Chapter 8 – Energy in the UK

Energy in the UK.

- *Wind Turbines*. Offshore Sussex Rampion Array. Onshore – legislation changes. The National Park. Sites in Brighton & Hove. Cooperatives, other medium sized companies and large companies.

We have said that big is beautiful for wind turbines, especially offshore, because of the greater energy produced. The pictures include an artist's indication of what the Rampion Offshore Array will look like.

There are many areas in and around Brighton & Hove where wind turbines could be erected, for example near Shoreham Power Station. The situation used to be that planning procedures had stopped or considerably delayed the introduction of onshore wind turbines in England (much less so in Wales and Scotland), so England was the most difficult place in Europe to erect wind turbines.

A part of the reason the Vestas factory for the production of wind turbines in the Isle of Wight was closed was because of local opposition to wind turbines. The planning regime has now changed, and it is well feasible that a large number of wind turbines, by many companies and cooperatives, small, medium and large, can now be put in place to provide the energy we need. It is now unlikely that wind turbine construction will take place in the South Downs National Park.

- *Localising food production*. Food airfreight and Mexican lettuce.
  Aircraft are likely to use fuel from oil for a long time to come (small nuclear reactors to propel aircraft have been built successfully, but the project was abandoned and long-term there are big safety issues here). We know the oil is running out, so it is prudent at first to increase aircraft fuel efficiency and also to limit use. I remember seeing in a supermarket a local and a Mexican lettuce on the shelf at the same price.


We need to change our habits so we consume local food to reduce transport costs, especially airfreight.



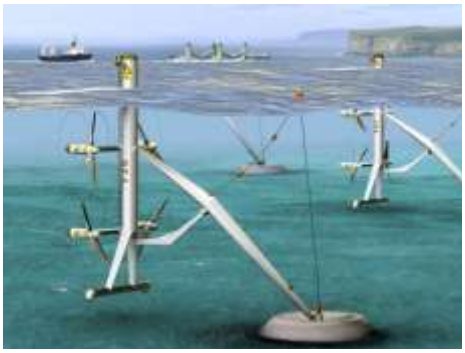
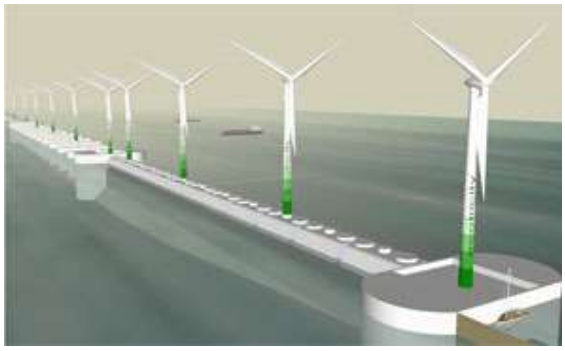
- *Solar thermal panels* – a local industry?
  There are now many local companies providing solar thermal panels on roofs, and it is even possible as do-it-yourself. It is still more efficient to insulate your loft, reduce drafts, put in an energy-efficient gas boiler and take your TV and PC off standby at night, but this is the next best thing.



- *Photovoltaics* – the promise of the near future.


Photovoltaics are wafers sometimes containing silicon which turn sunlight into electricity. They can be put on your roof and the technology is advancing rapidly so that in the not-too-distant future they will be economical means of supplying electricity to your home compared with the electricity grid. They can also be used to export electricity to the local distribution system.

- *Tidal power off Brighton & Hove. The Severn barrage*.
  Tidal power generators could be attached below water to the towers of the projected Sussex Rampion Offshore Wind Power Array, to provide further energy from the current in the Channel.

