

LESSON 12: RESOURCES & SUSTAINABILITY II (ENERGY)

Key Concepts

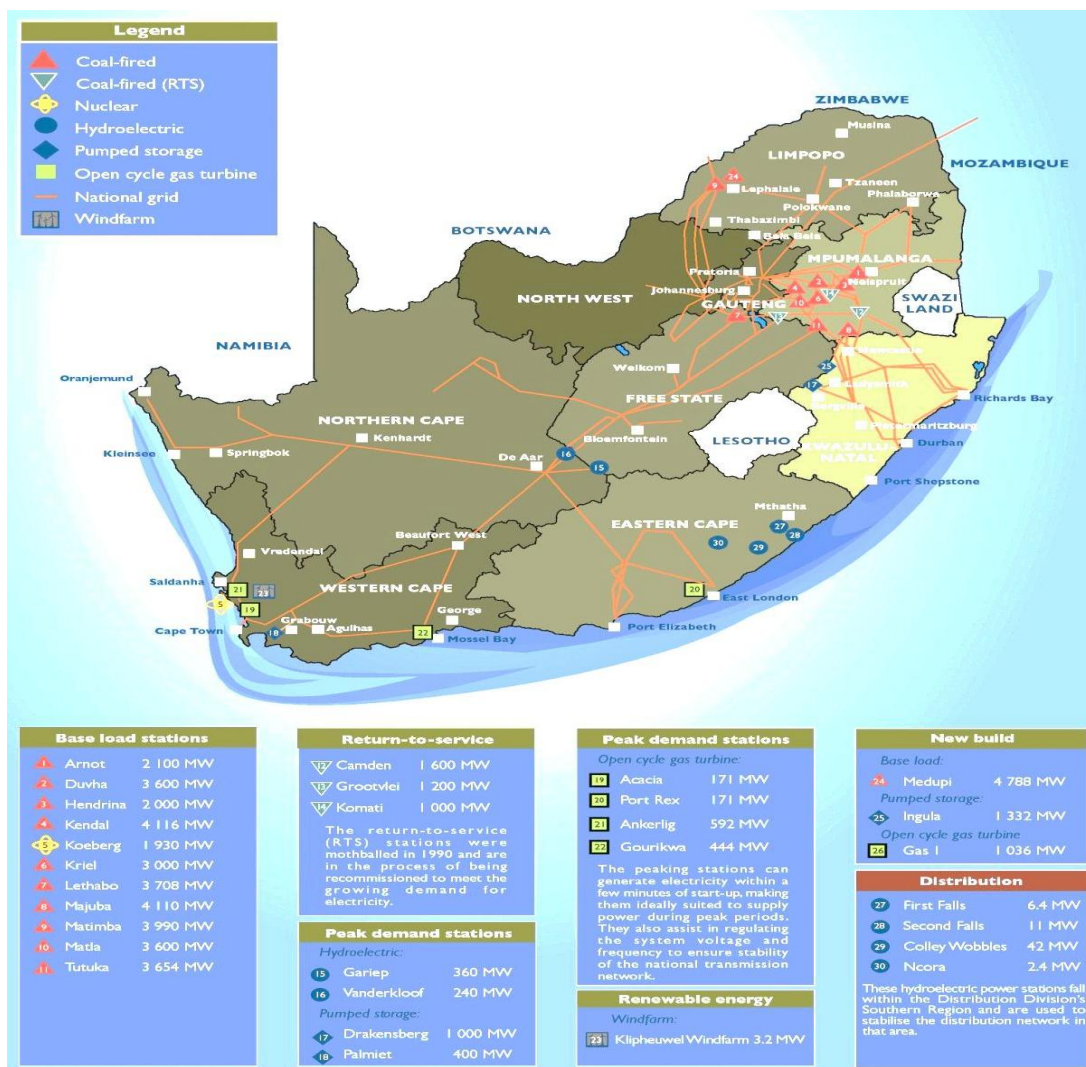
In this lesson we will focus on summarising what you need to know about:

