



INTRODUCTION

Providing access to energy sources such as electricity is necessary for increasing economic productivity and improving people's livelihoods. The energy sector is therefore regarded as one of the major sectors through which equitable economic growth and sustainable development can be achieved (DME, 2002).

The energy sector therefore plays an important role in South Africa's and the Western Cape's development prospects. In the last few years energy has been the subject of a number of studies, strategy papers and policies. Two of the most important current debates around energy focus on access to energy and the move towards cleaner energy, such as renewable resources (Spalding-Fecher, 2002).

At present, electricity in South Africa is primarily generated by burning fossil fuels (coal). Coal burning is South Africa's biggest contributing source to greenhouse gas (GHG) emissions, which in turn results in global warming and climate change.

In the Western Cape, natural gas also plays an increasingly important role in the energy mix. The province has a number of gas fields that are currently being exploited, e.g. off the Mossel Bay coast, or explored, e.g. off the Saldanha coast. Gas has the least negative environmental impacts of any fossil fuel and is recognized as a transition energy source between polluting coal based energy and cleaner renewable energy. The project to introduce natural gas is in keeping with the recommendations of the 1998 White Paper on Energy Policy (DME, 2003).

The key priority issues this chapter focuses on include:

- Access to energy; and
- The use of renewable and nuclear energy.

These issues should be considered in conjunction with the emissions and climate change issues addressed in the Air Quality and Climate Change theme.

DRIVERS AND PRESSURES

Some of the driving forces and pressures that influence energy provision in the Western Cape include:

Population growth and migration patterns – The Western Cape's population comprises 10.1% of the South African population and is estimated to grow at 1.8% per annum. This expansion in population results in increasing use and dependency on natural resources. The migration of individuals from rural to urban areas also places great demands for energy provision within the urban areas (DME, 2003).

Growing economy – Resource use is strongly influenced by the state of markets and the economy. Growing economies place pressure on resources by encouraging high levels of production and consumption and thus high levels of resource exploitation. Economic growth is often linked with increasing energy use (NER, 2002).

Technological advancement – The development of new technological methods and expertise increases access to alternative sources of energy. The stimulation of research and the provision of new energy sources may result in further economic and social development and growth.

Price of energy generation – South Africa has large resources of cheap coal used for electricity generation.



Even though none of these are located in the Western Cape, the province benefits from the cheap electricity transmitted via the national electricity grid. The price of electricity generated from coal serves as a benchmark which determines the relative financial affordability of other forms of electricity generation. Furthermore, the cost of electricity to the consumer is – together with overall levels of household electrification – an important determinant of the beneficial potential of electricity to households.

Climate change and the Kyoto Protocol – There is a general awareness in the Western Cape of the province's possible vulnerability to future climate change and the role of GHGs in that process. Furthermore, the Kyoto Protocol came into force in February 2005. It allows certain developed countries to offset their capped GHG emissions through Clean Development Mechanism (CDM) projects implemented in developing countries. South Africa might prove an attractive location for such CDM projects, which would promote cleaner energy provision.

Method of energy provision – grid versus non-grid electrification. The cost of connecting rural households to conventional power grids is typically higher than that for urban areas, as rural areas are located further away from the grid and have lower population densities. This increases the cost per household connection to the grid (Cowan, 2003).

ISSUE: ACCESS TO ELECTRICITY

Access to and affordability of electricity for both households and industry play a critical role in the future prospects of the Western Cape, especially in terms of development and attractiveness of the province as an investment destination. The following discussion will focus on the household level.

Electrification of households can contribute significantly to a number of government strategies, such as alleviation of poverty, empowerment of disadvantaged communities and improving the health and safety situation of residents. The affordability of electricity to households is important, as even households that are connected to electricity distribution grids may not be able to pay for and thus benefit from electricity.



STATE

Percentage of electrified households

A total of 83.5% of households in the Western Cape are electrified (see Figure 9.1). The total level of connectedness of households compares reasonably favourably with the rest of South Africa: the province's urban electrification level ranks fourth in South Africa, the rural electrification level first. About 31% of Western Cape rural households and approximately 16% of urban households do not have access to electricity (NER, 2002).

