Lights on but No-one at Home

Government Study on Electricity Supply Ignores Bigger Picture by Andy Wilson

The All-Island Grid Study, which was published at the start of the 2008, was described in glowing terms by Eamon Ryan, Minister for Communications, Energy and Natural Resources (DCENR). A press release from his department described the study, which was jointly commissioned by the DCENR and the UK Department of Enterprise, Trade and Investment (DETI) as "the most advanced and comprehensive of its kind in the world".

Minister Ryan went on to add: "This study shows that we can do more than reach our renewable energy targets - we can surpass them. Above and beyond our current target of 33 percent by 2020, the Grid Study tells us that it is feasible to generate 42 percent of our electricity from renewable sources by that date. This will be one of the highest levels of renewable electricity in the world. It will reduce our greenhouse gas emissions by 25 percent" (1).

Fine words indeed from Ireland's first Green energy minister but unfortunately, an examination of the study by energy strategists working on behalf of the Sustainability Institute has revealed many shortcomings and errors in the report.

For reasons outlined below, a 42 percent contribution from renewables to electricity supply by 2020 is an unlikely scenario, while the stated "25 percent" reduction in greenhouse gas emissions is simply impossible in the context of the 40 percent increase in electricity demand assumed in the report.

It turns out the study - which runs to some 700 pages and which cost an undisclosed sum to produce - is primarily devoted to examining the conventional generating capacity of the island of Ireland, and the ability of the grid infrastructure to absorb a major input from variable sources of renewable energy.

While the study found that the grid could be upgraded to cope with fluctuating and occasionally very large inputs from renewable energy, its terms of reference were very limited and it did not address the bigger picture issues of energy demand or security of supply.

Instead, the study assumed that electricity demand will continue to increase from its present levels at approximately 3 percent per annum, reaching around 54 TWh* per annum by 2020. Many energy strategists would argue that this 'business as usual' projection is no longer valid.

While electricity demand in Ireland has been on an upward trajectory ever since statistics on electricity consumption first were compiled, this increase was directly linked to factors such as the historically low price of electricity, the recent high level of prosperity and economic growth, and a growing demand for consumer products requiring electricity.

However, the relative price of domestic electricity has risen by 27 percent since 2000 and the industrial price has more than doubled in the same period (2).

Government Energy Projections

Government projections of a 40 percent increase in electricity demand by 2020 are predicated on crude oil being priced at $54-61 throughout the next 12 years, and assume an annual economic growth of 3.1-4.2 percent. This is clearly stated in a SEI report of December 2007(3).

While long term economic trends are notoriously difficult to predict, continued growth at the rate assumed by SEI now seems extremely unlikely. Certainly, in the short term, economic growth will be low or possibly negative.

Crude oil meanwhile, is *already* twice as expensive as the SEI assumptions for 2020. Indeed, in May 2008 the giant investment bank Goldman Sachs forecast crude oil will average $141 a barrel for the second half of 2008 and warned prices could rise to $200 within 2 years.

The soaring price reflects the increasing difficulty of supply keeping up with global demand. Although gas is the main power station fuel in Ireland , gas prices are strongly linked to crude oil. Also, the rising cost of oil will push up the price of electrical goods while simultaneously reducing disposable income.

It does not inspire confidence that long term national energy strategies are predicated on oil and economic scenarios which now appear invalid. There is a strong sense that the forecasts of continued increases in energy demand made by both SEI and the authors of the Grid Study are shaped to fit in with what the government of the day wants to hear. The mantra of economic growth repeated endlessly by successive governments allows no room for any other scenario.

There is also the bigger question of what level of electricity use is *desirable* in 2020. Given Ireland's stated aim of reducing greenhouse gas emissions in accordance with new EU targets, and the constraints which will be imposed by fossil fuel depletion, the logical step is to *reduce* electricity demand to a level that can be maintained long term.

Current and Projected Electricity Demand: Ireland (GWh per annum)

	N.Ireland	Republic	Total
Current Demand (est)	9.5	29.5	39.0
2020 All-Island Grid Study			54.0
2020 Sustainability Institute			29.0

Table 1

Strategies for Energy Reduction

There are many strategies which will lead to a reduction in electricity demand. These include educating the population, leading to less wasteful habits of energy use; heavy taxing of energy inefficient devices; higher

electricity charges during peak time coupled with lower charges at off peak; smart metering; obligatory energy auditing of all public buildings, government offices and large businesses; and removal of grants on technologies such as heat pumps which only add to electricity demand. These and other measures could reduce electricity demand by 25 percent (4).

This reduction would result in Ireland's electricity requirements in 2020 being only 29 TWh (about 1996 levels) instead of 54 TWh as projected in the official study. This completely changes the energy perspective (table 1).

Grid Study Scenarios

The All Island Grid study examined 6 'portfolios' with varying energy mixes from renewable and conventional energy sources (tables 2a&2b). In all 6 portfolios, the annual demand was assumed to be 54TWh , and that the maximum and minimum loads at 9300MW (Mega-watts*) and 3200MW respectively.

