Getting Disconnected

Electricity Interconectors Not the Answer

By Andy Wilson

*M*uch has been said about the merits of an all-Ireland policy on energy. While, from the point of view of resources, it makes sense for the island of Ireland to be considered as one unit, it is hardly the panacea for Ireland's energy problems its proponents claim. It conjures up the image of two alcoholics getting together to shake the last dregs out of an otherwise empty bottle of hooch.

The real white elephant, however is the much vaunted electricity interconnector to Britain. Although there are very real concerns about Ireland's future ability to generate all the electricity it needs, this pales into insignificance when compared to the problems Britain will face in the future.

The idea that Britain will have any surplus electricity to export to anywhere, other than during occasional off-peak periods in the middle of the night, is simply ludicrous. The island of Great Britain has a population almost ten times that of the population of the island of Ireland, but has only about three times the potential renewable energy capacity.

North Sea oil and gas production peaked at the start of the millenium while Britain's nuclear reactors are old and coming to the end of their life. Although Britain has substantial coal reserves, current production of 20 million tonnes per year is now lower than it was when Stephenson's 'Rocket' made its inaugural journey from Stockton to Darlington in 1825. This is less than one tenth of the output Britain achieved in the heyday of the coal era in the early 1900's.

During the 1980's and 1990's, Britain enjoyed a surplus of energy from its oil and gas fields in the North Sea, and for a short time was a mid-league table exporter of fossil fuels. It now seems likely that over-zealous production may have caused the premature decline of some oil and gas fields, as has occurred in Saudi Arabia. In any event, the rapid rate of extraction ensured that the North Sea gold would be spent sooner rather than later.

A Vulnerable Position

*B*y the early years of this decade Britain was once again looking east for its supplies of fossil fuels. In the last two years, Britain has become a net importer of both oil and gas, emphasising once again Ireland's extremely vulnerable position at the end of extremely long pipelines from Siberia, the Caspian sea basin and the Middle East.

Half of the 5 percent of its electricity that Britain generates from renewables comes from biofuels - principally land fill gas - and about a quarter from large scale hydro. A further quarter is provided by large scale wind farms. For all the investment in wind energy in Britain in recent years, the contribution to the national grid is barely more than 1 percent.

75 percent of all Britain's coal is imported, compared to only 34 percent in 1998 and only 10 percent in 1988. Twenty years ago only 7 percent of Britain's electricity generation relied on imported fossil fuels. By 1998 this had risen to 13 percent and in 2006 reached over 33 percent. This percent is projected to rise to over 50 percent within the next ten years as the North Sea gas fields are exhausted.

Furthermore, two thirds of all Britain's nuclear power stations are expected to come to the ends of their working life within the next 16-20 years. The picture is one of rapidly increasing dependency on imported fossil fuels for the generation of electricity.

The UK's principle strategy for deal-

ing with this looming crisis appears to hinge on the commissioning of a new generation of nuclear power stations. While some limited progress is being made to develop renewable resources, the percentage of electrcity being supplied by renewables is only rising very slowly.[1]

Limitations of Renewables

The best case scenario for 2017, several years before any new nuclear power stations could possibly come on stream, is about 10-11 percent of electricity from renewable sources, and even this is extremely optimistic.

Britain has developed most of its available large scale hydro capacity so there is little room for further development of this sector. Only the wind energy sector has the capability for significant expansion in the short term.

Energy from the waves or from tidal streams is many years away from being harnessed on a large scale. Although three wave energy devices developed by UK company Pelamis Wave Power have recently been deployed off the Portuguese coast, and four more are planned for Orkney in Scotland, 1000 such devices would be needed to supply less than 1 percent of the UK's electricity requirements. The Pelamis machines weigh 300 tonnes and cost about €3 million each.

