Electricity

RENEWABLE & SUSTAINABLE
ENERGY STUDIES

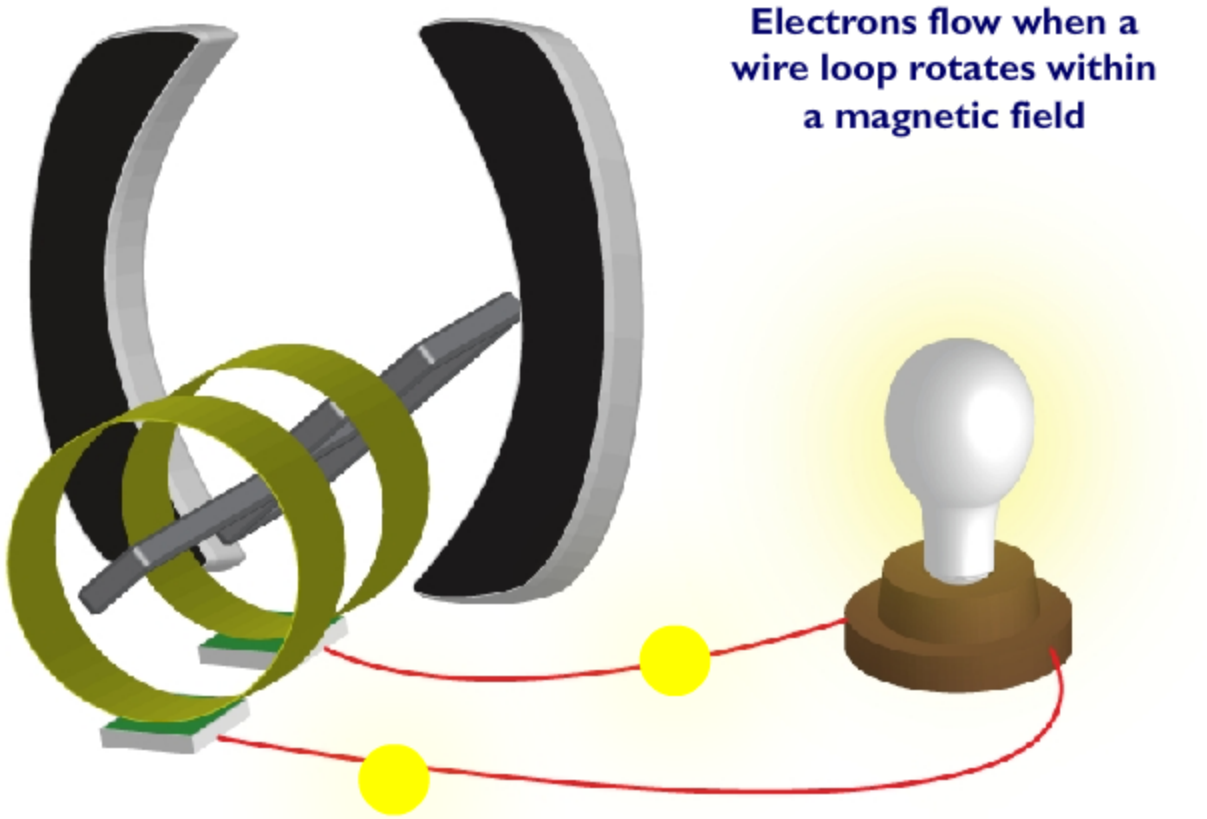
Generator consists of **coil**, **magnetic field** and **split rings**

Magnetic field produced by permanent magnets or electromagnets

Ends of **coil wires** are connected to two rings - **split rings**

Electrical current flows from **coil wires** to **external circuit** by means of **brushes** which come into contact with the **split rings**

Faraday's discovery (1831)



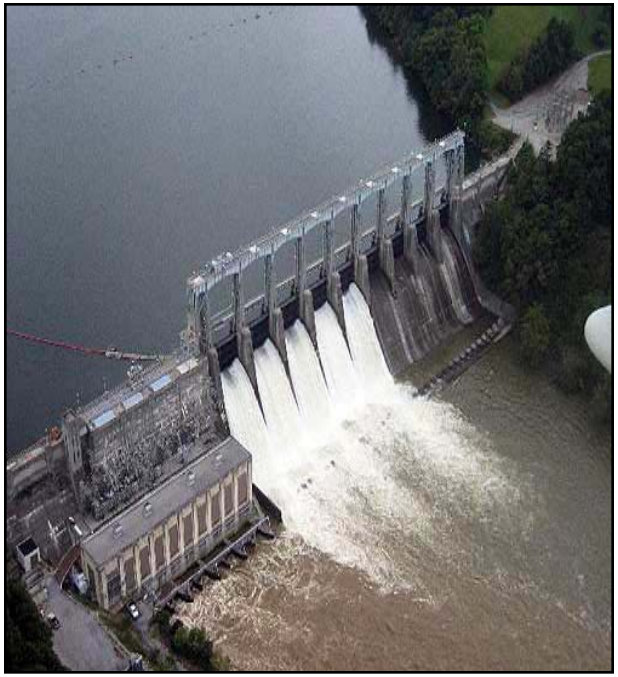
Power distribution network throughout **SA** and neighbouring countries

