

# **Environmental Management**

## **Key Terms:**

**Energy and the Environment**

# Fossil Fuel

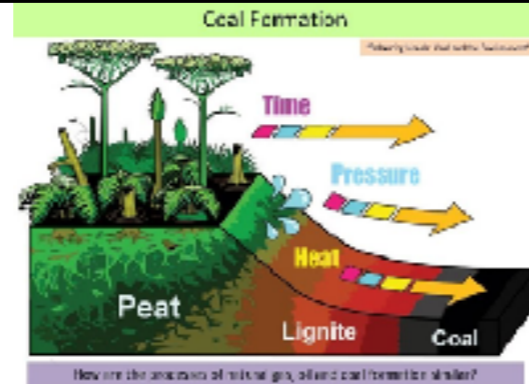
A carbon-based fuel, formed over many millions of years from the decay of living (plants and animals) matter.

# Peat and Coal Formation

Peat forms in wetland (e.g. bogs) where plant material has not been able to fully decay due to acidic and anaerobic conditions.  
Most modern peat bogs formed 12,000 years ago in high latitudes after the glaciers retreated at the end of the last ice age.  
As peat gets covered, the pressure and heat increase. At the right temp and pressure the peat slowly turns to coal. This takes millions of years.

# Peat and Coal Formation

(<https://slidetodoc.com/renewable-replaced-if-all-natural-resources-are-provided/>)



# Coal as an Energy Source

(<https://slidetodoc.com/renewable-replaced-if-all-natural-resources-are-provided/>)

- Pros:
- Affordable (coal price stable due to abundance)
  - Easy to burn and transport
  - High energy on burning
  - Reliable energy source
- Cons:
- Produces large amounts of CO<sub>2</sub>, SO<sub>2</sub>, NO and causes acid rain
  - Non renewable
  - Mining it can be dangerous

# Natural Gas and Oil Formation

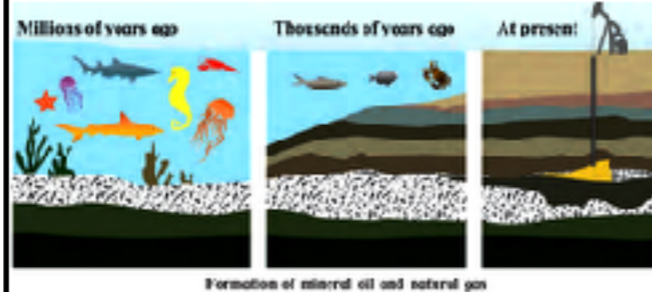
Organic material (plant and animal debris/remains) falls to the bottom of the ocean, where it starts to rot. Over time the decomposing matter starts to get covered by other layers of sediment (sand and soil). As the layers build up, so does the pressure and temperature. Caught in an oxygen-free, high pressure, high temp environment, the remains are turned into oil and natural gas. It seeps up through the permeable layers of rock until it reaches the surface or an impermeable layer of rock where it remains trapped and forms a reservoir.

# Energy Resources: Demand

- Increasing demand- Industry, domestic, transport:**
- increasing population size
  - increasing industrialisation and urbanisation
  - improvements in standards of living and expectations.
- Affecting factors:** economic, climate
- Reducing consumption:** housing insulation, turn off electrical devices/lights, energy efficient devices, alternative fuels/energy from waste, financial incentives/grants to upgrade to efficient technology/cars/designs etc., educating population, transport/building policies etc. - REDUCE, REUSE, RECYCLE

# Natural Gas and Oil Formation

(<https://www.sarthaks.com/1789299/how-is-mineral-oil-formed>)



# Energy Resources: Supply

**Renewable:** geothermal power, hydroelectric power, tidal power, wave power, wind power, solar power, biofuels, e.g. bioethanol, biogas, and wood.  
**Non-renewable:** oil, coal, natural gas, nuclear power (and sometimes wood)

# Renewable

An item or resource that will not be used up or can be replaced.

