Brazil's tender programmes shows that the selection criteria need to provide a fair, equitable, transparent and rigorous framework with which to select wind projects in order to minimise investment risk and uncertainty for wind IPPs participating in the procurement process (Dalbem and Gomes, 2009). Without this investment certainty, developers and investors will be reluctant to invest in the wind market as the risk of participation in the procurement process is too high. This will serve to impede the pace of wind energy development.

Thirdly, the example of Brazil's PROINFA shows that the selection criteria need to be carefully designed in order to ensure that the criteria can realistically be met by RE developers. In the case of Brazil's PROINFA, project developers did not have the capacity to meet the criterion for 60% local content requirement, which resulted in delays in the approval processes and hampered the development of wind energy projects (Dalbem and Gomes, 2009).

The outcome of Brazil's tendering programmes suggests that the REFIT Selection Criteria in South Africa need to be published sufficiently in advance of the procurement process in order to reduce participation risk and provide visibility for project developers. Secondly, the REFIT Selection Criteria need to provide a robust, transparent and equitable framework for RE projects in order to minimise investment risk for developers. Furthermore, the selection criteria need to take into account the ability of developers to meet the selection criteria, because if the criteria are too onerous on project developers, this will undermine the pace of wind energy development in South Africa.

6.3.2. Clear guidelines and timelines

The outcome of the bidding rounds in the UK's NFFO shows that clear guidelines and timelines for the procurement process (and successive bidding rounds) are required to provide investment security and long term visibility on pricing and quantities for wind energy (Connor & Mitchell, 2004). Furthermore, the evidence from the UK's NFFO shows that the absence of clear guidelines and timelines sufficiently in advance of the procurement process can increase the delays and complexities in the bidding procedures and increase the administrative burden and transaction costs for bidders.

The evidence from the NFFO bidding rounds in the UK suggests that clear guidelines and timelines are required in South Africa for the RFQ, RFP and PPA negotiation phases in the REFIT Programme as well as future REFIT procurement processes in order to provide long-term visibility to wind energy developers to enable them to plan accordingly.

6.3.3. Penalties for non-compliance and project non-completion

The examples of the UK's NFFO and Brazil's PROINFA show that penalties for non-compliance (especially for non-price criteria) and project non-completion are required to create a disincentive for project developers to submit unrealistic bids and to ensure that wind energy projects will reach project-completion within the target dates (Lipp, 2007). This suggests that penalties for non-compliance and project non-completion could be implemented in the first few years of the REFIT Programme in South Africa as they would ensure that wind energy projects will reach project-completion and would therefore ensure that South Africa achieves its short term renewable energy target by 2013.

6.3.4. Adequate monitoring regulations

The examples of China's Wind Power Concession Programme and Brazil's PROINFA illustrate that the introduction of non-price criteria can introduce complexities in terms of ensuring compliance with the bid submission after the award of a contract (Dalbem and Gomes, 2009). Therefore, in order to ensure project compliance after the award of a contract in the REFIT Programme in South Africa and to minimise the complexity and delays in the procurement process, the relevant institutions should have adequate monitoring regulations in place.

6.4. Long term price security creates investment certainty

Long term price security is fundamental in creating investment certainty and in ensuring stable and consistent growth of wind energy over the long term. This has been demonstrated by the Spanish and German feed-in tariffs which have provided long term price security and investment certainty and have driven stable and strong growth of wind energy over the past decade. Similarly, the examples of Spain's proposed retroactive cut to the feed-in tariff level in April 2010 and of the short term expiration cycles of the PTC in the US have clearly demonstrated that any unpredictable changes made to the support level or term of the contract severely undermine investor confidence and result in a flight of capital (Couture *et al*, 2010).

The example of Spain's feed-in tariff and Germany's EEG has further illustrated that the first few years of the feed-in tariff scheme allow policymakers to balance the feed-in tariff level to ensure that producer profits (and costs to the economy) are minimised and that wind energy IPPs are adequately incentivised to stimulate the investment in wind generation. Although regulator tariff revisions provide a useful mechanism to manage the level of wind deployment over the longer term, it is important that feed-in tariff revisions enhance the transparency and predictability in the REFIT scheme, as this is a key driver of stable and consistent growth of wind energy over the long term.

