South Africa

Large parts of South Africa's coastal land, as well as various areas inland, have an economically viable source of wind energy. The scale and maturity of the global wind industry have made it a cost-competitive energy option, compared not just to other renewable technologies, but also to many fuel-based technologies. While a variable energy resource, wind does not use water and can be installed relatively quickly and can be complemented by electric energy storage. With significant local content, these technologies can also raise the employment intensity of the electricity generation sector.

Cost of wind power

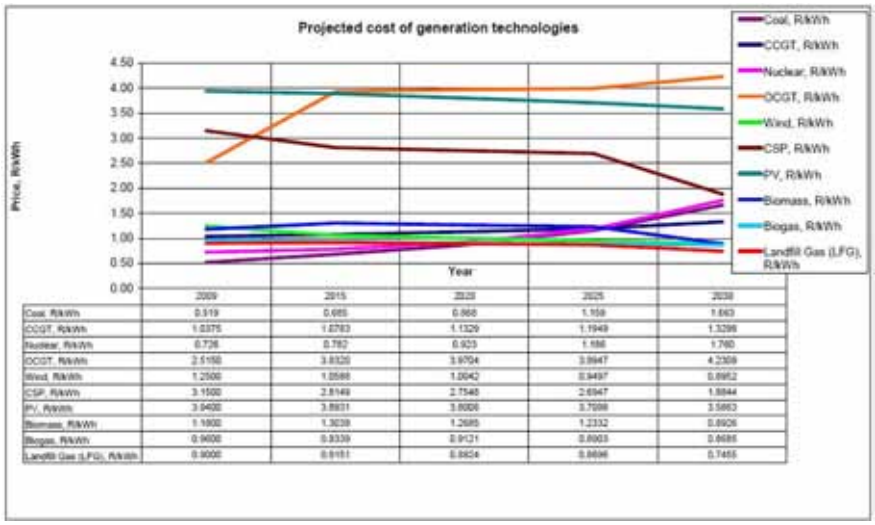


Fig 4 Projected cost of generation technologies South Africa

From Figure 4 it follows that by 2020 the projected cost of wind energy in South Africa becomes equal and less than that of nuclear and coal.

Integrated Resource Plan (IRP) 2010

The Integrated Resource Plan (IRP) as mandated by the Electricity Regulation Act No. 4 of 2006 is a resource plan established by the national sphere of government to give effect to national electricity policy.

The IRP 2010 ensures security of supply while supporting building local industry clusters. It assists in fulfilling South Africa's commitments to mitigating climate change. In addition to all existing and committed power plants (including 800 MW wind) the plan includes 9, 6 GW of nuclear; 6,3 GW of coal; 17,8 GW of renewable energy; and 8,9 GW of other generation sources for the period 2010 to 2030. Renewable energy will represent 42% of new capacity 43 GW by 2030 (excluding committed 800 MW), of which wind will total 20%.

Job creation potential

Analysis

The wind industry is still in its infancy in South Africa. Currently there is a total 10,16 MW (5.2 MW Darling Wind farm, 3.16 MW Eskom Klipheuwel Wind farm, 1.8 MW Electrawinds, Coega Wind farm) grid connected wind energy operating in South Africa This will change significantly with the implementation of IRP 2010. A rough estimate by making use of table 2 (15.1 jobs are created/annual MW) and table 3 (IRP 2010, 8 400 MW new build wind by 2027) indicates some 126,840* jobs (manufacturing, installation, direct employment) that could be created in the South African wind industry by 2027 (8 400 MW x 15.1).

*The analysis assumes that the IRP 2010 new build options will be implemented (i.e. there is a steady annual increase in installed MW wind energy). It further assumes that all these jobs take place in South Africa, which will require mandatory local content. It should also be noted that the actual total jobs could be higher as indirect and induced jobs should also be incorporated. So too should the opportunity for South Africa to 'leap frog' wind turbine technology e.g. gearless, permanent magnet generators and customizing in view of logistical and developing countries challenges and needs have been identified .

