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What is sustainability?

Sustainability means being able to carry on doing something without causing permanent damage to the environment. Another definition is 'meeting the needs of the present without compromising the ability of future generations to meet their own needs'. There are three parts to sustainability: social, environmental, and economic. These factors must be in balance to achieve sustainable resource use.

When something is unsustainable, this means it cannot continue. One of the most important reasons for unsustainable development is the huge amount of materials used by industrialised societies. People use more resources. The current rate of resources use by developed and developing nations is unsustainable. This means that future generations and developing nations will not have access to the same share of scarce resources.

THE DIFFERENCE BETWEEN SUSTAINABLE AND NON-SUSTAINABLE RESOURCE USE

Sustainable resource use Non-sustainable resource use

People and the environment Ecotourism, protecting scenery and wildlife Large scale tourism, especially at mountain and coastal resorts

People and resources Re-use, recycle and reduce, soil conservation, reforestation, organic farming, renewable energy use, clean drinking water Continued use of fossils such as coal and oil, unnecessary use of minerals, deforestation, soil erosion, heavy fertilizer and agrichemical use, polluted drinking water

Socio-economic Controlled urban growth Rapid urbanization and loss of farmland

Energy

*“We all have a responsibility to learn*

*how to live and develop sustainably*

*in a world of finite resources.”*

**– Archbishop Emeritus Desmond Tutu, 2009 Insert Citation**



Table 1

Every day, we use energy for different activities, from heating and cleaning to transport and communication. The energy we use comes in a variety of forms, namely liquid fuels, such as petrol, paraffin and diesel; gas, or electricity. Traditionally, electricity in South Africa has been cheap, but this is changing due to ageing infrastructure, limited fuel resources, and international pressure with regard to climate change. Since 2006, South Africa has had insufficient supply of electricity. While plans are underway to address this, this crisis will persist until at least 2016. The price of electricity will increase substantially in the coming years, therefore, our actions need to be energy efficient, and we must utilise renewable energy whenever possible.

# Why is energy efficiency important?

The main energy challenges facing us are as follows:

* There are several health problems associated with the different ways in which we generate energy.
* Emissions/pollutants are changing our environment.
* Our roads are becoming increasingly congested, which implies increasing air pollution and increased energy usage, as well as an increasing number of traffic accidents.

The two main energy categories are **non-renewable** and **renewable energy**.

* A non-renewable resource is a natural resource that cannot be produced, regrown, regenerated or reused fast enough to sustain its consumption rate indefinitely. These resources often exist in a fixed amount, or are consumed much faster than nature can recreate them. Fossil fuel is an example of non-renewable resources.
* A renewable resource, on the other hand, has an on-going or continuous source of supply (such as wind and solar power), and usually emits less carbon when electricity is generated.

# What can we do?

There are many quick, simple and inexpensive things we can do to help:

* Calculate your energy use. Audit your home to calculate what you can save.
* Use less fuel. Walk, cycle, share lifts, use public transport, drive more efficiently, or drive smaller, more efficient vehicles.
* Use less electricity. Buy energy-efficient appliances and lights, and turn off unused lights and appliances instead of leaving them in ‘standby’ mode.
* Use less hot water. Fit a geyser timer, use low-flow showerheads or install a solar water heater, shower rather than bath, and turn off the running tap while brushing your teeth.
* Cook efficiently. Use lids, the right size pans, or a Hot Box. A Hot Box is an insulated container in which you place a cooking pot. The box keeps the food hot and cooking, without using any energy.
* Cool efficiently. Fill your fridge as much as possible; make sure seals are clean and in good order and use natural shade and ventilation around your house.
* Wash efficiently. Fill your washing machine or dishwasher completely, and use colder, more efficient cycles on your washing machine.
* Heat your home efficiently. Stop draughts, use thermostats, insulate your home, and install a ceiling.
* Support ‘green energy’. Install a solar water heater or photovoltaic panels, and buy renewable-energy certificates.

Introduction to energy

# Energy sources

The vast majority of energy that the earth receives comes from the sun. This energy is called solar energy, and drives many of the processes on our planet, such as the wind, sea currents, photosynthesis (the process through which plants absorb carbon, sunlight and water to produce oxygen and sugar) and the water cycle.