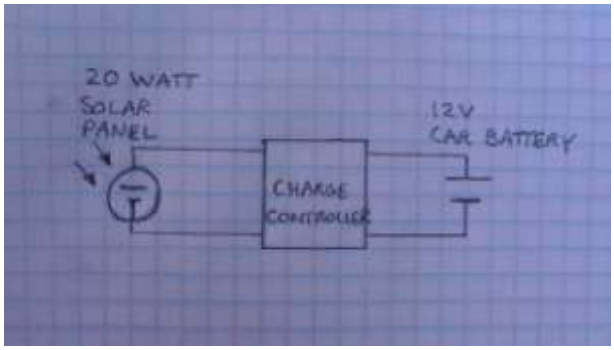
The 'Two lagoons' solution for the Severn Barrage would not only provide over 8 giawatts of electricity for the South of England, thereby reducing grid transportation inefficiencies from the North of the UK, it could also act as a site for wind turbines and the lagoons could act as storage for wind turbine energy, say at minimum consumption at night, should such energy be introduced on a massive scale, as has already been done in Denmark and will be in Sweden.

- *Oil and gas depletion in Brighton & Hove*. Shoreham Gas-Fired Station. Gas depletion from the North Sea, gas from Norway, from Algeria and gas for Europe from Russia. Competition for gas resources. Japan. Oil depletion. Dependency of transport.

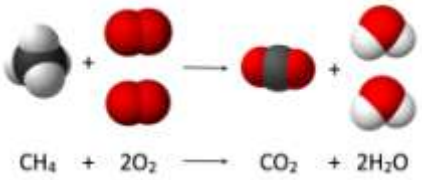

Most electricity generated near Brighton & Hove comes from Shoreham gas-fired power station. The gas produced from the North Sea is already in steep decline. The gas we need could come from Norway, but other European countries want this too and we were not providing the Norwegians with long-term contracts, so, quite simply, this had to change. Algeria is a major source of gas which would be brought here in tankers in liquefied form. There will also be competition for Algerian gas, for example from Japan. Europe is dependent on Russian gas, supplies of which have been intermittent. Global gas production will reach a plateau in 2013 and thereafter drop steeply.

Just under 40% of our oil consumption goes in transportation.

- *Electric vehicles.*
  We do not have the electricity generating capacity, or the fuel reserves, to transfer all oil consumption in transport to electricity use in vehicles. To maximise the use of our current capacity for this use on a large scale, electricity charge-up will have to be at low electricity generation time at night.



- *Coal*. The effect on climate. Government policy. Chinese policy.
  Coal is less efficient than oil and gas, both in terms of extraction, transportation and comparable burn efficiency. Shown below are the chemical reactions for burning methane and petrol. To generate the same amount of heat, coal liberates large amounts of the greenhouse gas carbon dioxide compared with oil and gas.

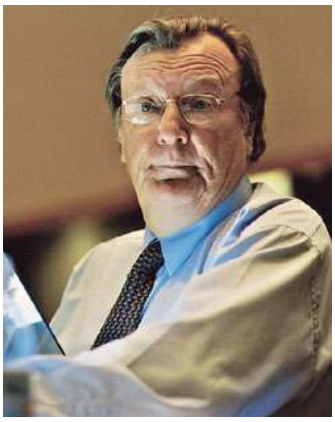


$$2C_8H_{18} + 25O_2 \rightarrow 18H_20 + 16CO_2 + \text{energy}$$

(octane + oxygen → water + carbon dioxide + energy)

  The UK government is committed to decommissioning coal-fired stations and not introducing new ones unless means to dispose of the carbon dioxide is in place. China, which does not have significant oil reserves but has coal in abundance is increasing production coal-fired stations by 8% a year, currently without disposal of the carbon dioxide.

- *Thorium* – a better alternative.
  We have already indicated that compared with uranium, provided one is not concerned with weapons production, thorium reactors make more sense than uranium or 'breeder' reactors using plutonium. There are various sorts of such reactor suggested and operational. Shown below is Carlo Rubbia's scheme for a thorium 'energy amplifier'.