SA Power Grid

Electricity Generation Mix

Coal	Nuclear	Hydro	Gas	Other
90%	5%	2%	1%	2%

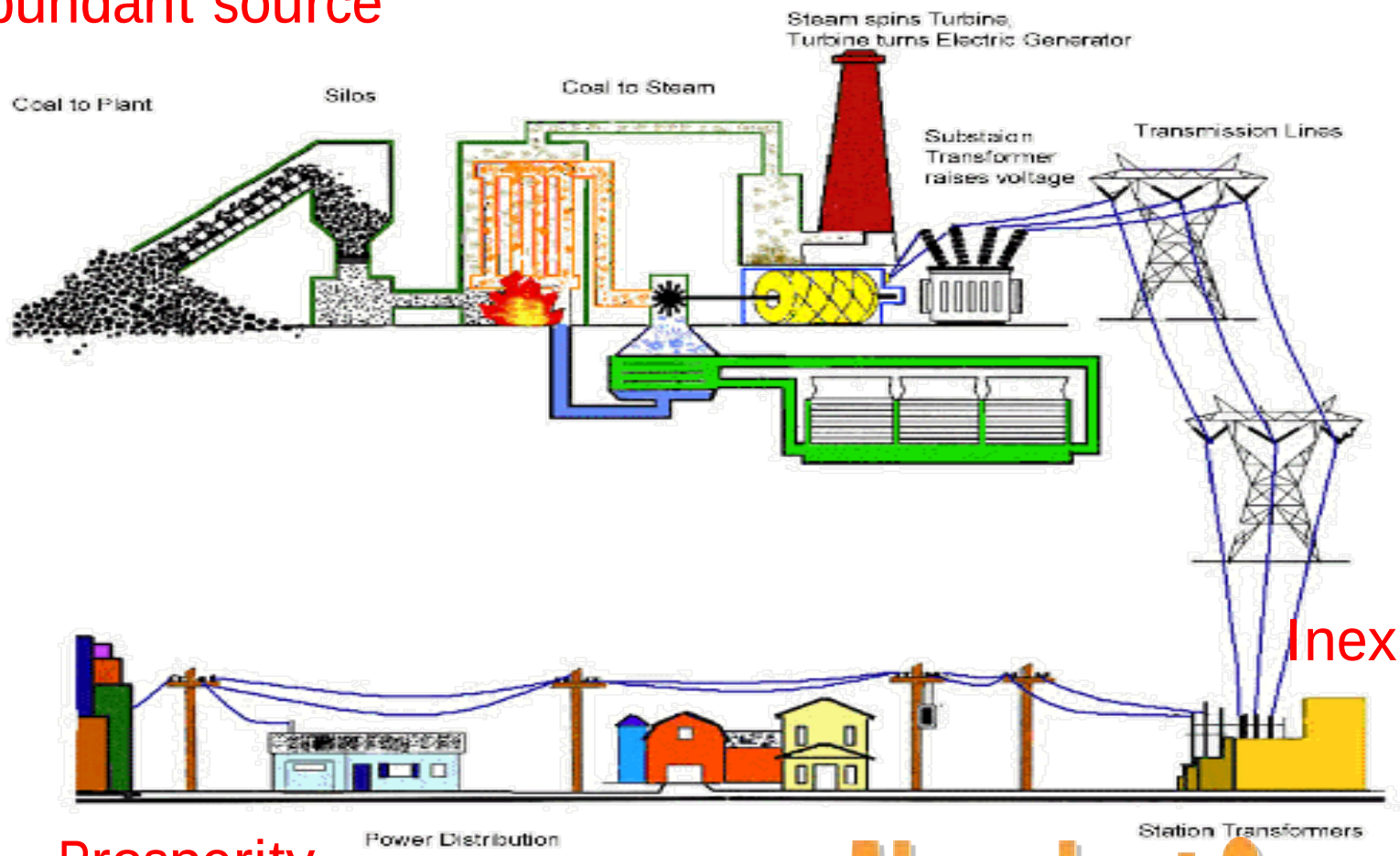
Ref. CRSES 2008



SA Electricity Supply

Use low quality,
low heat value,
high ash content

Abundant source



Inexpensive

Prosperity

Abundant Supply!