# Electromagnetic Induction

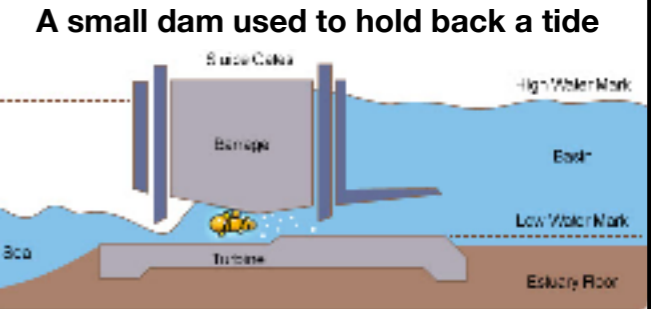
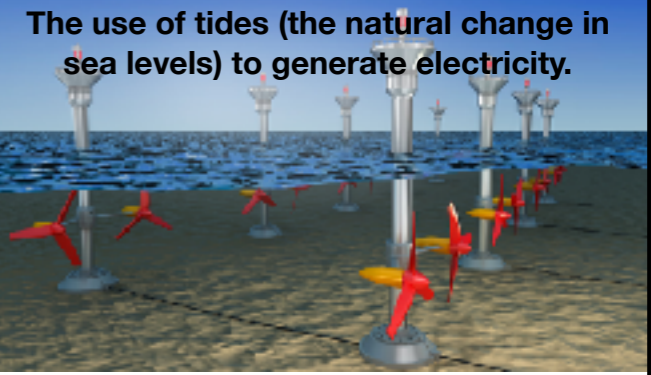
A process used for generating electricity that uses rotating, electricity-conducting, metal coils placed close to a magnet.  
Most electricity is generated this way.

Generator

A machine that converts mechanical energy (such as movement) into electrical energy.

### Tidal Power

(<https://www.clean-energy-ideas.com/hydro/tidal-power/what-is-tidal-power-tidal-energy-explained/>)



Turbine

A machine, often containing fins, that is made to revolve by the use of gas, steam or air.

### Tidal Barrage

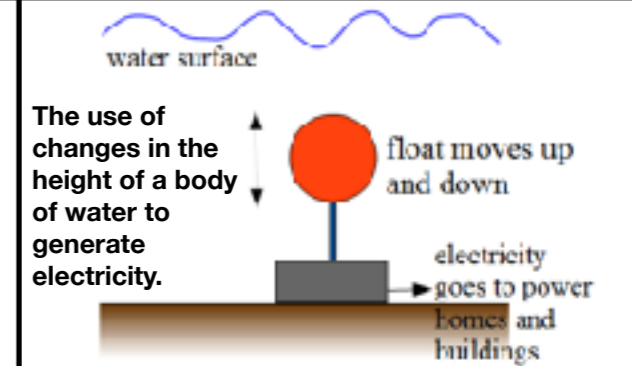
(<https://www.emsd.gov.hk/energyland/en/energy/renewable/tidal.html>)

Burner

A receptacle used to hold fuel as it is burned.

### Wave Power

(<https://www.real-world-physics-problems.com/wave-energy-for-kids.html>)

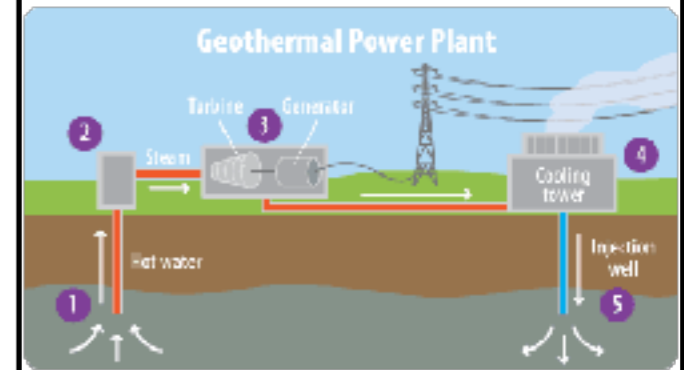


Boiler

A vessel used to heat water to convert it into steam

### Geothermal Power

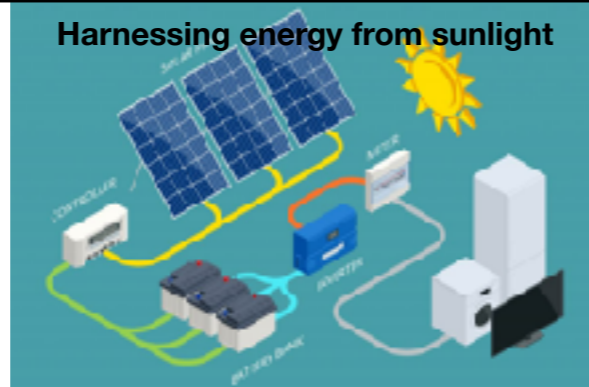
(<https://archive.epa.gov/climatechange/kids/solutions/technologies/geothermal.html>)