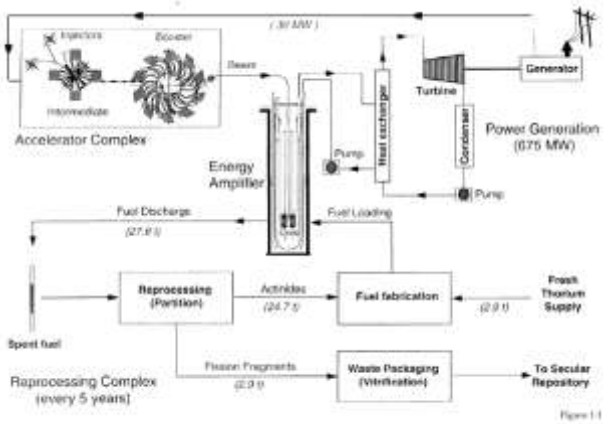


Figure 1. Rubbias Fast Energy Amplifier.

- *Thermonuclear* – is there any time left?

Thermonuclear reactors have been at the experimental stage since project Zeta began in the UK in 1954. The ITER megaproject for a fusion reactor is sited at Cadarache in France. There is plenty of deuterium present in seawater, so on the naïve face of it, this is almost an unlimited amount of energy available by this means. Because of the high temperatures and the expensive high-technology containment features of such devices, and the question of maintainability, it is questionable that such solutions will be of use before the major climate crises discussed later really hit.

Energy Efficiency.

- *An energy efficient National Grid*.
  High voltage direct current electricity transmission is more efficient than AC transmission – and 1 megavolts is now possible. Grid transmission losses reduced this way would enable us to save substantial amounts of energy in transmission. This will be used to transmit electricity from geothermal sources in Iceland to Scotland. The UK loses 35% of electrical energy in transmission, or in refining or extraction.

The longest undersea cable in 2009 was the NorNed link between Feda in Norway and Emmshaven in the Netherlands, a distance of 580km. It allows Norway to export its spare hydropower. This works at ±450kV DC, is rated at 700MW and cost 550M Euros. It started operation in May 2008. It has had a number of breakdowns but has been up for most of the time. This earned its operators 50M Euros in the first two months of operation.

The Iceland Scotland link is pushing the distance limit by 40% but it is not impossible or even wildly uneconomic. NorNed is not the highest voltage undersea cable. The SAPEI link from Sardinia to the Italian mainland runs at ±500kV and the 1100MW proposed power of the Iceland Scotland link is not the highest power undersea link. The cross channel link to France runs at 2000MW and the undersea portion of the Sumatra-Java link has been running at 3000MW from 2011.

The first commercial superconducting power link was installed on Long Island, America in 2008, 575MW at 138kV but only 600m long. It used a cuprate superconductor cooled with liquid nitrogen.

- *Smart grids. Efficient appliances. Standby*.
  Smart grids which turn off appliances from standby in your home when you are not using them and don't need them are now implemented. A problem is one of privacy, in that the electricity companies can observe which appliances you are using and pass it on to other, say commercial, organisations.

You can check the efficiency of your appliances by using a smart meter. If you turn off your PC at night, so it is not on standby – especially the monitor, and if you can do the same with your TV without having to reprogram the video recorder each time, then you can save on average ¼ off your electricity bill.

- *Local production, local consumption*.
  Consuming locally produced food substantially reduces transportation costs. We live in a global economy, but still many consumer goods can be produced locally comparable in cost and quality to those transported from across half the world.

- *Energy from waste. Bioreactors*.
  Methane from waste can be burnt, producing heat and electricity. The Newhaven incinerator serving Brighton & Hove produces poisonous dioxins in the reduced temperature of the stack to capture the heat generated and convert it to electricity, and generates immense amounts of poisonous ash which will have to be safely buried.

  Bioreactors, which 'steam' waste to convert it to biodiesel are a practical and a very much more economical alternative.

- *Reduce, reuse and recycle*.
  This is a whole philosophy and way of life!

- *District heating from Shoreham Power Station*.
  Most of the electricity generated for Brighton & Hove comes from Shoreham Gas Fired Power Station. Waste heat from it, which is currently dumped in the sea, could be used to heat homes in district heating schemes. Shown is John Kapp bathing in this warm waste water in November.