This imbalance in energy provision between rural and urban areas can be explained by the fact that the connection of rural households to the electricity grid is more expensive per unit than for urban households making electricity even less affordable to generally more impoverished rural communities (Cowen, 2003). As electrification is seen as an important step towards the empowerment of disadvantaged households, there is still a large electrification backlog which needs to be addressed.

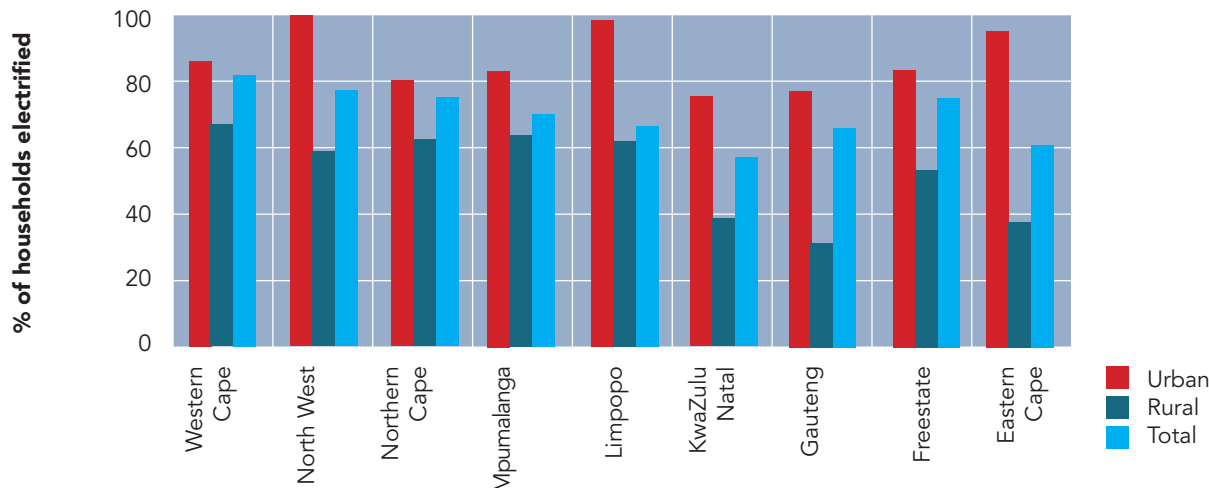


Figure 9.1: Electrification of households by province (Source: NER, 2002)

IMPACTS

- The fact that a higher percentage of urban households are electrified could encourage migration from rural to urban areas. Rural areas may fall further behind urban areas in terms of essential development objectives such as reduction of poverty and improvement of health and education standards, without widespread access to electricity.
- On the other hand, by further increasing access to electricity, the province can enhance its development potential, as electricity also provides people with access to technology and economic opportunities. Electrification can also represent an important step towards poverty alleviation.
- Replacing paraffin (for lighting) and wood fuel (for cooking) with electricity improves the safety and health of household members. Fires and respiratory diseases from smoke are much less likely.

ISSUE: USE OF RENEWABLE AND NUCLEAR ENERGY

Renewable energy includes energy derived from solar radiation through photo voltaic cells or solar water heating, wind, biomass, waves, tides, water power from small hydro-electric schemes in rivers and geothermal energy. Not all of these sources are equally available in all regions. While the Western Cape has a good potential source of solar and wind energy for example, the low average rainfall in the region may render hydroelectric power generation in rivers less economical.

Nuclear energy relies on an electricity grid to transmit the power generated and therefore faces the same transmission and distribution problems as energy production from coal. Nuclear energy production however uses less primary resources and has lower emissions than conventional energy production from coal. Concerns regarding nuclear power generation include long-term storage of nuclear waste, security risks of nuclear power stations and health risks in the event of an accident.

In the Western Cape, renewable energy can play an important role in addressing a number of issues. Producing energy from renewable sources is often safer, emissions-free, more water-efficient and less degrading to the environment than conventional energy production. It can thus improve environmental and public health in the Western Cape. Some renewable energy technologies could also be used to supply non-grid electricity to rural households that are too far from the existing electricity grid to connect them economically to it.

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Percent of renewable and nuclear energy in total energy mix

Renewable energy contributed 5.6% to total electricity production in South Africa in 2000 (see Figure 9.2). This

compares to a renewable energy contribution of 5.2% in 1999 (DME, 2002) and thus shows a marginal increase in the proportion of renewable energy in South Africa's energy mix. Similarly, nuclear energy has shown a marginal increase in the energy mix from 3.0% in 1999 to 3.3% in 2000 (DME, 2002), probably attributable to other energy sources contributing less. It makes sense to look at these data on a national level, as the electricity produced is added to the national grid and is consumed anywhere.

