

An overview of the Energy Picture for SADC countries, with a focus on renewable energy

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Definitions

Bagasse	Fibrous matter left over after crushing of sugarcane or sorghum stalks. It is used as a biofuel.
Biogas	Gases produced by the breakdown of organic matter in the absence of oxygen.
Biomass	Products, bi-products, and waste of biological origin. It can be used directly to produce heat through combustion, or indirectly through conversion into for example biofuel. Wood remains the most common biomass energy source.
Geothermal energy	Accessible thermal energy stored in the earth's interior
Hydropower	Power harnessed from the flow of water
Installed capacity of electricity	Installed electricity capacity is the electricity production capacity of a particular power plant. It is usually expressed in Megawatts and can come from hydraulic, nuclear, thermal, solar or wind power.
Ocean energy	Energy obtained from the ocean via waves, tidal ranges, tidal and ocean currents, and thermal and saline gradients
Primary energy	The energy stored in natural resources, such as coal, crude oil, natural gas and renewable sources.
Renewable energy	Any form of energy from solar, geophysical, or biological sources that are replenished through natural processes at a rate that equals or exceeds its rate of use.
Solar energy	Energy from the sun. Often the phrase is used to mean energy that is captured from solar radiation either as heat, as light that is converted into chemical energy by natural or artificial photosynthesis, or by photovoltaic panels and converted directly into electricity.
Wind energy	Kinetic energy from air currents arising from uneven heating of the earth's surface. A wind turbine for example converts the kinetic energy of the wind to mechanical shaft energy to generate electricity.

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1. Introduction

An energy access divide is apparent throughout most SADC countries, with a small proportion of people having access to quality energy sources while the majority of people use a variety of inefficient, often health-compromising, energy sources. Due to high levels of poverty many are unable to afford already cheap electricity, and the extension of the electrical grid is therefore not necessarily sufficient to ensure access to quality energy for the majority of citizens. Statistics show an apparent correlation between energy usage per capita and overall socio-economic development, and the roll out of energy programmes should therefore be integrated into the broader development planning.

SADC countries generally have good potential for renewable energy generation, and renewables can therefore play an important role in country roll outs of energy programmes. Yet while many SADC countries have renewable energy targets, conventional energy generation is still the primary focus of most energy policies in the region. This business as usual approach can be related to a number of factors, including lack of awareness of renewable energy, difficulties with accessing renewable energy financing and general lack of capacity. The current legal and institutional frameworks and institutional mechanisms have also been found to act as barriers to increasing the roll out of renewable energy.

Some efforts to aid the deployment of renewable energy within SADC have been made through the Renewable Energy Support Programme (RESP), and their development of a Renewable Energy Strategy and Action Plan (RESAP) for the region. These have to date had somewhat limited success, and recommendations for the way forward include: the need to provide country level support, with teams that include both international experts and local consultants that have a good understanding of the local and regional context; the need to promote local content and skills transfer; and, as technical expertise is not enough, the need for extensive work to establish political buy-in.

The aim of this report is to provide a short and concise picture of the energy status quo in each of the fifteen SADC countries, with a focus on the current and potential role of renewable energy. As there is currently no common approach for the collection and analysis of statistical information in SADC, the country specific information varies somewhat for the different countries. All the information in the report is based on a combination of the statistics provided on the SADC website¹ and the two following reports, SADC Regional Energy Access Strategy and Action Plan² and Mid-Term Review of the SADC Renewable Energy Support Programme³.

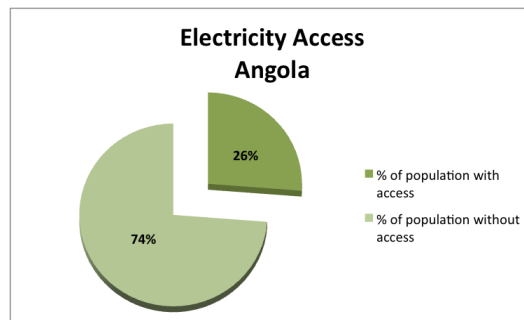
¹ <http://www.sadc.int/information-services/sadc-statistics/sadc-statiyearbook/>