Given that there has been a delay of over a year and a half in awarding the first PPA to a renewable energy developer in the REFIT Programme in South Africa, and that there is still no clarity regarding when the next tariff revision will occur, the evidence suggests that the timing of the first (and successive) revisions to the feed-in tariff level needs to be clearly specified in order to provide visibility, security and stability for investors over the short to medium term.

Furthermore, the evidence from Spain and Germany's feed-in tariffs suggests that regular tariff revisions over the next few years of the REFIT Programme would enable the South African government to balance the feed-in tariff level to adequately incentivise investment in wind generation and ensure that the country's short term renewable energy target is met by 2013. However, if any revisions are made to the feed-in tariff level, they would need to be predictable and transparent to ensure investment certainty and price security for investors and ensure stable and strong growth of wind energy in South Africa over the medium to long term.

6.5. Market caps for wind energy limit wind market growth

Experience with market caps for wind energy in France and Germany has shown that if market caps are set too low relative to the wind market size, then they can limit the amount of wind energy development that can occur and reduce the potential for market growth (Couture *et al*, 2010). Market caps can therefore create a disincentive for investors, developers and manufacturers from investing in a wind market, which may jeopardise the chances that renewable energy targets will be met in schedule. However, the outcome of experience with market caps in Germany and France shows that market caps, if set high enough relative to the market size, can reduce investment uncertainty ad provide a clear signal to investors, project developers and manufacturers about the extent of future market growth (Couture *et al*, 2010).

In the South African context, because the allocation to wind energy under IRP1 is limited to 400MW over the next three years, this may serve to limit the amount of wind energy development and jeopardise the chances that South Africa's renewable energy of 10,000GWh will be met by 2013. As a result, IRP2010 would need to have a sizeable allocation to wind energy which is large enough relative to the potential market size for wind energy over the long term in order to provide a clear signal to investors of the government's commitment to wind energy over the long term.

6.6. Medium and long term renewable energy targets create long term policy certainty

Clear, long-term government commitment to renewable energy through the implementation of medium and long term renewable energy targets creates policy certainty and investment security and facilitates sustained and efficient growth of wind energy over the long term. Countries such as China and Germany, which have successfully promoted large-scale development of wind energy, have both implemented clear and progressive medium and long term targets for renewable energy. This has been fundamental in creating long term policy certainty and investment security, and has been key to driving stable and strong growth of wind energy over the long term.

The outcome of these renewable energy targets in both China and Germany suggests that it would be important to set progressive medium and long term targets for renewable energy in South Africa, as this would provide a clear signal to investors of the future wind market size beyond 2013. The first few years of the REFIT Programme will allow the government to assess the level of wind energy deployment in the country, and thereby set progressive medium and long term targets. This will be fundamental in stimulating strong and consistent growth of wind projects in South Africa over the medium to long term.

6.7. Guaranteed buyer of renewable energy reduces counter-party risk

6.7.1. Eskom's SBO as the REPA in the short term

Experience in a number of EU countries has shown that policies that oblige the off-taker to purchase all renewable electricity from RE developers increase the level of investment certainty and reduce counter-party risk for RE generators and investors (Couture *et al*, 2010). In the South African context, this suggests that although the REFIT legislation stipulates that there is a purchase obligation on the off-taker, it would be crucial that there is clarity on the identity, composition and mandate of the off-taker in the REFIT Programme in the short term in order to reduce counter-party risk for investors and attract investors in the South African wind market.

Although the establishment of the interim ISMO is viewed as an important mechanism to attract private sector investment into the power sector, it could take up to a year or more to finalise (Pickering, Personal Interview, 2010). Because the immediate priority is to attract renewable energy IPP investment into the power sector, the allocation of the role of the REPA to Eskom's SBO in the short term would serve to expedite and kick-start the REFIT procurement process (Eberhard and Pickering, 2010).

6.7.2. ISMO as the REPA over the medium to long term

The outcome of experience in Kenya, through its successful unbundling of its national utility into a separate generation company (Kengen) and grid company (KPLC), shows that the establishment of an independent system market operator can effectively create an equitable base for procuring power from IPPs in the power sector (Eberhard and Pickering, 2010). The evidence from Kenya's success at attracting IPPs into the power sector suggests that the vertical unbundling of Eskom and the establishment of the new independent system market operator in South Africa would facilitate increased private sector investment into the wind energy sector over the medium to long term.