The Nuclear Option

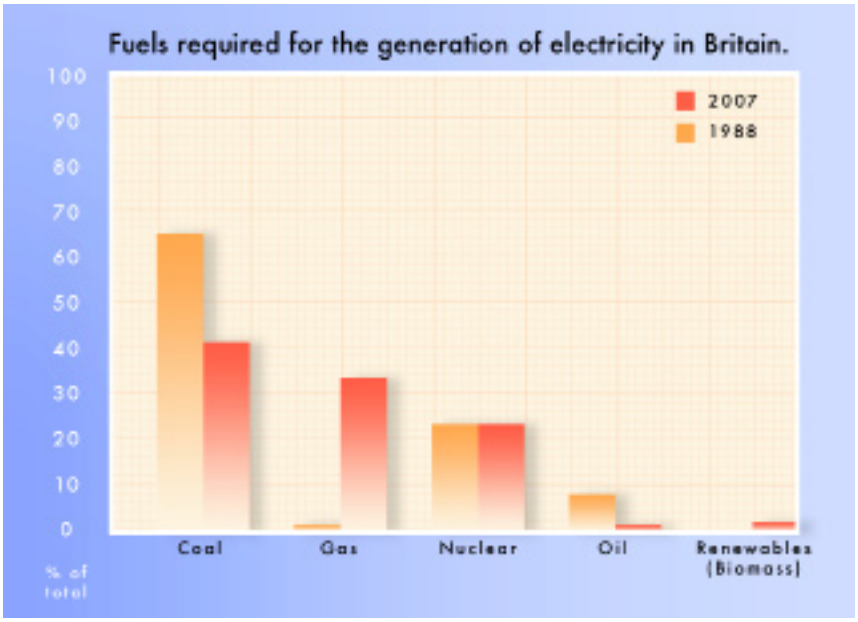
In the Energy White Paper published in the UK earlier this year, chapter five (Electricity Generation) devotes more than one third of its pages to nuclear energy. The text reads like a glossy brochure from the visitors centre at Sellafield. The many problems and difficulties associated with the British nuclear industry in the past (leaks of radioactive materials, accidents, health risks to workers, governmental cover ups, breaches of security, unforeseen technical problems, the high level of State subsidies needed to prop up the British nuclear industry, and the need for the State to underwrite the immense costs of any major accident should it happen) were quickly glossed over, or ignored.

The White Paper also claimed that "The UK has not had an incident at a civil nuclear power station where there has been an offsite release of radioactive material". Many people would disagree.

An article in the Obsever newspaper on October 7th 2007, which coincided with the fiftieth anniversary of the Windscale nuclear accident of 1957, quoted new research indicating twice as much radioactive material was released in the fire as was originally thought.

60 More Nuclear Plants

Although nuclear power is frequently presented as being the solution to Britain's energy problems, this is far from being the case. Even with no increase in demand for electricity over the next 20-30 years, Britain would need three to four times the nuclear generation capacity as it has at present in order to do without its fossil fuel fired power stations, and this assumes a significant helping hand from renewables.



Britain relies mainly on coal and gas for the generation of electricity.
Renewables contribute some 2% of the primary energy input for the generation of electricity, but about 5% of final supply.

In the unlikely event of Britain managing to build another fifty or sixty power stations in the next two decades, this will still not address the supply of energy for transport or for heating.

Irrespective of whether it sets in motion a new ambitious nuclear program or not, Britain will face very difficult choices regarding its energy supply. Having spent decades closing down coal mines it is likely that Britain will eventually begin to open them again, though this will prove costly and will do nothing to help Britain meet international obligations regarding carbon emissions.

Indigenous coal production is projected to fall by another 30-40 percent over the next fifteen years as existing mines become uneconomic or are worked out. One half of Britain's coal imports come from Russia, hardly a stable long term trading partner, while almost another one third of imports have to be shipped some 6000 miles from South Africa.

Ireland's Nuclear Fantasy

In spite of the very serious energy problems facing Britain, the Irish government is pinning its hopes on the electricity interconnectors to Scotland and Wales. Possibly there is a perception that Britain's next generation of nuclear power stations will save the day but this is simply wishful thinking on Ireland's part.

There is no likelihood of Britain having surplus electricity to export to Ireland, save in the middle of the night when Ireland has little use for it. Or does the long term Irish strategy entail the entire population becoming nocturnal with schools, workplaces and government buildings open at night in order to avail of Britain's off peak surpluses?

European Interconnectors

Some advocates of the interconnector strategy have proposed that the whole of Europe and North Africa be linked together by a series of massive cables, so that regions with shortfalls in electricity production can import surplus hydro energy form Norway or solar generated electricity from the Sahara desert.

One of the tenets of this argument is that there is always some renewable energy to be had somewhere, at any given time, so if the grid network is sufficiently large, renewable energy will

save the day. In theory, it sounds plausible. But has anyone really bothered to do the sums?

Let's look at Scandinavia first. Denmark, which generates over 20 percent of its electricity from wind, already avails of hydro (and nuclear) electricity from neighbouring Sweden and Norway when its own generating capacity is low. Hydro electricity in Sweden and Norway is on a massive scale. Norway, for example, is the sixth largest producer of hydro electricity in the world.