² No name, 2010. SADC Regional Energy Access Strategy and Action Plan. Developed by the Economic Consulting Associates for the SADC Energy Programme

³ Luxande, A and Schutze, E, 2012. Mid-Term Review of the SADC Renewable Energy Support Programme. Developed by Camco clean energy for the Ministry for Foreign Affairs of Finland

2. Country specific energy picture

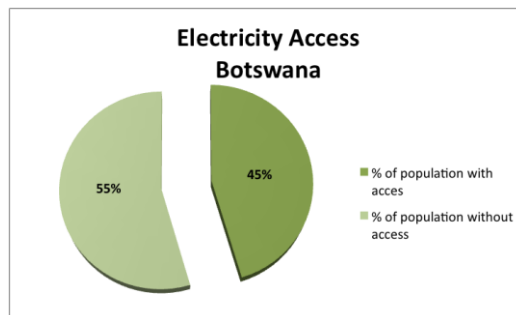
Angola



While Angola is the second biggest energy producer in SADC, due to its massive oil industry, only around 26 percent of the 18 million people in the country have access to electricity. Yet the country has seen a doubling of the installed capacity of electricity over the last 20 years, with installed capacity at 462 thousand kilowatts in 1990 and at 1 155 thousand kilowatts in 2008. Over half of the electricity generated comes from renewable energy, hydropower, with the remaining 35 percent generated through thermal power, a large emitter of carbon dioxide. In addition to hydropower, Angola also has potential for renewable energy production from biomass, wind and solar.

Despite a quarter of the population having access to electricity only 0,2 percent use electricity for cooking, with the most commonly used energy sources for cooking being gas, followed by wood and charcoal. Access to public water supply is relatively good in the rural areas, with 86 percent having access, while only 28 percent in the urban areas have access.

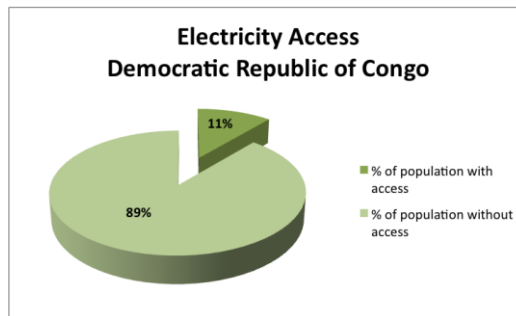
Botswana



Botswana consumes more energy than it produces, which requires the country to import 80 percent of its electricity from South Africa. From the electricity produced in Botswana, 20 percent is from thermal while 0,1 percent only is from solar energy. In addition to solar energy, the country has potential for renewable energy production from wind and biomass, and a renewable energy target of 25 percent of the grid-connected electricity has been set.

The country's Rural Electrification Collective Scheme (RECS), which includes the role out of some renewable energy, has played a big role in increasing electricity access. Access to electricity by rural households increased five-fold in the period 1996-2003. Still, at this point in time just under half of the 1,8 million people living in Botswana have access to electricity. Yet the two energy sources most commonly used for cooking is gas and wood, with only around 7 percent of the population using electricity for cooking. In terms of access to public water supply half of the rural population has access, while only 15 percent of the urban population does.

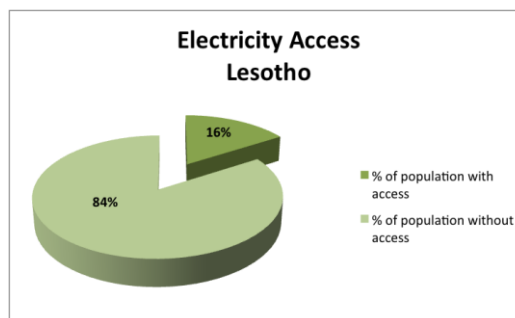
Democratic Republic of Congo



With its 75 million inhabitants, the Democratic Republic of Congo (DRC) is the most populous country in SADC. The Congo River, with the massive Inga falls, and related river systems provide great potential for hydropower generation, and 99 percent of the DRC's electricity generation is produced from hydropower. The DRC is currently the lowest per capita carbon dioxide emitter in SADC. Besides the potential for expansion of the hydropower generation, Angola also has potential for renewable energy production from wind and solar.