In order to create a similar entity in South Africa, it would be essential that Eskom's system operations and planning division is unbundled and that a new ISMO is established during the next three years. Importantly, the establishment of the ISMO would not delay or jeopardise the procurement process of RE IPPs in the REFIT Programme in the short term, as the role of the buyer would be allocated to Eskom's SBO until such time as the ISMO were established as a fully ring-fenced entity separate from Eskom, at which point the role of buyer would be transferred to the ISMO.

6.8. Long term "bankable" PPA reduces investment uncertainty

A long term "bankable" power purchase agreement that adequately reflects a balanced risk allocation between the producer and buyer of renewable electricity is critical to reduce investment uncertainty and provide market stability for investors. The importance of the structure and tenor of the power purchase agreement has been demonstrated in a number of jurisdictions, including in China during the Wind Power Concession Programme whereby long term power purchase agreements sufficiently protected the interests of wind IPPs which provided an incentive to invest in the Chinese wind market.

In the South African context, this suggests that the finalised Standardised PPA urgently needs to be published and would need to reflect a balanced risk allocation between the RE generator and off-taker, which is consistent with internationally project financed PPAs, in order to attract developers and investors into the South African wind energy market.

6.9. Enabling legal and regulatory framework reduces the administrative burden for wind developers

An enabling legal and regulatory framework is required to reduce the risks and excessive costs for wind developers and streamline and expedite wind energy development. Experience in a number of EU member countries has shown that an adequate legal and regulatory framework is required in the short term to reduce the administrative burden and excessive costs for project developers, and streamline and expedite wind energy development (UNDP, 2008). This suggests that in order to streamline and expedite wind energy development in South Africa, adequate legal and regulatory procedures need to be implemented in the short term. These are discussed below.

6.9.1. Clear authorisation procedures

Countries such as France and the UK have demonstrated that investors can be deterred and project profitability can be jeopardised if permitting and licensing procedures are complex, costly and unclear (UNDP, 2008). These countries have shown that RE developers require clear authorisation procedures for obtaining the necessary permits and licenses in order to facilitate increased generation in a simple, efficient and timely way. This would suggest that RE developers in the REFIT Programme in South Africa would require clear authorisation procedures for obtaining a PPA, grid connection and generation license in order to reduce the administrative burden for RE developers and expedite the permitting and licensing procedures.

6.9.2. Guaranteed grid access

The evidence from a number of EU member countries shows that guaranteed, non-discriminatory access to the grid for all RE generators is necessary to provide adequate protection and security to wind generators, which can help to increase investor confidence in the wind market, reduce administrative barriers and accelerate the pace of wind energy development. Therefore, in order to provide adequate protection to wind generators in South Africa, the REFIT legislation would need to clarify how wind energy IPPs will be guaranteed grid access in the REFIT Programme.

6.9.3. Clarity regarding grid connection cost-allocation approach

Experience in a number of EU member countries shows that RE developers require clarity on the rules for bearing and sharing grid connection and grid investment costs in order to minimise the delays in obtaining grid connection approvals and ensure streamlined grid connection procedures (Burgers *et al*, 2009). Furthermore, clear cost-allocation protocols in relation to delays in grid connection can serve to reduce the risk for project developers in the event of delay in connecting the wind farm to the grid. This suggests that the REFIT legislation in South Africa would need to clarity the rules for allocating costs between RE developers and grid operators for grid connection and grid investment costs in order to minimise the risks for project developers.

The outcome of experience with grid-connect cost allocation approaches in Spain and Germany suggests that a shallow grid connection cost supports wind energy development as there is a limited financial burden on RE developers in connecting to the grid (Couture *et al*, 2010). However, the shallow connection approach offers no incentive to RE developers to locate their wind farms to optimise the existing grid (Couture *et al*, 2010).

The recent experience in the UK with mixed connection charging suggests that the mixed approach strikes a middle ground between shallow and deep connection cost approaches as RE developers are required to share the grid upgrade costs with the grid operators and thereby provides an incentive for RE developers to choose the most cost-efficient grid interconnection point (Couture *et al*, 2010). The evidence from the UK would therefore suggest that a mixed connection approach could be appropriate approach in the South African context.