Furthermore, the analysis presented is based on data obtained from studies for developed EU countries. A detailed analysis, based on either an input-output or an analytical model and practical verification as the industry grows, will produce a more accurate estimation of the employment opportunities for wind energy in South Africa specifically. Further analysis would also be required to establish what the employment opportunities are per component, such as the tower and blades.

New Growth Path

Government has committed to making employment creation the main criterion for its economic policy. The New Growth Path (NGP), launched in November 2010 by the Ministry of Economic Development, articulates this sentiment, as made clear in its aim of establishing a more labour-absorbing growth path. The NGP set a target of five million new jobs by 2020. It builds on the government's long-term stance, reflected in initiatives such as Accelerated and Shared Growth Initiative (AsgiSA) and the National Industrial Policy Framework (NIPF).

The NGP identifies a number of job drivers led by agriculture, mining, manufacturing, tourism, infrastructure and green economy, which can create substantial employment. The Industrial Policy Action Plan (IPAP) constitutes a central tool in the NGP job-creation strategy and recognizes the potential of a wind industry in contributing to the green economy. It is anticipated that IPAP interventions will lead to 43,000 direct jobs and 86,000 indirect jobs, totalling 129,000 jobs.

Several initiatives to secure the necessary funds are ongoing, as it is clear that a combination of public, private and international funding will be required to finance the IRP 2010 new build renewable energy options (17.8 GW of which 8.4 GW wind).

(Sources cited: Wind Energy the Facts, 2009; European Wind Energy Association (EWEA), Wind at Work, January 2009)

Wind Energy Economics and Job Creation

energy
Department:
Energy
REPUBLIC OF SOUTH AFRICA

EMBASSY OF DENMARK

POWERED BY WIND

International experience

Wind power is developing rapidly at both European and global levels. Over the past 15 years, the installed capacity of wind power has increased globally from approximately 2.5 GW in 1992 to more than 159 GW at the end of 2009 – an average annual growth of more than 25%. Wind power additions reached a record high of 38 GW in 2009.

Due to ongoing improvements in turbine efficiency and higher fuel prices, wind power is increasing in economic competitiveness against conventional power production. At sites with high wind speeds on land, wind power is today considered to be fully commercial.

Table 1 Cost Structure of a Typical 2MW Wind Turbine in Europe (2006-€)

	Investment (€1000/MW)	Share (%)
Turbine (ex-works)	928	75.6
Foundations	80	6.5
Electric installation	18	1.5
Grid connection	109	8.9
Control systems	4	0.3
Consultancy	15	1.2
Land	48	3.9
Financial costs	15	1.2
Road	11	0.9
Total	1227	100

Note: Calculations by the author based on selected data for European wind turbine installations.

Source: Risø DTU

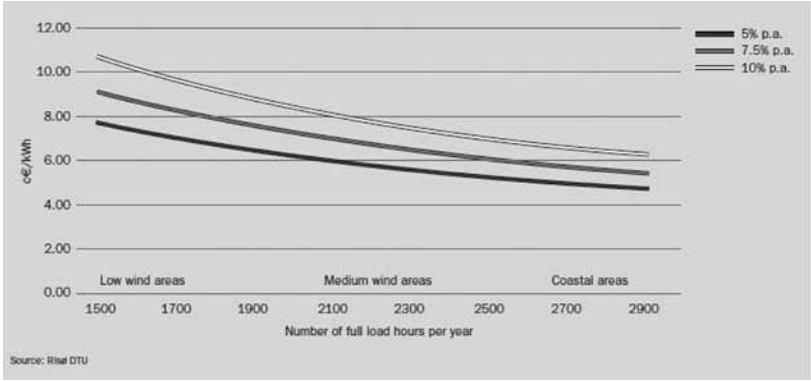
From Table 1, it follows that the capital cost of a wind turbine (turbine, foundations, electric installation, grid connection and control systems) makes up more than 90% of the total cost of a typical 2 MW wind turbine. Therefore, a wind turbine is capital intensive compared to conventional fossil fuel-fired technologies such as natural gas power plants, where as much as 40 to 60% of total costs are related to fuel and operation and maintenance (O&M). For this reason, the costs of capital (discount or interest rate) are an important factor for the cost of wind-generated power.