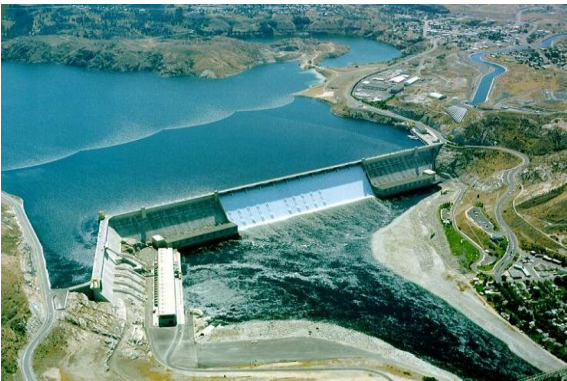
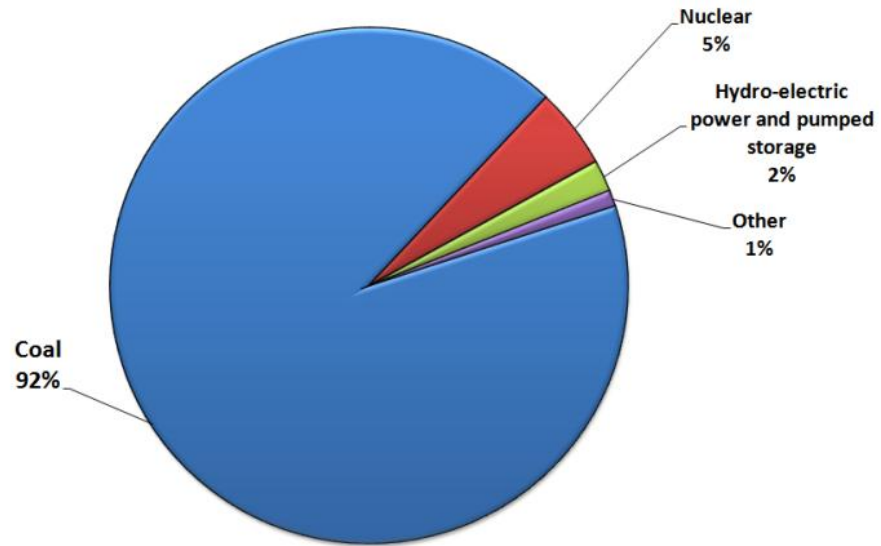
- Conventional energy sources and their impact on the environment
- Non-conventional energy sources
- Energy management in South Africa