# Measuring energy

Energy is defined as the capacity to do work. It is measured in units called joules (J). Power is the rate at which energy is used. This is measured in watts (W). One watt is equal to the energy consumed at a rate of one joule per second. However, as energy is used in vast amounts throughout the world, bigger units are normally used:

100 watts (100 W) = one hundred watts

1 kilowatt (1 kW) = 1 000 (one thousand) watts

1 megawatt (1 MW) = 1 000 000 (one million) watts or 1 000 kW

1 gig watt (1 GW) = 1 000 000 000 watts or 1 000 000 (one million) kW or 1 000 MW

1 terawatt (1 TW) = 1 000 000 000 000 watts or 1 000 GW

Worldwide energy use is estimated at 15 TW.

An appliance’s power use is expressed in watts, for example, a 60 W light bulb. To understand the total amount of energy used, we need to think about how long an appliance is used for, i.e. the amount of energy used in kilowatt-hours (kWh).

# ‘Ancient sunlight’ – fossil fuels

Most of our power comes from so-called ‘fossil fuels’, i.e. coal, gas and especially oil, which has become the single most critical resource on the planet. The oil supplies on which the world economy depends are tens of millions of years old, originating in ancient seas that teemed with microscopic plant and animal life. As these creatures died and their bodies fell to the ocean floor, they formed a rich organic mud. Over millions of years, these layers were compressed by sediment above them, slowly changing into the complex mix of hydrogen and carbon compounds that we know as oil.

# Some things to think about

Our economy largely depends on oil. Yet, South Africa has no natural oil resources. This means we need to buy this critical resource from other countries. All the money we spend on oil therefore flows out of our country. Sasol has developed and implemented technology that will convert coal to oil.

# Peak oil

Over the past decade, studies have shown that global oil production is reaching its peak, which will be followed by an irreversible decline. This event is commonly known as ‘peak oil’. From transportation to modern agriculture, petrochemicals to pharmaceuticals – everything relies on one commodity, namely cheap and abundant oil. However, oil is a limited, non-renewable resource.

# Energy and climate change

For the past 10 000 years, the global average temperature has changed by no more than 1 ºC either way. However, in the last 100 years alone, the average temperature of the earth has risen by about 0,5 ºC, and is anticipated to continue rising by 2–6 ºC over the next century. What is going on? Carbon dioxide (CO2) is one of the gases in our atmosphere. In 1999, CO2 levels were 32% higher than pre-industrial levels of 150–200 years ago.

# Where does our energy come from?

Paraffin, gas, petrol and diesel are all made from refined oil. Crude oil is shipped mainly from the Middle East, some 10 000 km away. It is pumped ashore at Saldanha Bay, 120 km north of Cape Town, and then piped to the Caltex refinery situated in Milnerton, 15 km from the city centre. From the refinery, the various liquid fuels –petrol, diesel, paraffin and liquid petroleum gas (LPG) –are distributed to bulk depots and smaller distributors.

## Renewable/cleaner energy

Renewable energy is initially costly in comparison with our existing coal power, which does not take the full environmental cost into account. The vast majority of the renewable energy cost is in the initial set up which contrasts strongly with technologies such as coal and nuclear power, which have ongoing fuel costs and large costs at the end of the plant’s lifecycle, such as decommissioning of the plant and safe storage of the nuclear waste.

## Green jobs from electricity generation

According to a study that compared the employment capacity of different electricity generation options, renewable sources are much more labour-intensive than conventional sources, such as nuclear and coal power. As such, they offer far better opportunities for local job creation.

## Nuclear power

Of the national electricity mix, 5% comes from South Africa’s only nuclear power plant at Koeberg near Cape Town. National Government and Eskom are looking to develop further nuclear capacity. Grave concerns about climate change resulting from increased concentrations of carbon dioxide in the atmosphere, to which coal-based electricity generation substantially contributes, have led some people to support nuclear power as an important energy solution.

**Decommissioning**

The cost of implementing nuclear technology has risen sharply from the original, unrealistic estimates that electricity from nuclear power would be ‘too cheap to meter’. The long term costs include dealing with nuclear waste and decommissioning expenses that far exceed previous estimates. It was thought that by the time most reactors needed decommissioning, an economic solution would have been found for dealing with the highly dangerous radioactive waste, but that has not happened as yet.