Electricity

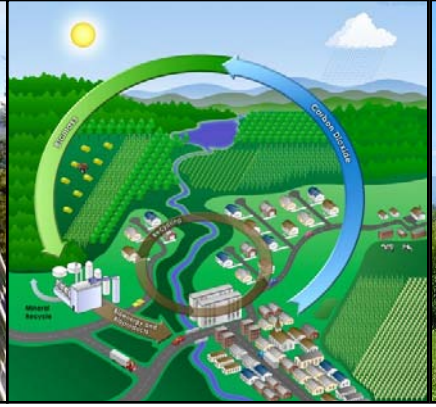
- Generated as needed
- Consistent and reliable

=

For a 220 W computer used 365 days per year

938kg of coal = One ton Bakkie load

Supply vs Demand?

Forms of Renewable Energy

Solar

Biomass

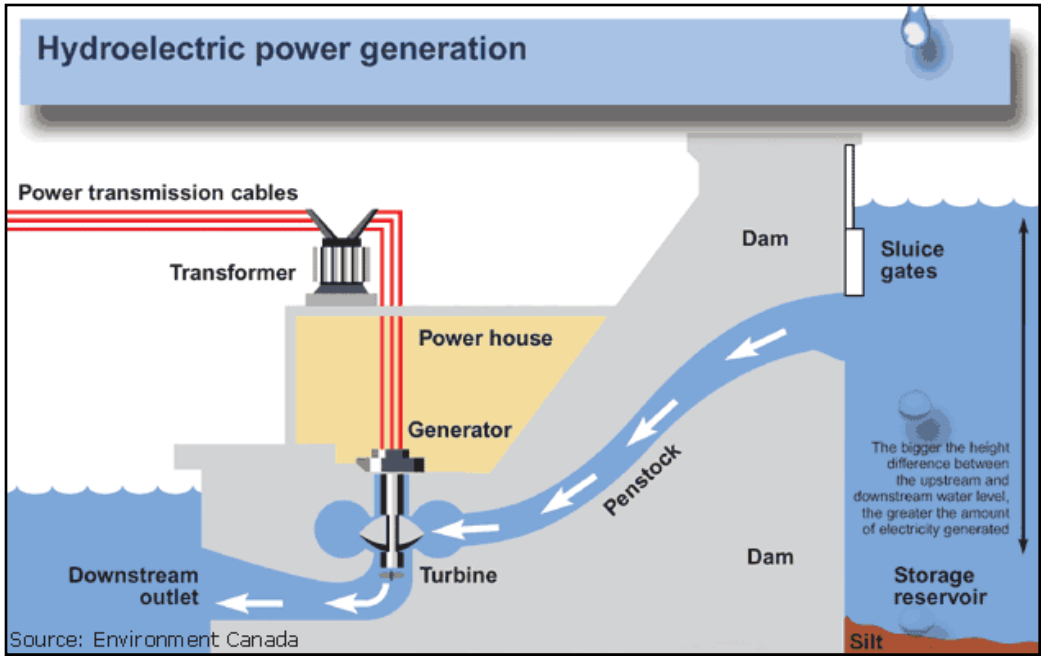
Wind

Hydro-electrical

Ocean

Wave

Geothermal



Forms of Renewable Energy

	Coal	Wind-grid connected with no storage	Grid connected Solar PV without storage	Hydro	Biomass	Nuclear	Gas Turbines
Installation cost Rand per M/W	R 16 milion/MW	R 16 milion/MW	R 63 milion/MW	R 1 milion/MW excluding the dam	R 17 milion/MW	The big question. More than coal!! Possilbly about R 25 milion/MW	R 3.5 milion/MW
Power reliability/availability	90-95% Very reliable	25-40% Intermittent	20-25% Intermittent	Depends on installation (10 – 95 %)	90 – 95% Very reliable	90 – 95% Very reliable	Used for peaking – available on demand
CO_2 emissions	1kg CO_2/kg coal burt	Low	Low	Medium (a dam releases methane)	Low	Low	High
Operating and fuel costs	high	low	low	low	Medium to high	High	Very High
Life span	50 years	25 years	20+ years	50 years	25+ years	50 years	40 years
Period for installation in years	6-8 years	2-4 years	2-3 years	Site dependent 3-6 years	1-2 years	8-10 years	1-2 years
Base load or peaking power?	Base	Intermittent	Intermittent	Could be base or peaking. Peaking in SA	Base	Base	Peak