6.9.4. Grid connection approvals

Experience in a number of EU member countries has shown that clear procedures for grid connection approvals are critical to reduce the wait times and delays for RE generators, and reduce administrative costs (Couture *et al*, 2010). The introduction of an obligatory financial commitment with the grid connection application such has been the case in Spain and the UK, has created a disincentive for speculative queuing and thereby improved the likelihood of successful development of wind projects (Burgers *et al*, 2009).

In order to provide certainty to developers in the South African wind market, it would be necessary to clarify how Eskom is processing grid connection applications and when Eskom will provide developers with their grid connection approvals. Given that there are currently approximately 12,675MW of wind farms which have submitted grid connection applications in South Africa, imposing an obligatory financial commitment for developers in wishing to obtain a grid connection approval might serve to expedite the grid connection approvals process, as it would reduce the number of non-serious grid connection applications and reduce speculative queuing.

6.9.5. Grid integration

Countries such as Denmark, Spain, Portugal, China, and Germany have shown that up to 15% wind energy penetration can be achieved without any notable grid upgrades and power system changes, however that it is crucial to manage the grid integration of wind energy and assist grid operators in balancing the supply on the power system so that the grid can support higher levels of wind penetration.

Grid integration of large amounts of wind energy can be managed through measures such as system wide grid integration studies, the integration of network planning with wind energy development planning, and generation forecasting. Given the discrepancy between the time required to get new transmission constructed versus a wind farm, it would be necessary in South Africa to conduct system-wide grid impact studies during the next three years in order to assist the government in assessing the technical feasibility of integrating large amounts of wind energy onto the grid. Over the longer term, as the installed capacity of wind generation in South Africa increased to between 10% and 15% of total electricity generation, it would be important that grid integration was adequately managed through the integration of wind energy development planning with network planning and forecast obligation.

6.9.6. Network planning

The evidence from China's inadequate power grid planning shows that the integration of wind energy development planning with network planning is fundamental to facilitate investment into the necessary grid reinforcements sufficiently in advance to minimise the delay in power grid interconnection of wind farms and support large-scale development of wind power (Couture *et al*, 2010). In the South African context, it would be essential that transmission network planning is fully integrated with wind energy development planning as this would ensure that there would be no power grid bottlenecks and would therefore prevent delays in connecting wind farms to the grid over the long term.

6.9.7. Forecast obligation

Integration of wind generation through a system of forecast obligation has been particularly successful in Spain as it has improved grid stability and balanced the integration of over 14% of wind generation in the power system (Held *et al*, 2007). This suggests that the integration of wind energy into the South African power grid could be improved over the medium to long term through a system of forecast obligation as it would assist the grid operator in balancing the supply on the power system, and enable South Africa to balance the integration of high wind penetration levels over the long term.

6.10. A stable and sizeable domestic wind market stimulates local manufacturing

International experience has shown that a stable and sizeable domestic wind market is a prerequisite to stimulate a local manufacturing industry (Lewis and Wiser, 2007). Countries such as Germany, China and Spain, which have been successful at stimulating local manufacturing, have depicted an annual domestic demand for wind energy of a minimum of 500MW over a period of at least three years (Lewis and Wiser, 2007). Additionally, the outcome of experience in implementing supportive policies to directly promote local manufacturing, such as R&D programmes, local content requirements, soft loans and export credit assistance, has shown that policies to directly support local manufacturing contribute significantly to the establishment of a domestic manufacturing industry.

Based on the evidence of countries which have successfully stimulated local manufacturing, such as Germany, Spain and China, stable and sizeable annual demand for wind energy in excess of 500MW would be required in South Africa over a minimum period of three years to stimulate local manufacturing (Lewis and Wiser, 2007). If a stable and sizeable annual demand for wind energy was sustained during the first few of the REFIT Programme, the government would need to implement direct support policies for local manufacturing such as local content requirements in order to stimulate a local manufacturing industry. This would ensure that wind energy development contributes to local economic development and job creation in South Africa over the long term.

6.11. Conclusion

Given that wind energy development in South Africa has been relatively limited to date, and that the development of a large-scale wind energy industry will make a significant contribution to local economic development, job creation, improving energy security and towards the government's energy policy objectives, the primary objective of this paper has been to evaluate how South Africa can address the challenges facing the wind energy industry and create an enabling environment to develop a large-scale wind energy industry.

