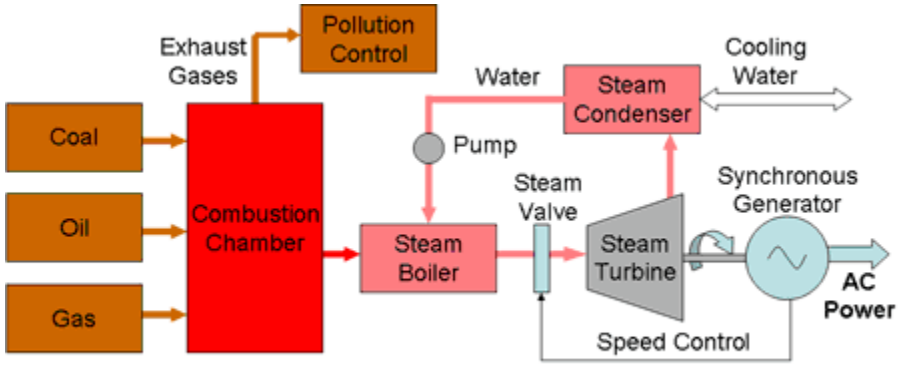
Conventional Electrical Energy Generation in the Caribbean and Around the World

Over 65% of the world's electrical energy used today is generated by steam turbine generators burning fossil fuels as their source of energy and large scale fossil fuelled plants provide most of the world's base load generating capacity. The electricity generation process is described in detail in the section about steam turbines. This page considers issues concerning the fuel.



Fossil Fuel Powered Steam Turbine Electricity Generation

Fuels

Fossil fuelled plants use either coal (60%), oil (10%)or gas (30%) in purpose designed combustion chambers to raise steam. These are all non-renewable resources whose supply will ultimately be exhausted. The energy content of these fuels and their variants is shown on theEnergy Resources page

Oil is probably the most convenient fuel and thirty years ago it accounted for 30% of the consumption but it has mostly been replaced by coal as oil prices have risen faster than the price of coal due to insecurities of supply. At the same time, the premium value of oil for transportation and chemical uses, rather than for just burning it to extract its calorific value, has also been recognised.

Coal is the least convenient. Its calorific content, on average, is less than half that of the other two fuels. Handling and transporting it is more difficult and it produces large quantities of residues, ash and greenhouse gases, some of which are toxic, depending on the quality of the coal.

Electricity Generating Plant

Drax Power Station

As a benchmark for comparison, in the UK, one power station, Drax, produces 7% of of all the country's electricity. It burns 13 million tons of coal a year in 6 X 660 MW coal fired generators providing a total of 4000 MW capacity.

Plans were in place to use 10% biomass co-firing with coal. This would require 400,000 hectares (1,000,000 acres) of elephant grass, rapeseed or 750,000 hectares of short-rotation willow to produce the 1.5 million tons required.

Recently however the target utilisation has been cut back to 1% since the total costs of the biomass fuel including transportation and processing is about three time the cost of coal.

Efficiencies

Taking into consideration the three conversion processes, thermal, mechanical and electrical, used to extract the energy from fossil fuels the overall efficiency of a modern fossil fuelled electrical power generating plant will be about 40%. This means that 60% of the energy input to the system is wasted. Efficiencies may be as low as 30% in some older plants.

Not all plants are typical however and the actual efficiencies obtained depend on the fuels used and the technical sophistication of the generating plant and processes.