### Solar Power

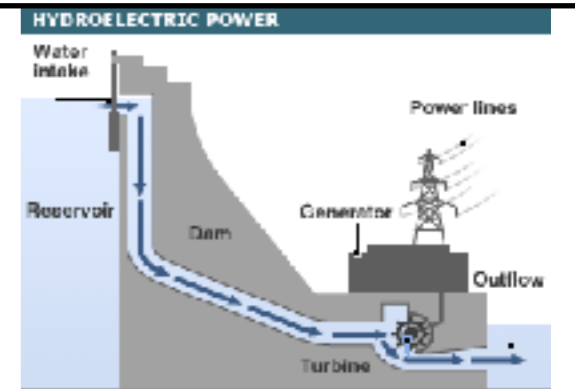
(<https://sunbadger.com/simple-solar-system/>)

### Harnessing energy from sunlight



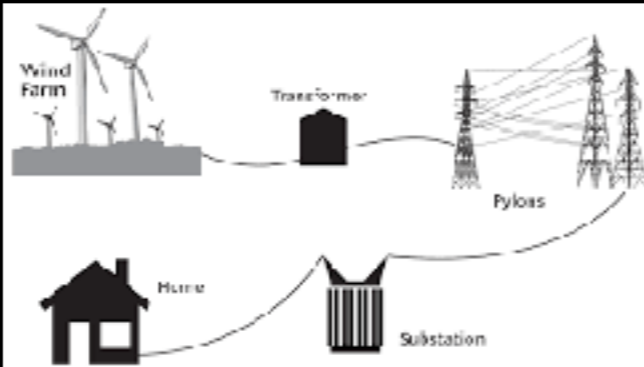
### Hydroelectric Power

([http://news.bbc.co.uk/1/shared/spl/hi/sci\\_nat/06/global\\_energy/html/hydrowind.stm](http://news.bbc.co.uk/1/shared/spl/hi/sci_nat/06/global_energy/html/hydrowind.stm))



## Wind Power

(<http://www.cees.org.uk/cms/uploads/pdfs/ActivitySheets-WindPower.pdf>)



## Biofuels: Cons

Cons:

- 1st Gen pushes up the price of food left for eating.
- Crops use a lot of water and land
- Mono-crop farming and fertilisers = soil erosion, loss of natural ecosystems and extra N<sub>2</sub>O (nitrous oxide) in the atmosphere.
- Fossil fuels used in production of biofuels = GHGs + pollutants that affect local communities
- Algae need lots of H<sub>2</sub>O, N and P = fertilisers.
- Produce CO<sub>2</sub> when burnt

## Biofuels

(<https://edgy.app/consumers-pay-extra-biofuels>)

E.g. bio-ethanol, biogas and wood.



## Non-renewable

An item or resource that exists in a finite amount that cannot be replaced.

## Biofuel 1

**Bio = living, fuel = energy**

**Bioethanol:** fermentation of sugar in crops (1st generation crops). Substitute for petroleum.

**Biogas:** gases (mainly methane) from decomposition of organic matter in aerobic environment.

**In LECDs:** burning animal dung or wood is a direct source of heat for warmth and/or cooking.

## Transport Policies

Current government initiatives:

- regulations regarding exhaust air quality
- restrictions on where vehicles can go
- restrictions on when vehicles can be on the road
- fuel taxation
- travel surcharges for peak time, central zone etc.
- improved public transport: reliable/cheap/widespread
- improving routes for pedestrians and cyclists
- encouraging car-sharing
- grants for new fuel-efficient or electric cars

## Biofuel 2

**1st Generation:** food related sources, E.g. corn/maize, wheat, willow, Jerusalem artichokes etc. High carbon content, so releases CO<sub>2</sub> when used as a fuel

**2nd Generation:** made from leftovers of food crops, e.g. husks, wood, straw, waste oils, animal fats etc. Emits CO<sub>2</sub> when a fuel, but less than 1st gen.

**3rd Generation:** Produced using micro organisms, e.g. Algae. Carbon neutral - uses as much CO<sub>2</sub> as it emits.

**4th Generation:** made from genetically engineered crops. Carbon negative - uses more carbon than emits.

## Hydraulic Fracking

**The process of obtaining oil or gas from shale rock.**

A vertical hole is drilled down, often 2-3km deep, and water, chemicals or sand are pumped through under pressure. The shale rock is fractured, allowing the oil or gas to escape the rock and come up to the surface.

