

The Energy Syndrome. 2011.

The Energy Trilemma. The three competing demands :-- **Reliability, Availability at a touch and Affordability.**

1. **ENERGY.** The current total electrical capacity is 75 GW. The average demand is about 40GW and in the winter is about 60GW. Between Electricity generated by Nuclear Power Stations in 2009 was 13%, in 2018 will be 8%.

The last of the Magnox stations, Oldbury and Wylfa will start decommissioning in 2010.

The first of the AGR's, Hartlepool and Heysham 1 will start to decommission in 2015 (but could be 2019).

Hinckley B and Hunterston in 2017.

Dungeness B in 2018 and

Heysham 2 and Torness in 2023.

After 2023 only Sizewell B will be operating.

- (a) By **2018** we will have lost **65%** of our current nuclear generation and **24%** of our total generation (equivalent to 15,300MW) due also to coal fired power station closures. This situation is only **8 years away.** It takes between 5 and 10 years to build replacement power stations.
- (b) As you will have heard recently, EDF, the French nuclear generator, have bought a major share holding in British Energy and are to build 4 reactors (PWR) two each at Hinckley Point and Sizewell. On 9 November 2009, Ed Milliband announced that a total of 10 new nuclear power stations are to be built to supply 25% of our total generation by 2025. The first plants are to be working by 2018, these are to be built on existing nuclear sites and planning permission to take 1 year. This will be a test of the Government's resolution to stream line the Public Inquiry Process in order to accelerate the commissioning of nuclear power stations. Remember, the Public Inquiry for Sizewell B lasted 2 years but the build only 5 years.
- (c) We are currently importing 50% of gas with a prediction of 80% by 2020 and it is getting politically and geographically dangerous to rely on foreign gas imports (e.g. Russia)
- (d) Clean coal technology is still in its infancy. Carbon sequestration or Carbon Capture and Storage, is still only being tested in pilot plants. The present consumption of coal is 55 million tons a year. This equates to about 200 million tons of CO₂. This amount has to be chemically captured, liquefied at some 800 psi and then pumped several hundreds of miles (e.g. North sea) for burial. This process can consume as much as 40% of the power that produces it. What COST ? The Government are funding £1bn on trial plant for Carbon Capture. Even so, it is anticipated that the cost will be competitive only with Onshore wind farms (£72 per MWH)
- (e) Security of electricity supply must take priority over everything including climate change. Increasing our nuclear generation will significantly go a long way to mitigating both these requirements and economically so.

- (f) **COSTS**. The Energy Minister gave the following costs for different kinds of generation to Parliament recently as, in ascending order, **Nuclear £38 per MWH; Coal £51 per MWH; Gas £52 per MWH; Onshore Wind £72 per MWH; Offshore Wind £92 per MWH**. With very heavy subsidies for wind turbines
- (g) **Politicians**. There are no professional engineers or scientists in any Party at Ministerial level. Where is the knowledge to make judgements on policy, or even to understand the technical advice ? We have had some 15 Ministers of Energy in the last 13 years.
2. **Radioactive Waste Management**. As I have mentioned previously we have safely stored radioactive waste for over 50 years. High Level Waste was originally stored in liquid form and cooled is now stored in glass blocks in steel drums.
- (a) PWR's generate only about 1/10 of waste currently generated by Magnox and AGR reactors.
- (b) Nuclear waste represents only 1% of toxic chemical waste.
- (c) About 4% of the price paid by the consumer of electricity generated by nuclear power is included to cover the cost of waste management and decommissioning. This equates to less than 0.1p/kwh of generating costs over a 50/60 year operating life.
- (d) The committee of radioactive waste management set up by Blair in 2003 to report by 2006 to investigate the various options of radioactive waste storage only confirmed the conclusion reached by the nuclear industry some 30 years earlier that waste should be buried in a deep underground stable rock formation, constantly monitored and retrievable.
- (e) The problem gentlemen, is POLITICIANS AND NOT SCIENCE, TECHNOLOGY, ENGINEERING OR COSTS.
3. **Renewables**. Nuclear power is a renewable source of energy. It generates a much more efficient fuel i.e. depleted Uranium and Plutonium than it consumes, natural Uranium. We could be self sufficient for a very long time with the stocks we have of Plutonium if "burnt" in fast breeder reactors.
- (a) **Wind Farms**. Currently the share of renewables in the form of wind turbines is about 5% of the total generation of electricity from 2775 wind turbines.
- (b) Brown announced on 26 June 2008 in the Commons that 3000 offshore and 4000 onshore wind turbines are to be built by 2020 which will supply 15% of electricity generation at a cost of £100bn. In numbers this equates to 11 wind turbines per week. An impossible task. The EU is even more cavalier, they say the British must generate 40% of electricity from renewables by 2020, mostly by wind turbines. This equates to 31 turbines per week. We are now in the realms of fantasy. The government has failed abysmally to meet its target of 10% by 2010. £100bn of investment could build between 30 and 35 nuclear power stations and certainly be much more cost effective. Value for money.
- (c) Wind turbines at best only provide electricity for 30% of their time annually (figure from the Wind Energy Association, not mine) compared to 90+% from a nuclear or fossil fired power stations. In addition, 100% back up