In recent years, three major trends have dominated the development of grid-connected wind turbines:

1. Turbines have become larger and taller;
2. The efficiency of turbine production has increased steadily; and
3. In general, the investment costs per kW have decreased.

The economic consequences of the trend towards larger turbines and improved cost-effectiveness are clearly shown in Figure 1. For a coastal position, for example, the average cost has decreased from around 9.2c€/kWh for the 95 kW turbine (mainly installed in the mid-1980s), to around 5.3c€/kWh for a fairly new 2000 kW machine, an improvement of more than 40% over 20 years (constant 2006 prices).

Fig 1 The cost of wind-produced power as a function of wind speed (number of full load hours) and discount rate; the installed cost of wind turbines is assumed to be €1225/kW



Within the MW-segment, turbines with capacities of 2.5 MW or above are becoming increasingly important. The wind regime at the chosen site, the turbine hub height and the efficiency of production determine the turbine's power production. Simply increasing the height of turbines has resulted in higher power production. Similarly, the methods for measuring and evaluating the wind speed at a given site have improved significantly in recent years and thus improved the site selection and efficiency of new turbines. Electricity production efficiency has also improved dramatically due to better equipment design.

Finance

The nature of business in wind energy is changing. Although there are still many small, privately-owned projects, a substantial shift towards bigger, utility-owned projects can be observed. This change brings new money (balance sheet financing) to the industry and decreases dependence on banks for initial funding (project finance).

Prices and support mechanisms

Two support mechanisms exist: direct and indirect instruments. Direct policy measures aim to stimulate the installation of renewable energy technologies immediately, whereas indirect instruments focus on improving long-term framework conditions. Besides regulatory instruments, voluntary approaches for the promotion of renewable energy technologies also exist mainly based on consumers' willingness to pay premium rates for green electricity.

A single instrument is not usually enough to stimulate the long-term growth of renewable energy sources. Whereas investment grants are normally suitable for supporting immature technologies, Feed-in Tariffs are appropriate for the interim stage of the market introduction of a technology. Once the market is matured and the market size is large enough to guarantee competition among the market actors, quota obligations and tender procedures become effective, especially for large-scale projects such as offshore wind.

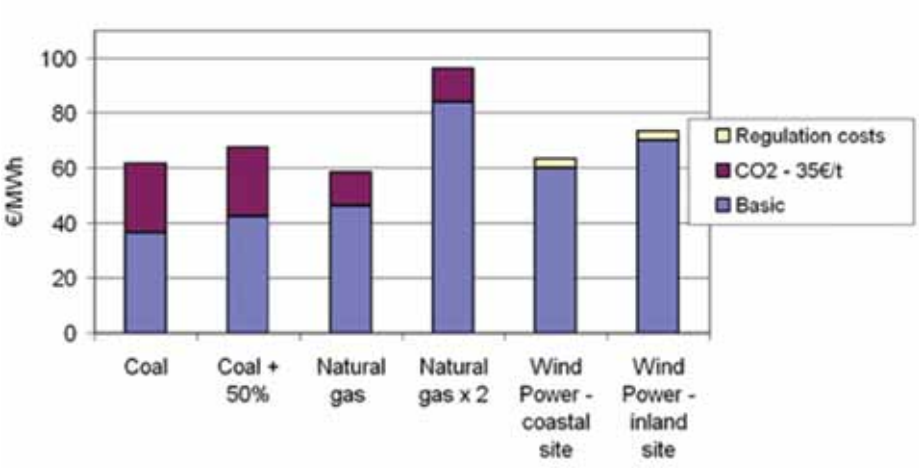
Wind power compared to conventional power

In general, the cost of conventional electricity production is determined by four cost components:

1. Fuel;
2. CO2 emissions (as calculated by the European Trading System for CO2);
3. Operation and maintenance (O&M); and
4. Capital, including planning and site work.