H<sub>2</sub>O: plentiful, easy to handle

Chemicals: can assist process, stop blockages, toxic  
Sand: the **proppant**

## Biofuels: Pros

**Pros:**

- Reduces reliance on fossil fuels
- Gives countries with no fossil fuels of their own economic (and political) security
- Easy to source - Infrastructure already there to grow 1st Gen crops, 2nd Gen sources easily available (and don't affect food economy), and 3rd Gen algae is easy to cultivate.
- simple to convert crops to energy.
- bioethanol/wood = growing, biogas = recycling waste products. Both = less CO<sub>2</sub>

## Proppant

A material, such as sand, used to keep cracks in the shale rocks open to allow gas or oil extraction.

<div data-bbox="87 65 672 404" style="border: 2px solid orange; padding: 10px; text-align: center;"> <h2 style="margin: 0;">Fracking</h2> <p style="margin: 0; color: green;">Pros and cons</p> </div>	<p>Pros:</p> <ul style="list-style-type: none"> <li>- increases supply of oil&amp;gas/reduces imports</li> <li>- less polluting than coal</li> <li>- shale below water table so minimal polluting</li> <li>- creates jobs</li> </ul> <p>Cons:</p> <ul style="list-style-type: none"> <li>- risk of polluting the water table</li> <li>- toxins from chemicals released locally - health</li> <li>- extra strain on local water supply - uses a lot</li> <li>- visual pollution &amp; destruction of local habitats</li> <li>- risk of tremors and earth quakes/longterm impact not known.</li> </ul>	<div data-bbox="1404 65 1989 404" style="border: 2px solid orange; padding: 10px; text-align: center;"> <h2 style="margin: 0;">Energy Resources: Sourcing</h2> </div>	<p><b>Considerations for which energy source to use:</b></p> <p><b>Economic factors:</b> local supply, world demand, import costs, cost of technology</p> <p><b>Social factors:</b> supporting local industries, investment in new industries/technologies, decline in other, change local health/education, decrease/increase reliance on another country, change national 'balance of payments', change political relations,</p> <p><b>Environmental factors:</b> pollution, changes to ecosystems, visual impact.</p> <p><b>Not all energy is consistently available, so might use several sources e.g. solar and fossil fuels</b></p>
<div data-bbox="87 474 672 813" style="border: 2px solid orange; padding: 10px; text-align: center;"> <h2 style="margin: 0;">Fossil Fuels:</h2> <p style="margin: 0; color: green;">Pros</p> </div>	<ul style="list-style-type: none"> <li>- Plentiful in some locations</li> <li>- Extraction provides jobs</li> <li>- Is a major source of income for some countries</li> <li>- Can give your country power over others</li> <li>- Technology and infrastructure to get it to places and use it already exists in most countries</li> <li>- Easy to store and transport</li> <li>- oil - can be made into a number of different products, easier to extract than coal, less polluting than coal.</li> </ul>	<div data-bbox="1404 474 1989 813" style="border: 2px solid orange; padding: 10px; text-align: center;"> <h2 style="margin: 0;">Fossil Fuels:</h2> <p style="margin: 0; color: red;">Cons</p> </div>	<ul style="list-style-type: none"> <li>- Releases a lot of CO2 and other toxic gases, causing climate change and acid rain</li> <li>- Extraction causes damage and pollution to local area</li> <li>- Supply is limited</li> <li>- Price is volatile, dependent on supply and demand, and withholding it or flooding the market can be used as a weapon against other countries</li> </ul>
<div data-bbox="87 870 672 1210" style="border: 2px solid orange; padding: 10px; text-align: center;"> <h2 style="margin: 0;">Nuclear Power:</h2> <p style="margin: 0; color: green;">Pros</p> </div>	<ul style="list-style-type: none"> <li>- Doesn't produce CO2</li> <li>- Small amounts of fuel = large amounts of energy</li> <li>- Employs lots of people at power plants</li> </ul>	<div data-bbox="1404 870 1989 1210" style="border: 2px solid orange; padding: 10px; text-align: center;"> <h2 style="margin: 0;">Nuclear Power:</h2> <p style="margin: 0; color: red;">Cons</p> </div>	<ul style="list-style-type: none"> <li>- Risk of radiation leakage</li> <li>- waste cannot be recycled and remains dangerous for 100,000+ years</li> <li>- Limited supply of uranium</li> </ul>
<div data-bbox="87 1267 672 1606" style="border: 2px solid orange; padding: 10px; text-align: center;"> <h2 style="margin: 0;">Geothermal Power:</h2> <p style="margin: 0; color: green;">Pros</p> </div>	<ul style="list-style-type: none"> <li>- Doesn't produce CO2</li> <li>- Unlimited supply as all power/heat comes from the Earth.</li> <li>- Easy to access in some places</li> </ul>	<div data-bbox="1404 1267 1989 1606" style="border: 2px solid orange; padding: 10px; text-align: center;"> <h2 style="margin: 0;">Geothermal Power:</h2> <p style="margin: 0; color: red;">Cons</p> </div>	<ul style="list-style-type: none"> <li>- Expensive to install</li> <li>- Only certain areas have suitable conditions to utilise it</li> </ul>
<div data-bbox="87 1663 672 2003" style="border: 2px solid orange; padding: 10px; text-align: center;"> <h2 style="margin: 0;">Hydroelectric Power:</h2> <p style="margin: 0; color: green;">Pros</p> </div>	<ul style="list-style-type: none"> <li>- Doesn't produce CO2</li> <li>- Water can be reused for other purposes</li> <li>- Easy to access in some places</li> </ul>	<div data-bbox="1404 1663 1989 2003" style="border: 2px solid orange; padding: 10px; text-align: center;"> <h2 style="margin: 0;">Hydroelectric Power:</h2> <p style="margin: 0; color: red;">Cons</p> </div>	<ul style="list-style-type: none"> <li>- Building dams impacts natural flow of water, and can stop it getting to other places</li> <li>- Can ruin local communities, natural environment and local ecosystems</li> </ul>