X-Planation

Conventional Energy Sources and their Impact on the Environment

Maps and graphs to show thermal, hydro and nuclear production in South Africa

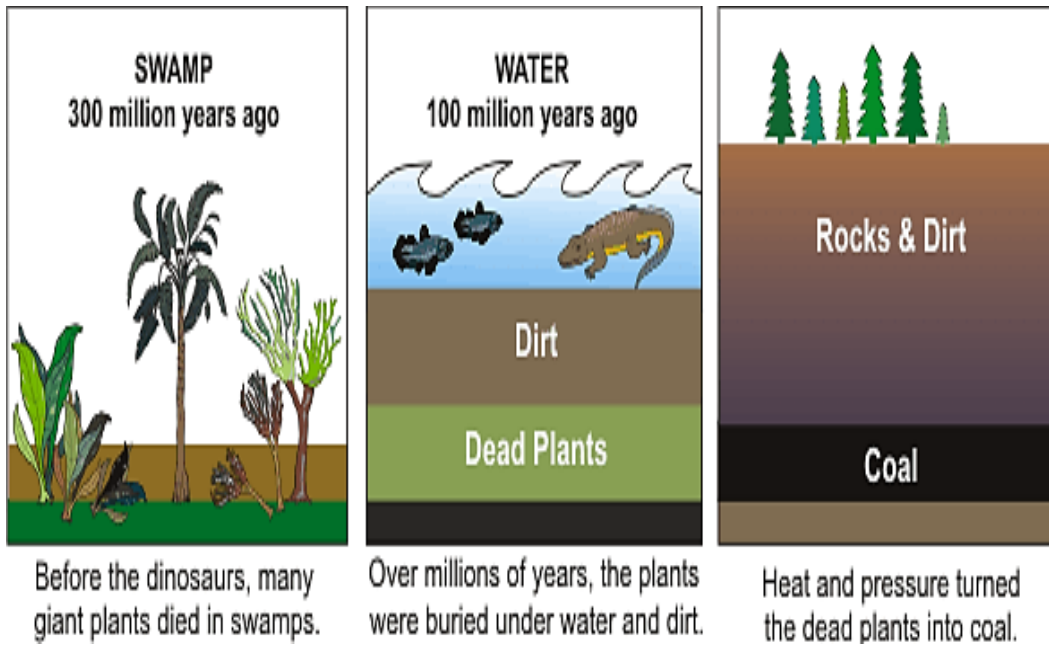




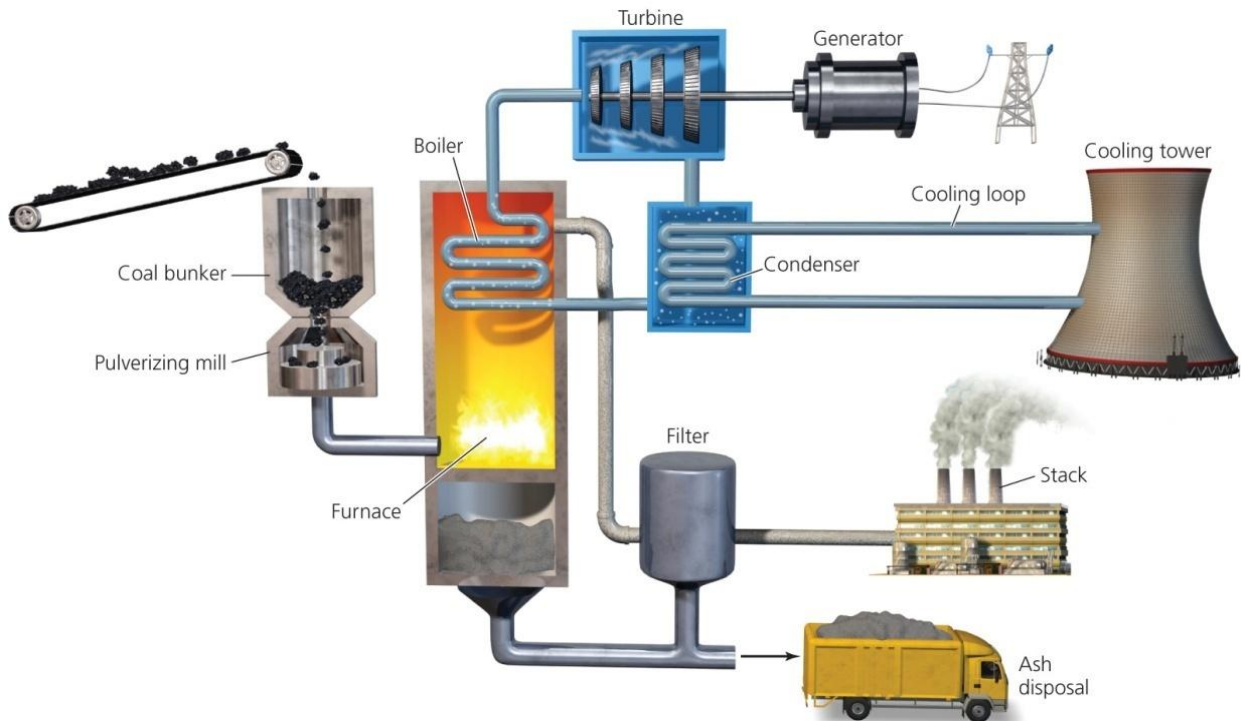
Thermal electricity generation using coal – outline of principles and processes