Only 11 percent of the population has access to electricity, and only half of those actually use electricity for cooking. As opposed to a lot of other SADC countries, electricity access is much greater in the rural areas than in the urban areas in the DRC. Yet throughout the country the majority of people use wood and charcoal for cooking, and accordingly biomass energy, firewood and charcoal, account for the majority of the primary energy consumption. Access to public water supply is the best in SADC, with 61 percent of the urban and 81 percent of the rural population having access.

Lesotho

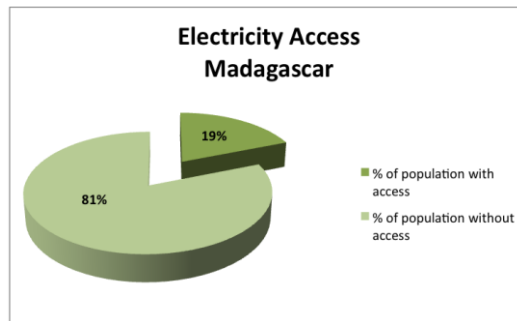


In the small, mountainous country of Lesotho hydropower accounts for 99 percent of the current electricity generation. Lesotho's installed capacity of electricity has been stagnant the last five years, and only 16 percent of the 1,9 million inhabitants currently have access to electricity.

In addition to hydropower, Lesotho has potential for renewable energy production from solar and wind, and the country aims for renewable energy to play an important role in the roll out of rural electrification. The country has therefore set a target, 35 percent of rural electrification to come from renewable energies by 2020. Focus on rural electrification is important, seeing that only 6 percent of the rural, versus 44 percent of the urban, population has access to electricity.

Only a small proportion of those with access to electricity use it for cooking, and over half the population depends on wood for cooking. Gas, kerosene and dung are other important fuels used for cooking. Access to public water supply is, contrary to electricity access, much better in the rural areas, with over 90 percent of the rural population being connected compared to 24 percent of the urban.

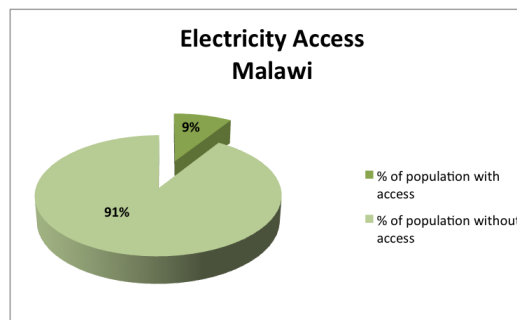
Madagascar



The island state of Madagascar, with its 20.7 million people, has over half of its electricity produced from renewable sources, largely from biomass. Madagascar also has potential for renewable energy production through hydropower, wind, solar, geothermal and ocean energy. This potential is important, seeing that the country is aiming to increase the share of renewable energy production to 74 percent by 2020.

While the country's installed capacity for electricity has doubled since 1990, 81 percent of the population still does not have access to electricity. Yet hardly anyone makes use of electricity for cooking, 0,2 percent, and wood is the major source of fuel for cooking, followed by charcoal. Access to public water supply is generally high, with over three quarters of both the urban and the rural population being connected.

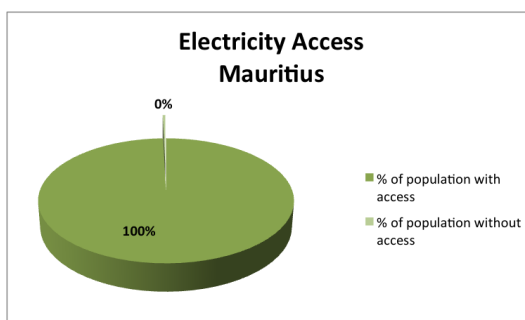
Malawi



In the landlocked country of Malawi hydropower generation plays an important role, producing 99 percent of the current electricity. Malawi has potential for further expansion of hydropower generation, as well as in other areas of renewable energy including biogas, biomass, solar, wind and geothermal. The Malawian sugar industry plays an important role here, providing opportunities for both biogas and biomass.