<p>Tidal Power: <b>Pros</b></p>	<ul style="list-style-type: none"> <li>- Doesn't produce CO2</li> <li>- Tidal movements not depended on weather conditions and are pretty predictable and constant</li> <li>- Renewable</li> </ul>	<p>Tidal Power: <b>Cons</b></p>	<ul style="list-style-type: none"> <li>- Limited to specific coastal areas</li> <li>- Impacts on tourism and local fishers</li> </ul>
<p>Wave Power: <b>Pros</b></p>	<ul style="list-style-type: none"> <li>- Does not produce CO2</li> <li>- Renewable</li> </ul>	<p>Wave Power: <b>Cons</b></p>	<ul style="list-style-type: none"> <li>- Limited to specific areas</li> <li>- Currently not very efficient, so large amount of resources needed.</li> </ul>
<p>Solar Power: <b>Pros</b></p>	<ul style="list-style-type: none"> <li>- Does not produce CO2</li> <li>- Renewable</li> <li>- Predictable and consistent in some places</li> </ul>	<p>Solar Power: <b>Cons</b></p>	<ul style="list-style-type: none"> <li>- Only efficient under certain weather conditions</li> <li>- Energy can only be generated in daylight hours</li> <li>- visual pollution, and potentially damaging to local ecosystems</li> </ul>
<p>Wind Power: <b>Pros</b></p>	<ul style="list-style-type: none"> <li>- Does not produce CO2</li> <li>- Renewable</li> </ul>	<p>Wind Power: <b>Cons</b></p>	<ul style="list-style-type: none"> <li>- Limited to specific areas</li> <li>- Energy can only be generated in certain weather conditions</li> <li>- Visual pollution</li> <li>- Uses a lot of space</li> </ul>
<p>Energy Resources: Government Policy to Reduce Consumption</p>	<p><b>Regulations:</b> building, minimal standards on electrical performance, incandescent bulbs, CFCs  <b>Grants and financial incentives:</b> insulation, heat pumps, solar panels, cars  <b>Transport policies:</b> exhaust regulations, no vehicle zones, tax on fuel, peak time surcharges, improved public transport, improving cyclist/pedestrian routes, encourage car sharing, car use restrictions, grants for newer/more efficient/electric vehicles  <b>Tax:</b> fuel duty and VAT (taxes), road tax, congestion charge  <b>Education:</b> public awareness campaigns, changes to school curriculums.</p>	<p>Oil Pollution</p>	<p><b>Main causes of marine oil spills:</b> leakage from off-shore oil rigs, leaks in oil pipelines, collision and damage to oil tankers. <b>But there is also:</b> ground seepage, small spills, washing/cleaning boats  <b>Impact:</b> damage/death to marine life, floating oil stops phytoplankton photosynthesising below surface, reduces oxygen in water, impact to food web, extinction of species in a locality, ruining habitats, impact on local economy - fishing/tourism.  <b>Management:</b> regulations, tanker design  <b>Clean up:</b> floatation booms, detergent sprays, skimmers. by hand</p>