Hydro electricity comprises almost all of Norway's entire generating output, while in Sweden the figure is about two fifths. Between them, Norway and Sweden provide over one third of Europe's entire output from hydro electricity.

It is recognised however that these countries have little room to increase hydro capacity, in fact hydro electric output in Sweden has been falling in recent years. Typically, surpluses are low, less than 10 percent of total output. But even if the entire hydro electric capacity of Sweden and Norway combined were somehow supplied to Britain, which would of course leave Norway with no electricity at all and Sweden 40 percent short of meeting domestic demand, it wouldn't provide half of Britain's needs.

Sun and Sand

When one looks at solar electricity the figures are even more depressing. Total European solar PV capacity is about 6000 MWp, (peak output 6000 Megawatts) of which about 75 percent is in Germany [2].

Many of the smaller installations are on domestic roofs in less than optimum locations . Owing to shading, poor aspect or less than optimum inclination, the annual output may often be under 50 percent of what is theoretically achievable at that location.

It is estimated that the total useable output from Europe's solar photovoltaic installations is about 5 TWh (Terawatt-hour*) per annum, equivalent to 1.3 percent of Britain's annual electricity requirements or roughly 0.17 percent (one six-hundredth) of Europe's requirements.

*1 Terawatt hour is equivalent to 1 billion kilowatt hours (kWh). A kilowatt hour is the same as one 'unit' of electricity on a domestic electricity bill.

Britain's annual electricity requirements are 386 TWh while Europe's are about 3000 TWh. The total area occupied by Europe's solar PV installations amounts to some 70-100 km2.

Lets assume for the moment that production can be increased 40 fold, and the current European solar PV installation rate of 2000 MWp per annum could be bumped up to 80 GWp (One Gigawatt is 1000 Megawatts) and all of this placed in the Sahara desert. Allowing for spacing between the solar arrays, the total area involved would approach 2400km^2. It would potentially supply (allowing for the much more favourable solar regime and best practise installation) up to 150 TWh per annum, or the equivalent of one twentieth of Europe's requirements.

Unfortunately, even in the Sahara desert, average monthly solar radiation in December is only some 35-50 percent of the radiation in June, so that about 70 percent of the output would occur between the spring and autumn equinox, when demand is at its lowest in most European countries.

Furthermore, peak output would take place during a six hour period straddling midday, a part of the day when electrical demand in many European countries in traditionally low. The mismatch of supply and demand means that the true useful yield of this immense solar installation might be as little as 2 percent of Europe's annual electricity requirements.

Solar photovoltaic panels are resource and energy intensive products to make. The energy required to make this quantity of panels and install them would require all Europe's existing nuclear power stations running full tilt for anything up to a year.

That doesn't even begin to factor in the frighteningly large infrastructural requirements of building a transcontinental interconnector capable of handling nearly twenty times more power than the whole of Ireland uses at peak winter demand, and 160 times more than the proposed new interconnector between Ireland and Britain.

Just in case that weren't enough of a difficulty, the much greater distances involved in deploying cables linking North Africa and the main European centres of population would require uniquely high operating voltages in order to avoid excessive transmission losses.

Resource Depletion

In terms of raw materials, one can only guess at the quantity of aluminium required, perhaps something in the region of 4-8 million tonnes or the equivalent of one to two thirds of the entire annual global production.

Add half a million tons of polycrystalline PV cells, copper wiring, encapsulation materials to protect the PV cells from damage, not to mention thousands of kilometres of electrical cable capable of handling up to 80 billion watts, and logistically it begins to look a little more complicated than putting a few panels on a house roof. You'd have to be a few panels short of a roof to seriously consider it.

references

[1] On Oct 23 2007, the *Guardian* reported that the UK Government may be abandoning earlier ambitious proposals to massively expand Britain's renewable energy sector by 2020

[2] In the original version of this article, capacity was given as 800MWp. While installed capacity has increased by a factor of 10 in just a few years, German production is showing signs of peaking. Another increase of this magnitude will be much harder to achiveve.

"Interconnectors only make sense when we do not look at the macro economic benefit of energy. In Ireland we are spending over the life time of two National development plans almost €12 Billion on energy infrastructure, yet projections show us still being over 90% reliant on imports in the years ahead. The same [money] could easily have equipped every community with its own generation capacity, reduced energy use and achieved much higher levels of security, local employment. The question has to be asked whether the "investment" was made to benefit the customers or the marketplace. Obviously the main beneficiaries are the companies in the sector. Nowhere does this become as obvious as when one looks at the proposed interconnectors."
Michael Layden. Energy strategist