While the country's installed capacity of electricity has nearly tripled since 1990, there is a great need for further increase in capacity. Only 9 percent of Malawi's 14,4 million inhabitants, mainly those living in urban areas, have access to electricity. Very few of those with access to electricity, only 1,2 percent, use it for cooking, while over 90 percent of the population rely on wood and the rest on charcoal. Connections to public water supply is, as opposed to electricity access, high in rural areas, 87 percent, and slightly lower in urban areas, 58 percent.

Mauritius

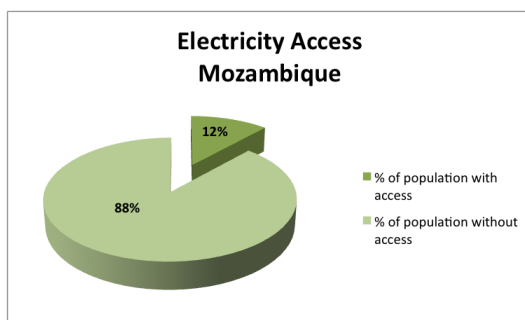


By ensuring sufficient production and roll out of the national grid the small Island state of Mauritius has accomplished total electrification. While electricity access is to some extent associated with the small size of the country and the population, the government's ability to link energy infrastructure with economic and social development projects is also an attribute of its success. Social tariffs and electricity priced according to household consumption, have further enabled the low income groups to also access electricity. Mauritius' electricity is generated mainly from coal, bagasse, fuel oil and kerosene, and a small proportion of hydropower. 37 percent of this energy generation is from renewable energy, largely due to the use of bagasse, which provides most of the energy needs of the sugar industry. The country's potential for expansion of renewable energy lies in wind, solar, hydropower and biomass.

While wood, charcoal and kerosene used to be the main domestic energy sources in Mauritius, the Government has guided a shift towards the use of Liquefied petroleum gas (LPG). As a result, 98,3 percent of the 1,3 million inhabitants now use gas for cooking.

Mauritius is in some ways a unique case, with its small population and high GDP per capita, yet it seems that many SADC countries could learn some valuable lessons from the approach of the country's experience.

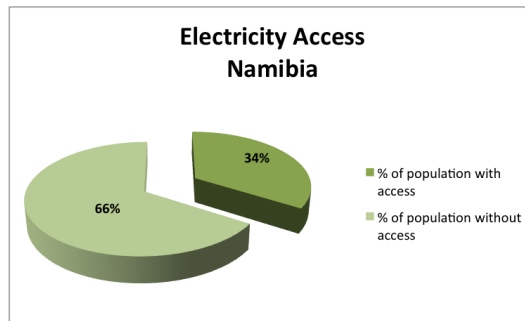
Mozambique



Mozambique has the second highest electricity production out of the SADC countries, a production that is largely based on its hydropower capacity. 98 percent of the electricity generated is from hydropower, with the remaining two percent shared by thermal, wind, solar, biomass and diesel. Mozambique has potential for further expansion of the renewable energy sector, including geothermal, wind technology potential along the coastline, solar potential across the country and biomass potential in the areas of sugar can production. Mozambique has set and already reached some renewable energy targets, and is also working towards a target of 5 percent biofuels for transport by 2015.

Despite its high production of electricity, electricity-intensive industries and exports account for large proportion of the consumption, and only 12 percent of the 23 million people living in Mozambique have access to electricity. As for the majority of the other SADC countries wood is the major source of energy used for cooking, followed by coal. Access to public water supply is relatively high in the rural areas, with 82 percent, but with only a third of the population in urban areas having access to public water supply.

Namibia

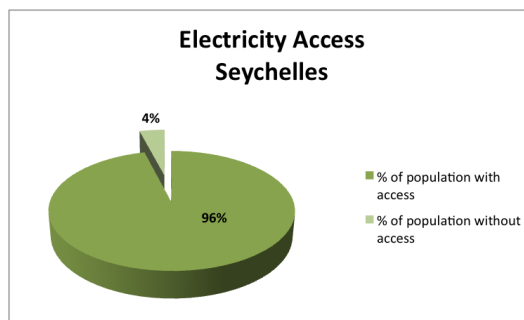


Namibia used to rely on imports from South Africa for its bulk electricity supply. Yet after South African Eskom refused to renew the contract Namibia now relies on a combination of imports from Zambia, DRC and Zimbabwe, as well as its own production through a hydropower station, a diesel station and a coal fired station.