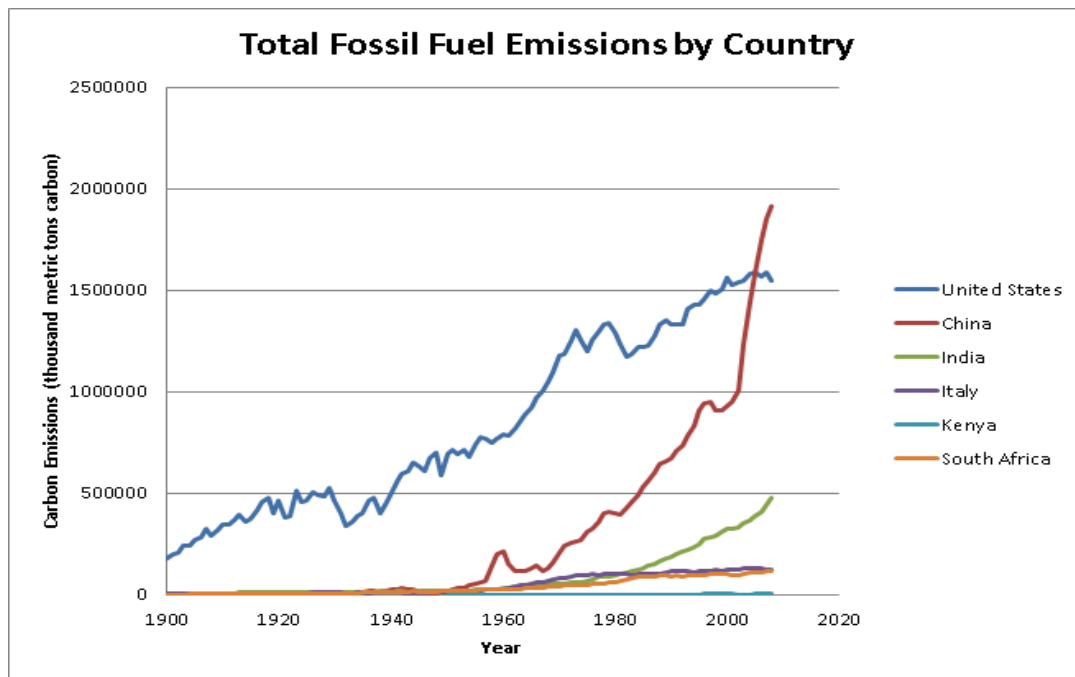
How is coal made?



The impact of coal mining and thermal power stations – environmental despoliation, solid waste, waste gases, and acid rain



South Africa's potential to meet long-term energy needs using conventional sources



Non-conventional energy sources

- Solar energy – examples from South Africa and the world
- Wind energy – examples from South Africa and the world
- The future of non-conventional energy in South Africa
- Possible effects of using more non-conventional energy on the South African economy and the environment

Solar Energy – examples from South Africa and the world





Advantages

- All chemical and radioactive polluting byproducts of the thermonuclear reactions remain behind on the sun, while only pure radiant energy reaches the Earth.
- Energy reaching the earth is incredible. By one calculation, 30 days of sunshine striking the Earth have the energy equivalent of the total of all the planet's fossil fuels, both used and unused!

Disadvantages

- Sun does not shine consistently.
- Solar energy is a diffuse source. To harness it, we must concentrate it into an amount and form that we can use, such as heat and electricity.
- Addressed by approaching the problem through:
 1. collection,
 2. conversion,
 3. storage.

Wind Energy – examples from South Africa and the world



- It is a renewable energy source
- The use of the wind to produce electricity
- Wind energy is the fastest growing energy source on earth
- The rate at which technology is improving is making wind power more and more appealing
- Most effective in areas that receive a decent amount of wind

The future of non-conventional energy in South Africa

- In 2011 the South African government recommitted itself to including renewable energy as part of securing energy needs for the country.
- Apart from solar and wind power, South Africa has the potential to develop other kinds of renewable energy resources e.g. hydro power, biomass and bio fuels, gas from landfill sites and wave energy.

