



Nuclear Waste Disposal: An Exploratory Historical Overview

Hydrogen –
Important Building Block
Towards Climate Neutrality

10 Years
of Phasing Out Nuclear Power

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Steam generator removal in Neckarwestheim
Unit 1 NPP (Courtesy of EnBW Kernkraft GmbH)

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Ireland Must Assess Domestic Nuclear Energy

Allan Carson

Ireland has a world-class power sector despite – or perhaps because of – having a small, poorly-interconnected grid. The expertise embedded in the power sector is reflected in its successful integration of world-leading quantities of variable, non-synchronous power generation into the electrical grid with little impact on system reliability to date.

Pioneering work enabled non-synchronous renewables – predominantly wind energy – to supply 40 % of Ireland's electricity on average, and up to 70 % on occasion, in 2020.

This expertise will be truly tested in an attempt to maintain a secure electricity generating system while averaging 70 % variable renewables, and over 95 % on occasion, by 2030. Even with success in these efforts, the grid's reliance on natural gas means that emissions from power generation will fall by less than half, leaving Ireland with a higher emissions intensity than is already achieved in many European countries.

Power plant evolution

Ireland's first government showed extraordinary vision when they allocated 20 % of the 1925 revenue budget to build a hydroelectric scheme on the River Shannon capable of producing 17 times the nation's power demand at that time. As the world's first fully integrated (generation, transmission, distribution, marketing and sales) national electricity system, it facilitated economic growth until, by 1970, indigenous hydro and peat fuel resources were being fully utilised and power generation was also heavily dependent on imported oil.

Nuclear energy was being considered as a means of meeting the projected rapid increases in power demand when the oil crisis of 1973 struck. However, discovery of natural gas reserves off Ireland's South coast in 1975, along with lower projections of economic growth and growing public opposition at a time of political upheaval, led to the plans for nuclear being dropped in 1980. The 915 MW coal fired station that was built at Moneypoint instead would dominate the power sector for the following 30 years.

Natural gas gradually replaced oil (and more recently coal) fired generation and eventually grew to supply 65 % of Ireland's power, where it remained until relatively recently. Although the All Ireland Grid Study in 2008 foresaw a technical limit of 40 % from wind energy, this putative limit

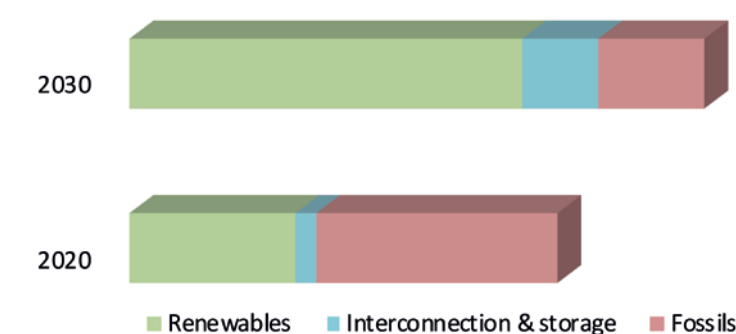


Figure 1
Ireland's electricity generating mix 2020 and 2030 (projected).

has been overcome through technical expertise and improvements in the operating performance of existing units. However, the resultant additional challenges relating to system stability and reliability will require an unprecedented upgrade to transmission and grid infrastructure if the renewable electricity plans are to be realised. Ireland's poor track record in building new grid infrastructure over recent years indicates a high degree of risk that these upgrades may not materialise as required to achieve the 70 % renewable energy target.

The National Climate Action Plan 2019 (CAP19), established to demonstrate how Ireland would achieve its emissions reduction target by 2030, projects that 2030 will see a doubling of power plant capacity, 73 % of which will be non-synchronous from intermittent sources, with most of the remainder consisting of natural gas.

The Climate Action plan

To date, Ireland's commitments to meet ambitious emissions reduction targets have been missed by a large margin – in 2018, for example, emissions were higher than in 2013, the start of the accounting period for the current EU binding commitment.