Portfolio 6 was eliminated from the study at an early stage on the grounds that the grid infrastructure would be unable to handle a fluctuating supply of this magnitude.

A comparison between Portfolios 1 and 5 is interesting. The installed renewable energy capacity is 2221MW in Portfolio 1 and 6521MW in Portfolio 5. Yet in spite of there being 4300MW of additional capacity, the corresponding reduction in conventional generating capacity is only 694MW. Translation: *for every 10 MW of renewable energy generating capacity installed, there is a saving of only 1.6 MW of conventional generating equipment.*

An examination of Portfolios 2-4 reveals the same problem. For every 10 MW of extra renewable energy generating capacity installed, the corresponding saving in conventional generating capacity is only around 1 MW (5).

While Portfolio 1, with its much more modest contribution from renewables seems very feasible, the other portfolios would seem an extraordinary misuse of infrastructure and resources. Possibly the mix of renewables could be changed, in order to provide a more even and consistent supply of electricity (which would help reduce conventional generating capacity), but this was not examined by the study. As can be seen in tables 2a& 2b, most of the emphasis was on on-shore wind.

Unfortunately, the development of this technology in Ireland so far has been tilted heavily in favour of large wind consortiums with shareholders to keep happy. Though rarely discussed, this model of wind energy ownership brings few benefits to localities in which wind farms are built. The Danish model of community ownership of wind farms keeps the proceeds from the sale of energy within the local population.

The variable and unpredictable output from wind means it is difficult to utilise the resource fully. Also, conventional power stations have to be permanently on stand by to cover for periods of no wind, which results in over-capacity of conventional generating equipment.

A better way to utilise wind generated electricity surpluses might be to use them locally for industrial processes (electro-smelting for example) which can be scheduled around the availability of power. Another option is to build more pumped storage facilities like the one at Turlough Hill in Wicklow, where surplus electricity can be used to pump water into reservoirs feeding hydro schemes. While such schemes may have undesirable environmental impacts, they can be assessed on a case by case basis.

One concern in relation to the development of the wind energy in Ireland is the presumption that turbine sizes will continue to increase. A decade ago, all turbines being installed were under 1MW. The All Island Grid Study assumed many new turbines would be in the 4-7MW range, even though the world's first 7MW turbine, with an estimated rotor diameter of 144 meters, has yet to be built.

It is questionable whether Ireland will be able to keep such turbines running in a post peak oil world , when imported parts will be expensive and slow to arrive. Even maintaining a road infrastructure capable of handling the equipment will be problematic. Energy strategist Michael Layden believes that that all future turbines in Ireland should be under 1MW in size, in order to facilitate the use of localised production and repair facilities (6).

Another issue which requires further examination is the environmental impact of large winds farms, something which is easily disregarded when they are perceived as just another "investment" opportunity. The State forestry company Coillte has applied for licences for 17 wind farms involving many hundreds of turbines of over 1MW in capacity, at potentially sensitive upland locations around Ireland (7).

Other Renewables

Other renewable options examined in the study included biomass, biogas, wave energy and tidal stream energy from undersea turbines.

Biomass was considered to be only viable in co-combustion power stations

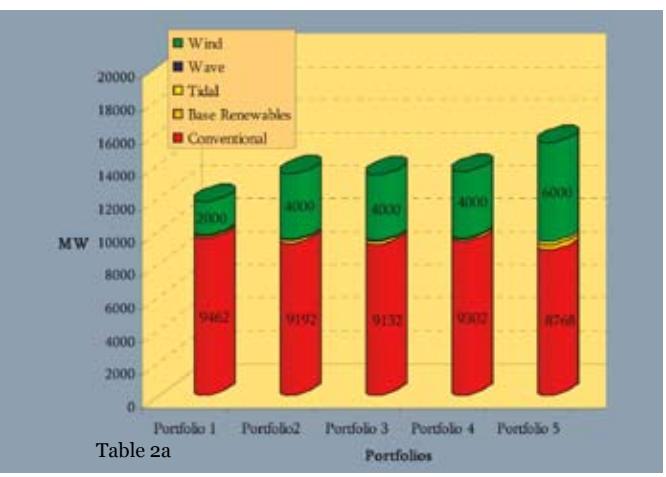

Table 2a

All Island Grid Study Portfolios: Generating capacity and annual output

	Wind (MW)	Base renewables (MW)*	Tidal / Wave (MW)	Total Renewables (MW)	Fossil fuels & turf (MW)	Total generating capacity (MW)	Renewable capacity as % of total capacity	Total annual output (TWh)	Renewable output (TWh)	Renewable output as % of total
Portfolio 1	2000	150	71	2221	9462	11683	19	54	8.6	16
Portfolio 2	4000	150	71	4221	9192	13413	31	54	14.6	27
Portfolio 3	4000	150	71	4221	9132	13353	32	54	14.6	27
Portfolio 4	4000	150	71	4221	9302	13523	31	54	14.6	27
Portfolio 5	6000	328	193	6521	8768	15289	43	54	22.7	42
Portfolio 6	7982	360	1593	9935	8346	18281	54	54	31.9	59