Ref. CRSES 2008

Renewable Power Plant vs. Non-Renewable Power Plant

Decisions

Will have to be made whether to invest in

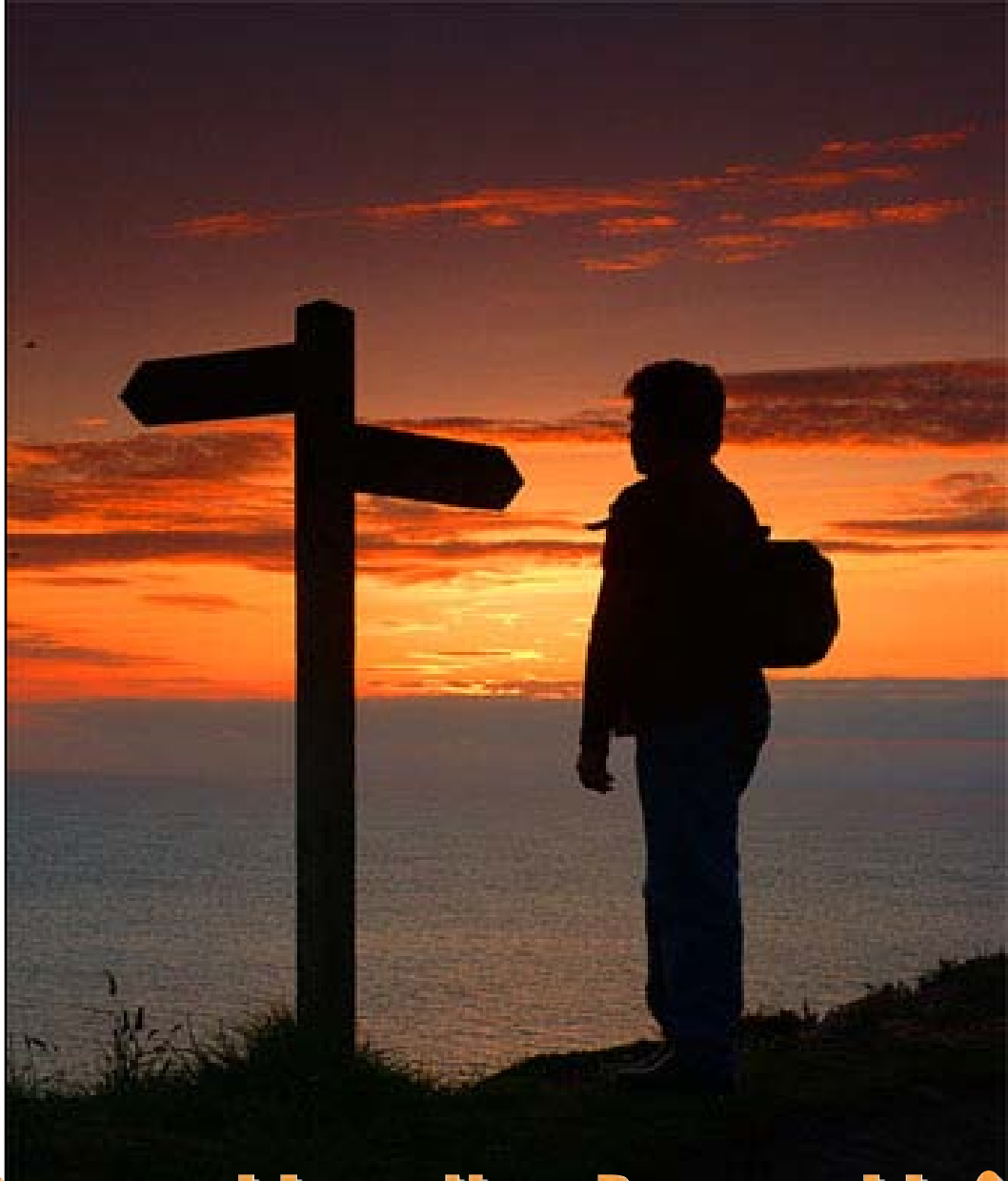
renewable energy
or to carry on

burning **fossil fuels** and paying

the **environmental cost**

that is linked to releasing more and more

greenhouse gasses



Decisions – Renewable or Non-Renewable?

The EU is working to establish an energy policy

• 2020 renewable energy 20% of the EU's energy consumption

EU Member State	2005 Figure	2020 Target	% To cover:
1 United Kingdom	1.3%	15%	13.7%
2 Denmark	17%	30%	**13%**
3 Ireland	3.1%	16%	12.9%
4 France	10.3%	23%	12,7%
5 Germany	5.8%	18%	12.2%
6 Italy	5.2%	17%	11.8%
7 Netherlands	2.4%	14%	11.6%
EU	**8.5%**	**20%**	**11.5%**

Ref. http://www.energy.eu/#renewable

Assignment

In South Africa energy is mainly generated by burning fossil fuels (e.g. coal). Burning fossil fuels generate greenhouse gasses like CO_2. Excessive release of greenhouse gasses causes global warming, resulting in climate change.

Electricity generated by burning coal causes almost 0.915 kg/kWh of CO_2 to be released.

Select any ten appliances in your home and complete the table below over a period of 5 days.

		Power		Usage time per day	Energy consumption per day	Number of days	Total Energy consumption
Appliance	Amoun t	Watt	kilowatt (kW)	hour (h)	kWh		kWh