Implementing wind power avoids the full fuel and CO2 costs, as well as a considerable share of conventional power plants' O&M costs. The amount of capital costs avoided depends on the extent to which wind power capacity can displace investments in new conventional power plants. This is linked directly to how wind power plants are integrated into the power system.

Fig 2 Sensitivity Analysis of Costs of Generated Power Comparing Conventional Plants to Wind Power, Assuming Increasing Fossil Fuel and CO2 Prices, 2010 (Constant 2006-€)



In Figure 2 the natural gas price is assumed to double compared to the reference (equivalent to an oil price of $118/bbl in 2010), the coal price to increase by 50% and the price of CO2 to increase to €35/t from €25/t in 2008. As shown in Figure 2, the competitiveness of wind-generated power increases significantly. Costs at the inland site become lower than those of the natural gas plant, and are only around 10% more expensive than those of the coal-fired plant. On coastal sites wind power produces the cheapest electricity.

The uncertainties related to future fossil fuel prices such as resource availability, political risks, and climate change, imply a considerable risk for future generation costs of conventional plants. Conversely, the capital costs per kWh generated by wind power are almost constant over the lifetime of the turbine following its installation. Therefore, although wind power might currently be more expensive per kWh, it can account for a significant share in the national portfolio of power plants since it also hedges against unexpected rises in prices of fossil fuels in the future. The consistent nature of wind power costs justifies a relatively higher cost compared to the uncertain risky future costs of conventional power.

Employment

Wind energy companies in the European Union (EU) currently employ around 108,600 people. When indirect jobs are taken into account, this figure rises to more than 150,000. A significant share of direct wind energy employment (approximately 77%) is located in Denmark, Germany and Spain, and its combined installed capacity represents 70% of the EU total. The sector, however, is less concentrated at present than it was in 2003, due to the opening of manufacturing and operation centres in emerging markets, and due to the fact that many wind-related activities, such as promotion, O&M, engineering and legal services are now carried out at a local level. Wind turbine and component manufacturers account for the majority of the jobs (59%).
In addition to the 108,600 direct jobs outlined, the European wind energy sector also affects employment in sectors not directly related to wind energy. Approximately 43,000 people were directly employed in wind energy in 2007. European Wind Energy Association (EWEA) analysis concludes that 15.1 jobs are created in the EU for each new MW installed. In addition, 0.4 jobs are created per MW of total installed capacity in operations and maintenance and other activities related to existing installations.

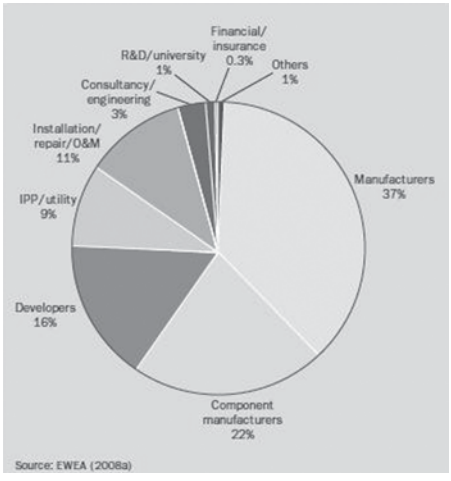


Fig 3 Direct employment by type of company, according to the results of the EWEA survey

Table 2

Employment/MW (2007)	Jobs	Jobs/Annual MW	Jobs/Cumulative MW	Basis
WT Manufacturing – Direct	64,074	7.5		Annual
Wt manufacturing – Indirect	42,716	5.0		Annual
Installation	10,665	1.2		Annual
Operations and maintenance	18,657		0.33	Cumulative
Other direct employment*	15,204	1.3	0.07	75% annual/25% cumulative
Total employment	151,316	15.1	0.40	

* IPP/utilities, consultants, research institutions, universities, financial services and other.