TAP 606- 1: Power station efficiencies

Teachers may find it useful to have some web references to look at efficiencies of power stations

These were valid in October 2005

http://aie.org.au/Content/NavigationMenu/Resources/EnergyData/Power_Station_Effic.htm

from

http://www-g.eng.cam.ac.uk/mmg/environmental/young2.html The fifty percent nuclear power station

“The economics of the (Gas Turbine Modular Helium Reactor) GT-MHR is also very attractive due to its unique design, which offers high plant efficiency, modularization and simplicity.

The 600 MW (t) GT - MHR has a plant efficiency of about 48%, which is 10% over its predecessor, and is about 16% higher than that today's commercial nuclear power plants. A four unit GT-MHR plant has 2400 MW total thermal power, which generates about 1128 MW electricity. For the same amount of thermal power, a light water reactor plant only generates about 777 MW (e), a difference of 351 MW (e). If the electric rate is $ 0.10124 per kWh,

The 351 MW (e) output difference for one day is about $ 76. In addition to the electricity generation difference, the high plant efficiency also increases the fuel efficiency of the GT-MHR. For the same power output, the GT- MHR is expected to consume 35% less uranium. Furthermore, the environmental advantage of producing less radioactive waste, the high fuel efficiency can lower the handling and manufacturing cost of the fuel. The GT-MHR also has an option to be fuelled with the weapons plutonium which could be readily available.”

http://www-g.eng.cam.ac.uk/mmg/environmental/young2.html High efficiency power generation with low emissions

Quote from Prof John Young:

"The world's first power station generating electricity for public use was built in 1882 in Holborn Viaduct in London. Steam raised in a boiler (coal-fired with manual stoking, of course) was used to drive a reciprocating steam engine and the station efficiency was probably about 6%. Then came the more efficient steam turbine invented by Sir Charles Parsons (a Cambridge educated engineer) and this dominated the 20th century. Both coal and oil were used as fuel and by 1975 the efficiency of the best power stations was around 40%. In the 1980's, the discovery of large natural gas reserves, the development of heavy-duty industrial gas turbines and the de-regulation of the electricity supply industries all contributed to the development of the gas and steam turbine 'combined-cycle' resulting in a current best station efficiency of just under 60%. This huge efficiency improvement of almost 20 percentage points has occurred over the last 15 years and is an astonishing engineering achievement not fully appreciated by the public."

http://www.gepower.com/about/press/en/articles/baglan_bay_article.pdf (NB 1.73 Mb PDF)

“GE’s H System is the first gas turbine combined-cycle system capable of breaking the 60% fuel efficiency barrier. Why is that so important? Fuel is the single largest cost of running a power plant, and even a 1% gain in thermal efficiency can mean as much as a $15 million to $ 20 million saving over the life of a typical plant of this size.”

Huntley power station New Zealand

“A new high efficiency combined cycle gas turbine power plant to be built at the existing Huntley site. This project is known as the Huntley Energy Efficiency Enhancement Project (Huntley e3p). The new power plant will utilise the latest thermal generation technology to generate up to 365 MW of electricity, bringing the potential generation at the Huntley site to 1365 MW. The Huntley e3p plant will be approximately 50% more energy efficient than the current generating technology at Huntley. While the existing station uses a simple steam turbine to generate electricity, the Huntley e3p uses a gas turbine first and then also converts what would otherwise be waste heat to electricity using a steam turbine.”

http://www.makingthemodernworld.org.uk/learning_modules/geography/06.TU.06/?section=6

“For example, a typical coal fired power station converts 3.45 MW of chemical power from coal into only 1.2 MW of electrical power. The difference (2.2 MW) is lost as heat. In reality it would be more accurate to describe a power station as a generator of heat rather than a generator of electricity!