A 2018 Irish government review of the national performance in reaching the United Nations Sustainable Development Goals indicated poor performance from Ireland. Firstly, it concluded that Ireland would not meet the EU 2020 emissions reduction targets, and secondly its dependence on fossil fuel imports was expensive

and environmentally unsustainable. The report stated that a low-carbon future must ultimately involve moving away from fossil fuels altogether, but did not provide any examples of viable alternatives to them.

The Irish Government's Climate Action Plan 2019 (CAP19) sets out an ambitious course of action to address the climate disruption that it says "is already having diverse and wide-ranging impacts on Ireland's environment, society, economic and natural resources". It initiates policy actions to 2030 and aims to define a roadmap consistent with achieving a net zero energy system by 2050.

The main features of CAP19 for power generation in 2030, compared to 2020, include:

- Variable renewable electricity supply increase from 30 % to 70 %
- Variable renewable capacity increase from 4,500 MW to around 13,500 MW
- All coal, peat and oil-fired power stations to close
- Interconnection increase from 500 MW to 1,700 MW
- Hydro pumped storage plant increase from 290 MW to 650 MW
- Battery storage plant increase to 1,700 MW, and
- Greenhouse gas emissions fall from around 10 million tons to 4 - 5 million tons.

CAP19 contains no specific policy statement on how to keep annual power sector emissions on a reduction pathway beyond 2030. Once the power plant identified in CAP19 is developed, installing more such plant

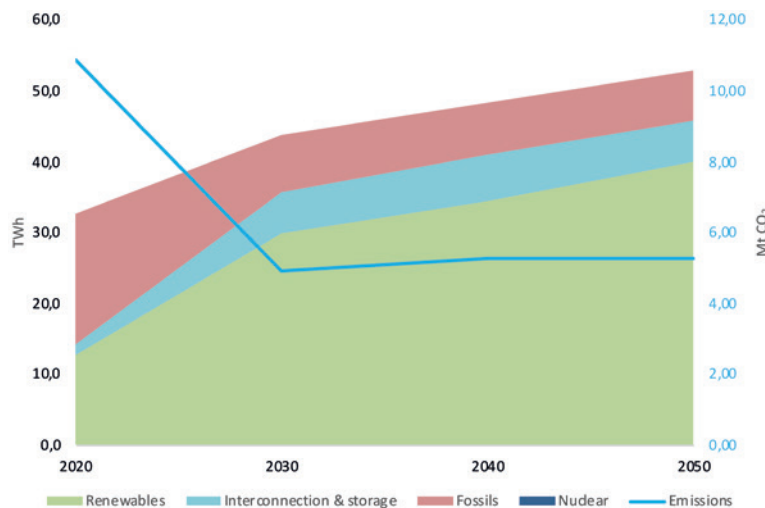


Figure 2
Projected power generation (left hand axis) and emissions (right hand axis), if CAP19 is extended out to 2050 – 18for0 analysis.

is unlikely to achieve significant additional emissions reduction benefits. This is demonstrated in **Figure 2** which results from work undertaken by 18for0 and shows that a simple extension of the CAP19 policy will fail to achieve net zero by 2050.

Challenges

Full implementation of CAP19 for power generation by 2030 is recognised as a significant challenge by the Irish national grid operator (EirGrid), as it will require an unprecedented transformation of the entire electricity sector to remain stable while being supplied by over 95 % non-synchronous generation for extended periods.

EirGrid's transmission development plan is designed to increase integration of non-synchronous generation through various non-energy system services, including reserve and fast frequency response to enhance grid stability and reliability. These services are likely to be ever more important as the instantaneous System Non-Synchronous Penetration (SNSP) limit is increased from 65 % to over 95 % by 2030 and possibly to 100 % thereafter.