While widespread electrification is a challenge in a country with low population densities and dispersed settlement patterns, Namibia has come some way since independence in 1990. 34 percent of the 2,1 million inhabitants now have access to electricity, with the urban and rural percentage at 70 and 13 percent respectively. In the country's White Paper on Energy Policy, widespread household energy access is a key focus. The roll out of Energy Shops, where customers can purchase energy baskets with a variety of off-grid energy technologies and appliances through subsidised loans, is for example expected to play an important role in expanding household access to energy, especially in the rural areas.

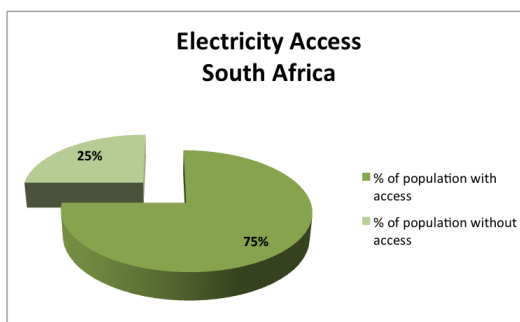
Nearly all of those with access to electricity use it cooking, while the remaining population largely depend on wood, as well as some gas. Access to public water supply is low in urban areas, 16 percent, while just over half of the rural population has access.

Seychelles



Seychelles, an archipelago in the Indian Ocean, is with its 87 000 inhabitants the least populous country in SADC. It is relatively different from other SADC countries, with the highest GDP per capita and with a total population the size of a middle sized town. Seychelles has more or less accomplished complete electrification, but it still has some way to go when it comes to the role of renewable energy. None of the country's energy is currently generated from renewables, but Seychelles aims for 15 percent of electricity generation to come from renewables by 2030. The main renewable potential lies in solar, and a grid connected rooftop photovoltaic systems project is currently underway.

South Africa

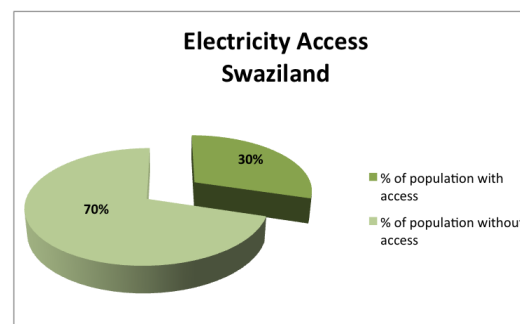


South Africa, with its 50 million people, is by far the biggest energy producer in SADC. It is also a big exporter of energy, with monopoly on the region’s energy supply. Coal and coal products represent the largest proportion of South Africa’s primary energy supply (68 percent), followed by oil and oil products (17 percent). While South Africa also generates energy through some natural gas and nuclear, renewable energy supply, including biomass, hydropower, solar and wind, is growing. Out of the country’s total net electricity generation of 238,3 Kwh, 0,25 Kwh is currently from biomass and waste, 0,02 Kwh from solar, tide and wave energy and 0,03 Kwh from wind. South Africa has set further targets for renewable energy supply, aiming to produce 13% of electricity from renewables by 2020. Some argue that more ambitious targets are needed, seeing that South Africa is by far the greatest carbon dioxide emitter in SADC. In addition to biomass, hydropower, solar and wind, South Africa has renewable energy potential in ocean energy supply.

South Africa’s installed capacity of electricity went from 26392 megawatt in 1990 to 43061 megawatt in 2008, a period during which the country also electrified over 5 million homes. This meant that as per 2008 75 percent of South Africans had access to electricity, with the remaining 25 percent without access mainly comprising the rural poor. In an attempt to extend electricity access the South African government initiated a programme in 1999 to grant private companies the right to set up off-grid energy utilities in identified concession areas. While concessions are mainly for Solar Home Systems, there is also focus on promoting a range of fuels and appliances, like in the Namibian Energy Shops outlined above.