generation has to be provided by conventional power stations when the wind is not blowing. The public have continuously been misled by the Greens and the government when they state that a particular wind farm will provide enough electricity for say 40,000 homes. That is only true when the wind is blowing. They always quote the installed capacity of the farm and NOT its capable annual units generated (25/30%)

Typical wind turbines need a wind speed of 6-10 mph to start operating and automatically stop at a wind speed of 55 mph to protect their mechanisms. Even between those wind speeds the amount of electricity generated is variable and usually below the turbine full theoretical output. Britain's largest wind farm at Whitelee near East Kilbride operated to just 7.3% of its capacity in a year. Ironically, the total capacity is to be increased by 217MW.

- (d) In January 2009 and again in January 2010 when the maximum demand on the Grid system was at its peak of the cold spells, wind energy only subscribed 0.2% to the system. This because during cold spells, generally it is due to a high pressure system over the country and that means little or no wind. This is at a time when maximum power is required from all forms of energy.
- (e) More than £15bn is required to connect the planned 33GW of wind power to the Grid system on the main land.
- (f) Electricity consumers are paying more than £1bn a year to subsidise wind farms and other forms of renewable energy. This was a levy introduced in 2002.
- (g) The "Renewable Obligation" (RO) paid to the wind industry last year was £400m. So each wind turbine earned on average £130,000 in subsidy. Add in the profits from selling the electricity they generate and after construction costs are cleared they will be making nearly £300,000 per year per turbine. Half of it courtesy of the government. **These are not wind farms they are subsidy farms.**
- (h) Surely the final nail in the coffin of wind turbines. A new 1650MW EPR nuclear power station costs £5bn to construct. An off shore wind farm of the same capacity, at £3m per installed megawatt, would cost about the same-- £4.95bn. But with a load factor of 30% for wind, even without taking account the back up required when the wind does not blow, to average 1650 MW output would cost £15bn, three times the nuclear cost for the same output. In addition, the lifetime of the wind farm (optimistically considering its environment) as 20 years, and a nuclear station lasts for 60 years, the wind farm would have to be replaced three times over the next 60 years to match the nuclear power station. So the cost of an off shore wind farm is 9 times that of an equivalent nuclear station. Note, these figures do not take into account the need MW for MW, for back up from conventional power stations. Chris Huhne, Secretary of state for Climate Change and Energy, a professional accountant, still does not know Value for Money.

I submit that to meet all the requirements of our electrical energy and climate change criteria, we must proceed apace with nuclear build. A safe, clean, reliable and well proven technology and cheaper form of electrical generation. There has

been enough procrastination by governments over the last 10/15 years and the time has now come, albeit too late, for immediate action to provide a stable and secure electricity supply system.