While EirGrid is at the forefront of variable renewable integration into electrical grids, there remains an increased risk associated with extending CAP19 due to the unprecedented and uncertain nature of many of the changes that are introduced to accommodate the large percentage of variable renewable generating capacity within the electrical grid. This could ultimately lead to an increased risk of power shortages or blackouts.

The need to mitigate these risks in maintaining grid stability and reliability will likely lead to a continued reliance on natural gas post 2030, hampering Ireland's ability to eliminate its reliance on fossil fuels and to achieve the March 2021 legally binding commitment to net zero by 2050.

Moreover, Ireland's gas fields are projected to be fully depleted by 2030, leaving Scotland as the sole supplier of natural gas. The very limited availability of natural gas storage capacity will heighten Ireland's particular vulnerability to market fluctuations and geopolitical disruption.

Options

CAP19 established a steering group to examine the feasibility of using carbon capture and storage (CCS) in Ireland, and research is also underway into using surplus renewable energy to produce biofuels, synthetic gas, hydrogen or a 'Power-to-x' technology. None of these technologies has yet been proven at scale and their commerciality for power generation is still uncertain.

More recently, a study undertaken by the Centre for Energy, Climate and Marine Research (MaREI), and sponsored by the Wind Energy Ireland trade association, modelled a route to achieving net zero by 2050. The model, while useful, was limited in the breadth of technologies considered and made a number of very challenging assumptions concerning technology that is not yet commercially viable.

This model reflects current government policy quite well, and highlights the great amount of risk within that policy. If the assumptions fail to be

realised, the Irish electricity generating system could be locked into the use of natural gas for the foreseeable future and may not achieve net zero by 2050.

It is entirely consistent with Ireland's environmental commitments and imperative that the potential of all low carbon forms of electricity generation should be assessed.

Nuclear power is a proven, low-emissions technology that the European Council's scientific arm, the JRC, has recently found to be as sustainable as other forms of low carbon electricity generation.

18for0 undertook a study in 2020 that outlined a scenario for the introduction of nuclear power into the Irish power generation infrastructure. The study found that generating 18 % of Ireland's electricity from nuclear power technology would reduce reliance on natural gas and would support long-term, permanent reduction in carbon emissions. See **Figure 3**, which shows emissions continuing to fall towards zero by 2040 when 18 % nuclear energy is included in Ireland's power generation mix.

The study by 18for0 also outlines how the introduction of nuclear power would bring a wide range of economic and societal benefits while decreasing the cost of generating electricity. See **Figure 4**.

18for0 is currently assessing 'With Nuclear' costs against the scenario outlined by MaREI.

Despite the obvious potential benefits of the 'With Nuclear' scenario outlined by 18for0, the Irish government has confirmed that it has no intention of considering nuclear power in its future plans, citing the legislation that currently prohibits nuclear power from being developed in Ireland.

If Ireland is intent on retaining affordable electricity while achieving net zero by 2050, the government must urgently commission an independent assessment of all forms of low carbon electricity generation including nuclear power, in order to understand the relative merits of our net zero economy options.

Moving Forward

Ireland's strategy to achieve net zero by 2050 is currently uncertain, as it relies on a single policy option that depends heavily on assumptions about technologies that are not currently commercially available. To address this, 18for0 is making a number of requests of the Irish government.