Possible effects of using more non-conventional energy on the South African economy and the environment

- Lowering the demands of fossil fuels, which cause global warming and climate change.
- To reduce South Africa's dependence on imported fuels such as oil.
- Reduce the production of carbon dioxide and other harmful gases.
- Reduce South Africa's carbon emissions.

Energy Management in South Africa

- South Africa's changing energy needs
- Energy management, towards greener economies and sustainable life styles: responsibilities of governments, businesses and individuals.

South Africa's changing energy needs

South Africa's energy demands are determined by the population size.

The provision of electricity to communities will stimulate the creation and growth of local businesses.

Employment

Energy management, towards greener economies and sustainable life styles: responsibilities of governments, businesses and individuals

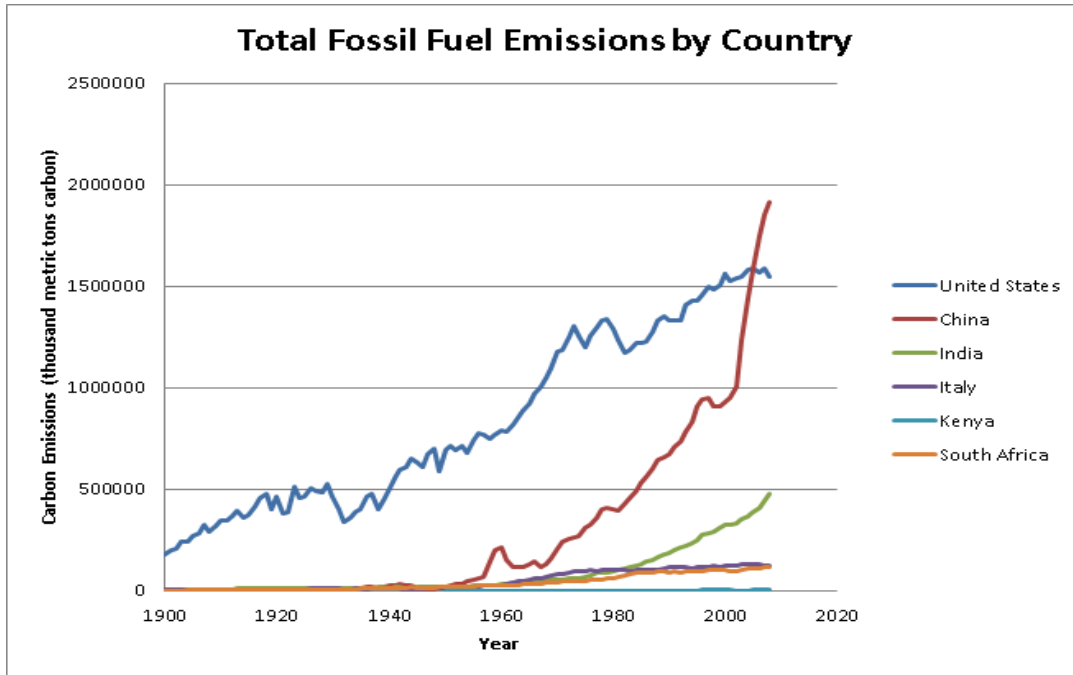
Key areas in improving energy efficiency in South Africa:

- The changing human behaviour, for example switching off lights and water geysers, managing electricity use.
- Promoting energy-efficient appliances, for example energy-saving globes, fuel efficient transport.
- Adoption of low-carbon technologies, for example solar geysers, more fuel efficient power stations.

Questions

Question 1

Study the graph below and answer the questions that follow:



- Identify the country with the highest fossil fuel emissions. (1 x 2) (2)
- Give a reason for your answer. (1 x 2) (2)
- Explain why South Africa is ranked 6th amongst the countries with fossil fuel emissions. (2 x 2) (4)
- Write a paragraph (approximately 12 lines) suggesting ways in which countries can reduce their total fossil fuel emissions. (6 x 2) (12)

X-ercise Questions

Question 1

(Adapted from Gr 11 Exemplar 2013, DBE, Paper 1, Question 3.4)

South Africa has rich coal deposits in the north-east of the country, and as such the majority of South Africa's coal-fired plants are located in Mpumalanga. Historically, this has given South Africa access to cheap electricity, but it is also one of the leading causes why the country is on the top 20 list of carbon dioxide emitting countries.