Assumed maximum peak load 9600MW. Assumed minimum load 3500MW. *Biogas and biomass sources

Table 2b

burning a high proportion of coal, turf or possibly oil. The study stated that in order to meet the harvest requirements, a minimum of 10,000 hectares of new forestry would be required per annum, well above current planting levels. An alternative option using short rotation coppicing would require the planting of 50,000 hectares (in total) of biomass willow. Given that this is equivalent to around 10 percent of Ireland's total tillage, this represents a serious challenge.

Methane from sewage and landfill gas was presented as being a relatively limited resource in terms of electricity generation. Contemporary systems of sewage treatment do not lend themselves to the capture of methane while landfill is seen as a diminishing resource. Biogas derived from municipal wastes has greater potential and could deliver about 700GWh per annum by 2020, or 1.2 percent of the envisaged demand.

Tidal resources capable of being developed by 2020 exist at only a few favourable sites. In the medium term, the potential generating capacity was estimated at 65 -280MW, with an annual output of 400-900GWh.

Wave energy is potentially one of Ireland's biggest renewable energy resources, but many questions remain about the viability of the technology. One of the most advanced developments, the Pelamis, has recently been deployed off the Portuguese coast but it is much too early to know how well it will perform in the long term. The All Island Grid Study estimated the installed capacity could eventually reach 1600MW, but in Portfolios 1-5 the installed capacity was assumed to be zero.

We found the appraisals of the non wind renewable technologies reasonably credible, but suggest the methane and biomass resources could be examined further, particularly for small scale localised generation based on CHP (Combined Heat and Power) and district heating serving hospitals and other large institutions.

Surprisingly, solar photovoltaic technology was not seriously considered in the study, even though installed capacity in Germany is now around 4000MWp with an annual yield broadly comparable to the current total output from wind farms in the Republic of Ireland (8).

CO2 Emissions

The 40 percent increase in electricity demand presumed in the study would lead to an estimated 20 percent increase in electricity generation-related greenhouse gas emissions by 2020. Any calculations include emissions related to the embodied energy of manufacturing, installing and maintaining wind turbines – perhaps 5-7 percent of the total lifetime energy yield of the turbine. It is difficult to estimate the lifetime yield for turbines yet to be designed or built, but historically, outputs have always been far lower than wind industry projections (Table 3).

Pelamis Wave Energy Converter. Photo Pelamis Wave Power

Current and Future Electricity-generated Carbon dioxide Emissions

	Electricity Total TWh/annum	Percentage Electricity Renewable	Emissions Renewables M Tonnes per annum	Emissions Conventional M Tonnes per annum	Total Emissions M Tonnes per annum
Current	39	7	0.6	21.8	22.4
All-Island Study 2020 Portfolio 1	54	16	1.8	25.0	26.8
Sustainability Institute 2020	29	25	1.8	12.0	13.8

Table 3

Conclusions

In spite of the voluminous amount of research undertaken, the All Island Grid Study has answered few questions in relation to Ireland's long term energy security. The knowledge that the grid infrastructure could accommodate an enormous input from wind sources is of little comfort, given the presumed continued high requirement for imported fossil fuels.

Furthermore, it is likely that the proposed massive investment in wind and accompanying grid infrastructure, along with the planned new gas fired power stations, will mortgage Ireland to assets it does not even need.

The lack of interest exhibited by the Irish State and UK DETI in examining different energy demand scenarios is worrying. It demonstrates a failure to understand that recent trends in relation to energy use cannot be sustained, and that the only viable long term scenario will involve energy reduction.

The Sustainability Institute proposes that the two national bodies commission a series of alternative studies, including at least one from an organisation with no prior involvement with the big energy players, and which might bring something new to the discussion table. The studies should have the widest possible remit, and must examine longer term scenarios as well as the medium term ones. These studies should be offered for tender at the earliest opportunity.

* TWh: 1 Terawatt-hour is equivalent to 1 Billion kilowatt hours/units of electricity. A Megawatt is 1 thousand kilowatts: equivalent to the energy required to simultaneously run about 10,000 televisions.

1 DCENR Press Release 10 January 2008
2&3 SEI Energy in Ireland 1990-2006
4 Reductions assumed to be spread between public, commercial, industrial and domestic sectors. Electricty use in transport in assumed to increase.
5 From Workstream 3, All Island Grid Study
6 Michael Layden has a extensive background in wind energy, both in Ireland and the US.
7 Putting up wind farms is more profitable than growing trees. Coillte expect a 12-14 percent return on their wind investment. Irish Times May 2nd 2008.
8 www.solarserver.de. Installed solar PV in Germany reached 3800 MWp in 2007 and is growing at about 1000MWp per annum.