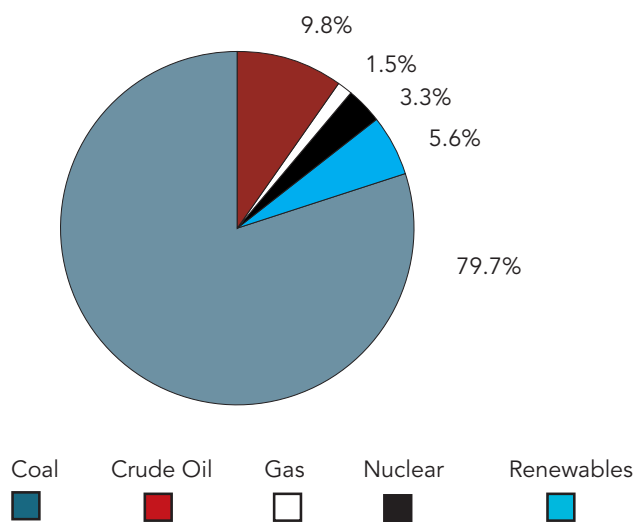


Figure 9.2: Energy sources used in electricity generation in South Africa, 2000 (Source: DME, 2003)

Production of renewable and nuclear energy in the Western Cape

The PSDF has stated the aim that renewable energy should make up 25% of the province's energy mix by 2020. The following section gives a brief descriptive overview of the renewable and nuclear energy sources in the province. The province hosts the only two wind power generation projects in South Africa:

- An Eskom demonstration site in Klipheuwel with three wind turbines and a combined capacity of 3.2 megawatts (Generation Communication, 2004); and
- South Africa's first commercial wind farm near Darling with four wind turbines and a combined capacity of 5.2 megawatts, expected to come into operation at the end of 2005 (SABC News, 2005).

The province uses a hydro-electric power generation scheme adapted to its limited water resources. The Palmiet Pumped Storage Scheme has a capacity of 1 000 megawatts and generates electricity by conveying water from an upper dam through turbines into a lower dam. When the demand for electricity is low, the water is pumped back into the upper dam and re-used (Generation Communication, 2003).

The Western Cape is also the site of the only nuclear plant in Africa. Koeberg Nuclear Power Station north of Cape Town has an installed capacity of 1 800 megawatts. Nuclear waste from the power station is currently stored on site and at Vaalputs in the Northern Cape (Eskom).

Non-grid energy in the Western Cape is produced by a variety of sources and in a range of locations, e.g. by small-scale windmills on farms and by solar water heaters and photo voltaic cells in Lwandle near Cape Town (DME, WESGRO 2000).

Summary and Status of Indicators Used in this Chapter

Energy Indicators	How we are doing?	Comments
Percentage of electrified households	😊	Most people in the province have access to electricity.
Percentage of renewable and nuclear energy in the energy mix	😞	In SA only 5.6% of the energy used comes from renewable sources.
Production of renewable and nuclear energy in Western Cape	😐 ?	Data is currently unavailable, but the Western Cape has the only nuclear power station and only two wind farms in the country.

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- The increased use of renewable and cleaner sources for energy production can reduce problems associated with energy from fossil fuels, such as respiratory diseases and the emission of pollutants and greenhouse gases.
- Increasing the proportion of renewable energy in the energy mix is in keeping with the recommendations of the 2003 White Paper on Energy Renewable Energy (DME, 2003a). The White paper is setting a target of 10 000 GWh renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. This is approximately 4% (1667 MW) of the projected electricity demand for 2013 (41539 MW) (DME 2003b).
- The Western Cape currently has a strong position in South Africa in terms of research and application of renewable energy technology. It also has a good supply of renewable energy sources such as wind, sun and waves. The province might thus be in a good position to benefit from future foreign investment in clean development technologies within the framework of the Kyoto Protocol.
- The success of increasing the renewable energy contribution to the energy mix will largely be dependant on pricing structures, subsidies, power purchasing agreements etc, which will largely be determined by the Department of Mineral and Energy Affairs (DME).