- Coal is not a sustainable source of energy. Explain this statement. (2 x 2) (4)

- 1.2 State TWO environmental impacts of coal mining and thermal power stations. (2 x 2) (4)
- 1.3 Discuss THREE management strategies that can be put in place to reduce South Africa's carbon emissions from coal-fired power stations. (3 x 2) (6)

Question 2

(Adapted from Gr 11 Exemplar 2013, DBE, Paper 1, Question 4.3)

The newspaper article in FIGURE 2 refers to the future use of nuclear power in South Africa.

FIGURE 2: NUCLEAR POWER IN SOUTH AFRICA

While the likely cost of South Africa's planned nuclear power stations has been grabbing headlines, a more pertinent question is: When will they actually be built?

The IRP2010 plan – released in April 2010 – called for the construction of six nuclear stations generating 9,6 GW of energy by 2030, with a new 1 600 MW nuclear power plant to be built every year between 2023 and 2026, and the last two in 2028 and 2029.

In practical terms, a decision needed to be made within a year to go ahead with the first two of those planned six new nuclear stations. That has not happened. It was announced in mid-September that South Africa was postponing a decision by one year for safety reasons after the tsunami incident at Japan's Fukushima nuclear plant in March 2012.

It was stressed that, globally, coal was 'here to stay' as an energy source until at least 2035, despite intense environmental opposition.

– Brendan Ryan (adapted)

- 2.1 What is nuclear power? (1 x 2) (2)
- 2.2 Where is South Africa's current and only nuclear plant located? (1 x 2) (2)
- 2.3 Despite the many advantages of nuclear power, South Africa still relies heavily on conventional energy resources such as coal to generate electricity. Why is this the case? (2 x 2) (4)
- 2.4 Give ONE reason for the delay in building nuclear power plants in South Africa. (1 x 2) (2)
- 2.5 With reference to the advantages and disadvantages of nuclear power, write a short paragraph on whether you agree, or disagree, with the government's decision to build more nuclear power stations. (6 x 2) (12)

Solutions to X-ercise Questions

Question 1

(Adapted from Gr 11 Exemplar 2013, DBE, Paper 1, Question 3.4)

- 1.1 Coal is non-renewable
Once used it cannot be replaced and no electricity can be generated
- 1.2 Environmental despoliation
Produce solid wastes
Produce greenhouse gases when it's burnt
Gases emitted pollute the atmosphere
Gases emitted cause acid rain
- 1.3 Coal cleaning prior to combustion
The use of high efficiency coal combustion technologies
Filters/electrostatic precipitators in chimneys
Laws limiting emissions
Heavy fines if law is broken
Use clean energy sources such as water, sun and wind
Revegetation
Public awareness

Question 2

(Adapted from Gr 11 Exemplar 2013, DBE, Paper 1, Question 4.3)

- 2.1 Energy produced by nuclear fusion/from uranium
- 2.2 Koeberg
- 2.3 Large coal reserves in South Africa
Coal seams close to surface and easily obtained
Relatively cheap to produce electricity
- 2.4 Due to the accident at Japan's Fukushima nuclear plant
- 2.5 Agree
It is environmentally clean - no emissions of greenhouse gases such as CO₂
No global warming and acid rain
Nuclear energy is cheap and competitive with fossil fuel
It is possible to generate a large amount of electricity in one single plant
Nuclear energy prices are stable
Uranium doesn't take up much space and can be easily stored until needed
Uranium is plentiful - there is enough to last most of a century if we use it wisely
Nuclear energy is safe
The cost to human health and the environment is low
Disagree
The storage and management of dangerous high-level radioactive waste
High-level nuclear waste can last for thousands of years before being safe again
The possibility of explosion of nuclear materials
Potential terrorist threats
The high cost of building nuclear facilities
The possibility of accidents
Long time frame needed for planning and building of a new nuclear power generation plant