**Limited resources**

Both coal-fired and nuclear technologies rely on the use of finite resources (coal and uranium), and are associated with substantial environmental hazards. Longer-term energy solutions must be aimed at developing cleaner, renewable-source energy technologies.

**Sustainable energy** is the [sustainable](http://en.wikipedia.org/wiki/Sustainability) provision of [energy](http://en.wikipedia.org/wiki/Energy) that meets the needs of the present without compromising the ability of future generations to meet their needs. Technologies that promote sustainnable energy include [renewable energy](http://en.wikipedia.org/wiki/Renewable_energy) sources.

**Green Energy** is energy that can be extracted, generated, and/or consumed without any significant negative impact to the environment. The planet has a natural capability to recover which means pollution that does not go beyond that capability can still be termed green.

**Green power**s a subset of renewable energy and represents those [renewable energy resources](http://en.wikipedia.org/wiki/Renewable_energy_resource) and technologies that provide the highest environmental benefit. Green power is defined as electricity produced from solar, wind, geothermal, biogas, biomass, and low-impact small hydroelectric sources.

# Energy management and the move towards greener economies

Two ways in which South Africa can move towards greener economies are:

* changing its fuel mix
* using available energy more efficiently

## Changing the fuel mix

South Africa has started to reduce its reliance on getting 70% of its energy from coal. South Africa is aiming for a more balanced fuel mix in its energy plan to 2030.

## Using available energy more efficiently

Greater energy efficiency will help the available energy to go further, while at the same time reducing the environmental impact of energy production.

## Strategies for sustainnable energy production in South Africa

| **Category** | **Figures** | **Technologies, policies and management** |
| --- | --- | --- |
| **Residential** | residential_house_zazou  Figure 1: Residential | Cleaner and more efficient water heating can be provided through increased use of solar water heaters and geyser blankets.  The cost of solar water heaters will reduce More efficient lighting and energy-efficient globes. |
| **Industry and business** | http://www.jas-socal.org/Resources/Pictures/JAS/IMG-GreenBuilding.JPG  Figure 2: Industry | Greater industrial energy efficiency to reduce national consumption.  This will depend on laws that will help enforce the policy. |
| **Biofuels** | http://ecx.images-amazon.com/images/I/41G7%2BmLTs6L.jpg  Figure 3: Biofuels | Biodiesel and other biofuels are carbon free.  Biofuel crops needs to be managed so that it does not undermine food security. |
| **Increase in use of renewable energy sources** | http://content.magicbricks.com/wp-content/themes/timesofindia/img_resize/phpThumb/phpThumb.php?src=http://content.magicbricks.com/wp-content/uploads/2012/04/green.jpg&w=292&h=200&zc=1  Figure 4: Renewable energy sources | Share of renewable electricity.  A more significant contribution can be made by solar thermal wind and small hydroelectric projects.  New technology costs will decline as global production increases. |
| **Nuclear** | http://thumbs.gograph.com/gg57847524.jpg  Figure 5: Nuclear | There should be at least 9.6 MW of new nuclear capacity by 2030.  The draft energy plan includes six new 1 600 MW reactors coming online in 18-month intervals from 2023.  Environmentalists point out that although nuclear is a very low carbon emitter; it does pose other environmental problems. |
| **Imported hydroelectricity** | http://themarcellusshale.com/wp-content/uploads/2013/08/royalty-free-gasoline-clipart-illustration-30314.jpg  Figure 6: Hydroelectricity | The share of hydroelectricity imported from other parts of South Africa can increase as more hydroelectric capacity is built in South Africa. |
| **Imported gas** | http://www.clipartguide.com/_thumbs/0060-0610-1618-3739.jpg  Figure 7: Imported gas | Natural gas can be imported to provide 5 850 MW of combined cycle gas turbines compared to the current 1 950 MW. |
| **Government** | http://2.bp.blogspot.com/_ZC2nsH64aOo/SigNm66gJMI/AAAAAAAAF9A/0px_7K8gW7E/s320/green+workers+clipart.jpg  Figure 8: Government | The government can impose a fuel-input tax on coal used for electricity generation.  The government can change legislation to allow other power producers to supply electricity to municipalities and to Eskom.  The government can introduce subsidies that encourage industries and individuals to switch to more efficient and greener technologies. |

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