This paper has identified the key challenges facing the wind energy industry in South Africa and has given insight into how these challenges could be addressed by considering the lessons learned from experience in other countries which have encountered similar barriers to wind energy development or which have overcome these barriers by implementing a variety of policy measures. Based on the lessons learned from international experience in promoting wind energy, this paper has described a possible set of policy measures in South Africa which could serve to address the challenges facing the wind energy industry, and could further provide long term policy certainty and stability in the wind market and create an enabling environment for the development of a sustained and large-scale wind energy industry over the long term.

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8. Appendix

8.1. Appendix 1

Table 6: Estimated job creation potential by different electricity generation technology

Energy technology	Total jobs	
	Construction, manufacture & installation jobs (per MW) in 2009 [2020 - 2030]	Operation & Maintenance and fuel processing jobs (per MW)
Existing coal	0 [0]	0.75
Supercritical coal	2.5 [2.3]	0.65
OCGT	3.4 [3.4]	0.17
Nuclear	1.8 [1.8]	0.68
Biomass	8.5 [8.5]	14
Landfill gas	3.8 [3.8]	2.3
Wind	15 [10.4]	1
CSP	10 [6]	0.4
Solar photovoltaic	30 [9.1]	0.4

Source: Edkins et al (2010)

8.2. Appendix 2

Table 7: NERSA's Draft Selection Criteria Evaluation Matrix

No	Description of criterion	Gate keeping criteria	Points	Maximum points per subcriterion	Maximum points per criterion
				100	100
1	**Compliance with the integrated resource plan and the preferred technologies :**				7
	Compliance with IRP and REFIT technologies	Pass or fail		7	
2	**Acceptance by the IPP of a standardizes power purchase agreement**		10	10	10
3	**Plant Location that contributes to stabilization of the grid and mitigates against transmission losses**				15
	Power credit of the facility in terms of the system reserve			6	
	>=0.8		6		
	>=0.4 and < 0.8		3		
	<0.4		1		
	Loss factor reduction credit				
	>=2%		9	9	
	1-2%		5		
	<1%		1		
4	**Preference for a plant location and technology that contributes to local economic development**				10
	Local employment under plant operation per MW of installed capacity(operating employment rate):				
	>2		10	10	
	>1 but <= 2		6		
	<=1		2		
5	**Compliance with legislation in respect of the advancement of historically disadvantaged individuals**	**Pass or fail on the minimum of 4 points**	8	8	8
	Black Ownership				
	10% to <20%	1			
	20% to 50%	1.5			
	>50%	2			
	Black Management				
	20% to <35%	1			
	35% to 50%	1.5			
	>50%	2			
	Black Female Management				
	1% to <5%	1			
	5% to 10%	1.5			
	>10%	2			
	Black Skilled Personnel as % of payroll				
	20% to <35%	1			
	35% to 50%	1.5			
	>50%	2			
6	**Preference for projects with viable network integration requirements**			15	15
	Shallow connection cost as a Percentage of the total cost				
	>=80%		15		
	<80%		5		
7	**Preference for projects with advanced environmental impact approvals**			10	10
	Record of Decision (ROD)		10		
	EIA application		6		
	EIA preparation		2		
8	**Preference for projects demonstrating the ability to raise finance**			10	10
	Underwritten bids		10		
	Letter(s) of undertaking from investment and/or commercial bankers to secure term finance		6		
	Letter(s) of undertaking from investment and/or commercial bankers to secure construction finance		2		
9	**Preference for small distributed generators over centralized generators**	**Pass or fail on the minimum size of facility**	5	5	5
	Biomass >=1 MW				
	Biogas >=1 MW				
	Landfill gas >=1 MW				
	Concentrated Solar Power (CSP) >= 20 MW				
	Wind >= 20 MW				
	Small hydro >= 1 MW				
	Photovoltaic (PV) >= 1 MW				
10	**Preference for projects that can be commissioned in the shortest time**			10	10
	Time to Commercial Operation Date				
	<10 months		10		
	10-18 months		6		
	>18 months		2		

Source: NERSA (2010a)