While all of those with access to electricity use electricity for lighting, only two thirds of the South African population currently uses electricity for cooking, with wood and kerosene the two other energy sources most commonly used for cooking. Access to public water supply is better in the rural than in the urban areas, with 50 percent of the rural and only 10 percent of the urban having access.

Swaziland

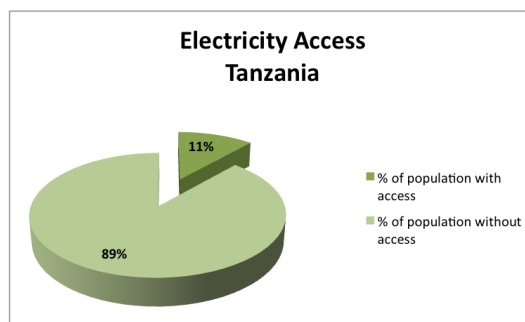


The Kingdom of Swaziland has the third smallest total electricity production of the SADC countries, and only 30 percent of the 1 million inhabitants have access to electricity. As for most of the SADC countries, access to electricity is higher in the urban areas, 65 percent, than in the rural areas, where only 20 percent have access. A large proportion, 89 percent, of the electricity generated comes from renewables, largely due to the use of biomass.

Swaziland has set some renewable energy targets, including installation of solar water heaters on 20% of all public buildings, development of solar water heater standards, establishment of fiscal incentives for promotion of renewables and establishment of a demonstration centre for renewable energies. In addition to biomass, which currently makes up a large proportion of electricity generation, Swaziland has potential for renewable energy production from wind, hydropower and solar.

Under half of those with access to electricity use it for cooking, and the majority of people in Swaziland still use wood when they make food, while a small proportion, 11 percent, use gas. Public water supply is, as in most other SADC countries, highest in the rural areas, 48 percent, with only 16 percent of the urban population having access.

United Republic of Tanzania

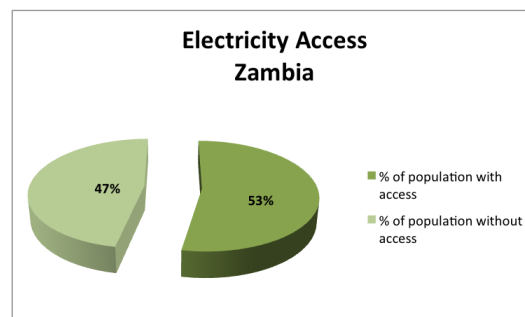


With its 44,5 million inhabitants Tanzania is the third most populous country in SADC. Tanzania has one of the smallest GDPs per capita in SADC, and only about a tenth of the population has access to electricity. Rural electrification is particularly challenging, with only 2 percent of the rural population currently having access to electricity. In order to facilitate accelerated rural electrification the Tanzanian Ministry of Energy and minerals has established a framework for promotion of the development of small power projects utilising renewable energy technologies. The framework reduces the bureaucratic process by using standardised documents and minimising paperwork requirements.

Current electricity generation in Tanzania is largely renewable, with 99 percent generated from hydropower and one percent from thermal. Tanzania also has the potential to branch out into other sources of renewable energy, including geothermal, biomass and solar.

Only a tiny fraction of those with access to electricity use it for cooking, and the most common source of fuel for cooking is wood, followed by charcoal. Some households also use kerosene. Access to public water supply is a lot more common in the rural areas than electricity, with 70 percent having access. In the urban areas, on the other hand, only 23 percent have access.