Indicators Suggested For Future Use

It is recommended that the following data be monitored for inclusion in future SoER reports for the Western Cape:

- Percentage contribution of renewable energy and nuclear energy in the Western Cape.

RESPONSES

The table below summarises some of the legislation and other initiatives that have been implemented in response to the energy issues discussed above:

Inter-national	<ul style="list-style-type: none"> • Kyoto Protocol
National	<ul style="list-style-type: none"> • DME: White Paper on Renewable Energy, 2003 • Bulk Renewable Electricity Generation project (SABRE-Gen) • The South African Wind Energy Association (SAWEA) • White Paper on Energy Policy for the Republic of South Africa • DME driven reform of the Electricity Supply Industry (ESI) and the Electricity Distribution Industry (EDI) • Government target: produce 10,000GWh (estimated 4% of total energy mix) energy from renewable sources by 2013, mainly biomass, wind, solar and small-scale hydro (DME, 2003) • Integrated National Electrification Programme • Non-grid Electrification Programme launched in 2001 • Free Basic Electricity (FBE) introduced for poverty alleviation • Government's target is to achieve universal household access to basic electricity in 10 years • The National Nuclear Regulator (established in terms of the National Nuclear Regulator Act)
Provincial	<ul style="list-style-type: none"> • Estimated annual research expenditure of R4 m on renewable energy by Western Cape institutes (WESGRO, 2000) • PSDF target: renewable energy is to supply 25% of provincial energy by 2020 • Western Cape Sustainable Energy Strategy (2005) • DARLIPP (Darling Independent Power Producer) to generate wind power for the electricity grid • Koeberg Nuclear Power Plant
Local (other)	<ul style="list-style-type: none"> • Cape Town target: produce 10% (571 MW capacity) of electricity from renewable sources by 2020 (CCT&SEA, 2003)



LINKS

This chapter has the strongest links with the following chapters:

Air Quality and Climate: The use of fossil fuel-generated electricity results in air emissions, which has a negative effect on the air quality of surrounding environments. Furthermore, emissions generated by the production of electricity from fossil fuels contribute to the concentration of greenhouse gases such as CO₂ and SO₂ in the atmosphere. This aggravates global warming.

Health: The release of noxious gases from the usage of fossil and wood fuels affects the health of those exposed to it. Children are particularly vulnerable to such conditions. Electrification and a move towards cleaner energy production could alleviate these problems.

Economics and Poverty: Electricity is a major input into many economic activities. Its availability and price in the Western Cape will thus have an impact on the province's economic performance and ability to attract investment. Moreover, electricity can be a potent ingredient in the fight against poverty. Electrification, particularly of poorer households, will impact the Western Cape's poverty levels.

Transport: – the transport industry relies on energy sources such as petrol and electricity to operate.

CONCLUSION

The majority of people in the Western Cape, especially those in urban areas, have access to electricity, although a significant proportion still have no access. Electrifying rural households has proven more difficult as a result of their distance from the electricity grid, which leads to



high connection costs. Besides having physical access to electricity, however, the service also needs to be affordable if it is to benefit all people in the Western Cape, both rural and urban.

As a response, the Department of Minerals and Energy launched initiatives such as 'Free Basic Electricity' and the 'Non-Grid Electrification Programme'. The aim of these initiatives is to enable remote households to access electricity and make the service affordable to poor households and thus contribute to poverty alleviation and a better quality of life.

The Western Cape's energy supply is dominated by conventional technologies and fossil fuels. However, the province is also rich in renewable energy sources such as sun, wind and wave power. Renewable technologies are often cleaner, safer and more water-efficient than coal-fired electricity plants. The province is already commercially producing alternative energy from water and nuclear

power, is set to soon have the first commercial wind farm in South Africa, and hosts test sites for energy generation from renewable sources such as solar power. Nevertheless, the province is far from achieving the renewable energy target set out in the PSDF draft. A comprehensive strategy to increase the contribution of renewable energy to the general energy mix is required.

Focus should also be placed on establishing ways to reduce energy consumption and promote energy conservation and efficiency, especially within the transport sector, where use of private transportation remains strong.

NOTES ON DATA

- Currently very little energy data is available at a provincial level. However the PGWC has commissioned the development of a Sustainable Energy Strategy, which will help to identify and then begin to fill these data gaps.