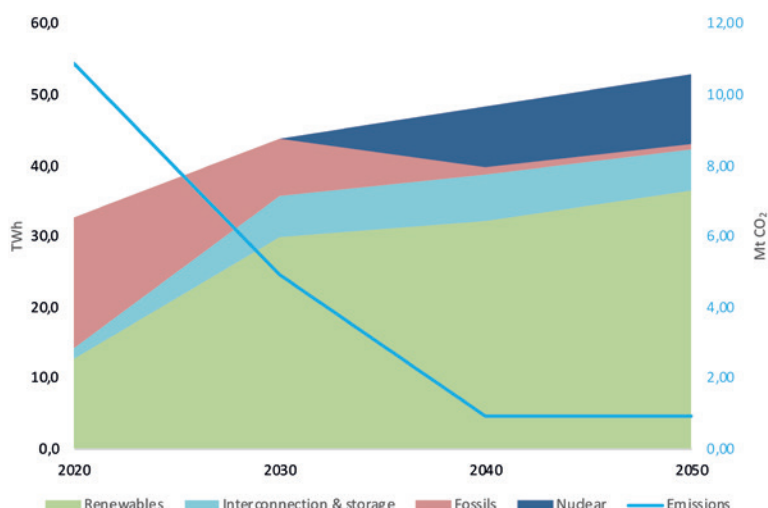


Figure 3

Projected power generation (left hand axis) and emissions (right hand axis), if nuclear energy is included after 2030 – 18for0 analysis.

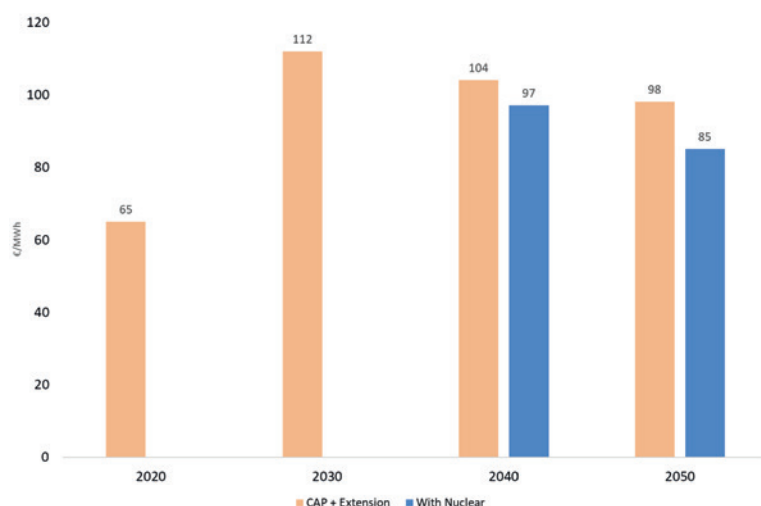


Figure 4

Cost of generating electricity between 2020 and 2050 with and without nuclear power.

First, to repeal the legislation that prohibits nuclear power in Ireland. Next, to commission an independent assessment of all forms of low carbon electricity generation to provide a platform to ensure that the plan to achieve net zero by 2050 is credible, takes account of technology readiness and can be updated as necessary. Finally, to drive a public debate on the use of nuclear power in Ireland, possibly through a citizens assembly or other appropriate forum.

18for0 has initiated discussions for collaboration with industry partners as we attempt to fill the void left by the Irish government in the development of pre-feasibility studies and nuclear power policy proposals. We would very much welcome contact from those offering to provide support or from those seeking further information about our work.

Ireland needs to implement a wider range of options than is outlined in the current Climate Action

Plan if the required carbon emissions reductions are to be achieved in an affordable and environmentally responsible manner. 18for0 is starting a national conversation about the future of Irish electricity production and the potential role nuclear power may play. The risks are too great – and too urgent – to ignore.

Author



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Allan Carson is a project manager and chemical engineer with over a decade of experience working within nuclear project development and licensing both in the UK and internationally.

18 FOR 0

18for0 is a clean energy advocacy group of voluntary professionals with over 150 years of combined experience in the energy industry. We are concerned about the credibility of current proposals to achieve net zero emissions in Ireland by 2050. Our name derives from our assessment that introducing 18 % nuclear energy into a power system dominated by renewables would be an effective way to reduce power sector emissions to their minimum.

18for0 would like a Citizens' Assembly to review the legislation currently prohibiting the development of nuclear power in Ireland. We believe that an official study should also be conducted to assess the viability of all forms of low carbon electricity production for deployment in Ireland, in order to achieve climate targets.

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