Environmental Issues

- **Air Quality**

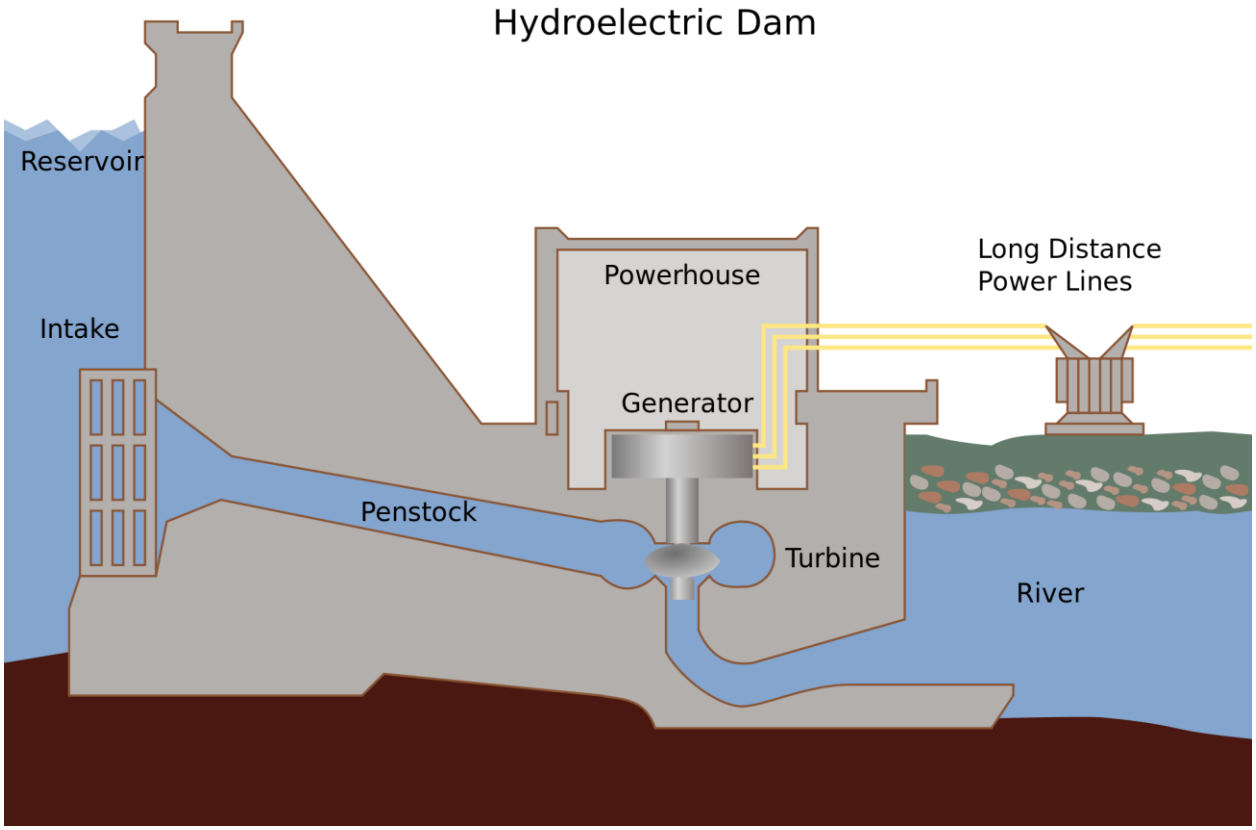
  The combustion process is notorious for its potential to release unpleasant gases and solids into the atmosphere. Naturally occurring fuels are not pure by any standards and contain uncontrolled amounts of other elements and compounds which may be left as residues when the fuel is burned. The combustion process itself can create noxious gases from the fuel or from impurities in the fuel if not properly controlled.

  Coal is considered to be a particularly dirty fuel, releasing from combustion, Sulphur Dioxide (SO_2) and Oxides of Nitrogen (NO_x), which both contribute to acid rain, as well as particulates which may contain trace metals such as Cadmium, Mercury and Lead.

  Fortunately methods for containing these pollutants have been developed over the years and most nations enforce their use by setting basic environmental standards. There is of course a cost involved in implementing the necessary controls and this all adds to the price of electricity.

- **Global Warming**

  Another unavoidable consequence of burning any fossil fuel is that the process generates greenhouse gases, mostly Carbon dioxide (CO_2) but also Sulphur dioxide ($SO_{2)}$ and Methane (CH_4), all of which contribute to global warming. If we want to eliminate this risk to the environment, we must either find alternative ways of generating electricity or find some way of capturing the massive quantities of CO_2 generated by the world's fossil fuelled electricity generating plants. While a start has been made, we are far from having practical solutions to these problems.



What is energy efficiency?

Energy efficiency is "using less energy to provide the same service".
There are other definitions, but this is a good operational one.
The best way to understand this idea is through examples:

When you replace a single pane window in your house with an energy-efficient one, the new window prevents heat from escaping in the winter, so you save energy by using your furnace or electric heater less while still staying comfortable. In the summer, efficient windows keep the heat out, so the air conditioner does not run as often and you save electricity.

When you replace an appliance, such as a refrigerator or clothes washer, or office equipment, such as a computer or printer, with a more energy-efficient model, the new equipment provides the same service, but uses less energy. This saves you money on your energy bill, and reduces the amount of greenhouse gases going into the atmosphere.

Energy efficiency is not energy conservation.
Energy conservation is reducing or going without a service to save energy.
For example: Turning off a light is energy conservation. Replacing an incandescent lamp with a compact fluorescent lamp (which uses much less energy to produce the same amount of light) is energy efficiency.
Both efficiency and conservation can reduce greenhouse gas emissions.

http://www.iepa.com/wheeling.asp

http://www.freedrinkingwater.com/water-education/water-health.htm