Zambia

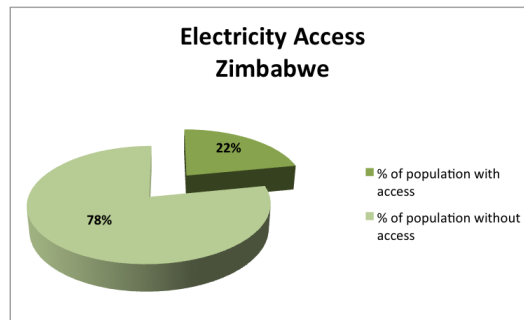


In the landlocked country of Zambia 53 percent of the 13,5 million inhabitants have access to electricity, reflecting some of the best electricity access in SADC. As opposed to a lot of other SADC countries Zambia's electricity access is

best in the rural areas, where 22 percent have access, compared to the 4,5 percent who have access in the urban areas. Electricity production is generated almost exclusively from renewable energy, largely from hydropower.

Despite the relatively high electricity access in Zambia, electricity is far from the most common source of fuel used for cooking. Over half of the Zambian population use wood for cooking, while just over a third use charcoal and only 17 percent use electricity. Access to public water supply is relatively similar in the urban and the rural areas, with just over half of the rural population having access and just under half of the urban population having access.

Zimbabwe



Out of Zimbabwe’s 12,8 million inhabitants 22 percent have access to electricity. As for the majority of SADC countries access is a lot higher in the urban areas, where 53 percent have access, versus the 4,5 percent who have access in the rural areas. Zimbabwe has experienced fluctuations in its overall electricity production the last twenty years, but production levels are now nearly back at 1990 levels. Over half of the country’s electricity is generated from thermal, while the remaining is produced from two renewable sources, mostly from hydropower and some from bagasse. For the primary energy supply, 70 percent is from renewable energy sources. Zimbabwe also has potential for renewable energy from solar, wind and geothermal, as well as expansion of the current hydropower and biomass production.

As for most of the SADC countries wood is the energy source most commonly used for cooking. Two thirds of Zimbabweans use wood for cooking, while a relatively big proportion use electricity. Public water supply statistics are also similar to other SADC countries, with nearly half the rural population having access, while only 5 percent of the urban population has access.

3. Summary and reflections

With the exception of South Africa, per country electricity production is generally low across the SADC countries. Renewable energy, mainly hydropower, plays an important role in current electricity production in some countries, accounting for close to 100 percent of the total production in DRC, Lesotho, Malawi, Mozambique, Swaziland and Tanzania. Yet people’s access to electricity is generally very low across these and most other SADC countries. Expanded production and access is therefore needed across SADC, and renewable energy could play an important role as all the SADC countries have potential for electricity production from a variety of renewable energy sources.

Rural electricity access is generally a lot lower than urban access, reflecting the challenge of expanding the electrical grid to distant and often sparsely populated areas. This has in some countries sparked government programmes for the roll out of a variety of off-grid options. For example, in South Africa private companies have been granted the right to set up off-grid energy utilities, mainly solar, in identified concession areas. The roll out of Energy Shops in Namibia is another example, where energy baskets with a variety of off-grid energy technologies and appliances can be purchased through subsidised loans. Mauritius provides a slightly different example, having achieved total grid electrification, partly due to the government’s ability to link energy infrastructure with economic and social development projects.

SADC can also learn from and take advantage of developments taking place in other parts of the world. For example, there is an important shift currently taking place in some places, from inflexible, centralised grid systems that depend on large central power stations to more flexible, decentralised energy systems with mini-grids or off-grid solutions such as solar rooftop photovoltaic systems.

As was illustrated from the various SADC country statistics presented in this report, many people with access to electricity still use other energy options for cooking. Wood is by far the most common source of energy used for cooking, with consequences for natural forests and woodlands. Wood can only be considered a renewable energy source if replenishment is equal to or exceeds the rate of use. The use of wood as a major energy source can thus not go unmonitored, and resources need to be focused on ensuring sustainable harvest. There is also a need for exploration of alternative fuels for cooking, such as solar and gas, with focus not only on availability of fuels but also on the social and cultural acceptance. Many technologies are already available, for example biogas digesters that produce gas from the breakdown of organic matter such as waste.

As outlined in this report there is potential for expansion of renewable energy production across all the SADC countries, with a variety of technologies and approaches already being piloted in some areas. In expanding electricity production and access in SADC there is thus great potential for innovative renewable energy solutions to play a central role. Such a shift requires, among other things, efforts towards increasing in country awareness, knowledge and technical capacity for renewable energy.