Wave Power. Over the past 50 years many devices have been proposed but so far none have proved practical. The latest is PELAMIS, a long hinged snakelike structure developed in Scotland, first installed off the coast of Portugal. But its hopes were not realised after bearing failures connecting the units after only 2 months at sea. PELAMIS 2, has been ordered by E.ON to be deployed next year off Orkney. This device, 180m in length will generate 750kw. The equivalent of one nuclear power station (1000mw) would require a PELAMIS 2 to be 150 miles in length.. Need I say any more.

4. **Sources of Carbon Emission.**

The World pours out **31 billion tonnes** of CO₂ and Britain accounts for only 2% At 545.6 million tonnes per year. Power stations 33%; Transport 23.8%; Industry 22.9%; Homes 13.8%; other Sources (agriculture, forestry, NHS) 8.1%.

Carbon emissions by fuel (grams of carbon / unit of electricity) are Coal 955; Oil 828; diesel 772; Gas 430; Solar 133; Geothermal 79; Energy crops 17; Hydro 8-9; Wind 8; Nuclear 4.

The main uncertainty is whether the principal cause of climate change is the emission of man-made greenhouse gasses, mainly CO₂ produced by burning fossil fuels. Or is it caused by nature continuing to impose periods of warming, cooling and climate change as has been going for millions of years ?. If so, then the world wide expenditure of astronomical sums on hideously expensive renewable energy systems, particularly monstrous wind turbines, will be seen in the future as the most reckless spending frenzy ever undertaken by mankind.

5. **Nuclear Across the World.** Currently there are 436 commercial reactors in 30 countries generating 372,000MW which is equivalent to 15% of global demand. Some 56 countries operate 250 research reactors.

There are 220 reactors which power 150 ships and submarines.

Engineers have more than 13,600 reactor years of experience.

Another 30 reactors are under construction and 90 planned.

In 2008 nuclear generation in the world saved the equivalent of 620 million tonnes of oil and avoided about 5 billion tonnes of CO₂ emissions.

6. **Energy Strategy.** Immediately before the general election in May, I sent the then shadow energy secretary Greg Clark, a copy of my energy syndrome and comments on the Conservative Party Energy Policy. He agreed partly with my paper but disagreed with the nuclear aspect. I was not surprised as he is a green as also the energy adviser to David Cameron, Zac Goldsmith. Their energy policy which I copied all 27 pages, was the absolute drivel I have ever read.

Just after the election, I sent the Con/LibLab energy secretary Chris Huhne a copy of my paper plus correspondence to Greg Clark. As expected, the response was roughly the same. Chris Huhne is a self confessed anti nuclear. In the correspondence I suggested the following as a secure and independent energy policy that would take us well into the next century.

1. Immediate build of gas fired power stations (the only ones that can be built in time) to cope with the energy gap due in 3 to 5 years time, until new nuclear comes on stream in about 2018. The use of gas goes much against the grain, but of necessity is the only answer in the immediate short term.
2. Build a family of nuclear from 2018 onwards to keep pace with the ever increase in electricity demand (1% to 1 ½% annually)
3. Direct these hundreds of billions of pounds of wasted money on wind farms to reenergise the Fast Breeder Reactor programme. Other countries eg Russia, India and Japan have seen it as a very wise option. FBR's guarantee independence of primary fuel supplies and energy for over 100 years.
4. Increase significantly the resources for the HSE, Nuclear Installations Inspectorate so that they can keep ahead of licensing the generic and site specific reactor designs (PWR)
5. The natural progression from the above is PWR, FBR, perhaps Fusion by 2050 or thereabouts. This drives us into a most exciting, challenging and realistic energy future. It is time for the government to bite the bullet as far as energy policy is concerned and not pussy foot on such important issues on which the economy of this country relies.
6. Restore the loan of £80m the previous government were to give to Sheffield Forgemasters to obtain a 15,000 ton press to facilitate the manufacture of PWR pressure vessels. With the world increase of PWR's now on order, Sheffield Forgemasters could play a prominent role in the future of the power industry. It is false economy for this government to cut this loan. It is a loan and not a grant.

Dr E O Maxwell
February 2011.