Europe's Energy Crisis: Implications for Ireland

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Introduction

For the first time in seventy-five years there is a major war in Europe.

The war in Ukraine and the resulting global economic sanctions on Russia are seriously impacting world energy supplies. This is already reflected in increases of up to 50% in world oil prices and vastly higher increases in spot prices for natural gas.

There is every possibility that these sanctions will be ramped up further and will lead to significant mismatches between oil supply and demand at a global level.

More seriously, at a European level, the short-term impact on natural gas supplies is likely to be extremely severe as Europe moves away from Russian deliveries. Central and Eastern Europe - and Germany in particular - are heavily dependent on piped Russian gas supplies.

Following over a month of intensive military confrontation in Ukraine there is every possibility that Russian gas supplies to Europe will be curtailed rapidly and that rationing of natural gas will become necessary in the EU before the end of the current year.

Ireland has set challenging targets for decarbonisation of its economy by 2030. Inherent in these targets are an immediate expansion of renewable energy sources, primarily wind power, and the increased electrification of domestic heating and transport.

A successful transition will mean that by 2030 the Irish economy will be far more dependent on a stable and cost-effective electricity supply than it is at present.

We note a report on Ireland's energy security is being prepared by Government and is due for publication by mid-2022. We believe it is important to understand that plans to expand Irish renewable electricity sources will not lead to the elimination of gas fired generation in either the short or medium term.

At 10.15 on the 25th of March 2022, the demand for electricity on the island of Ireland was 5124MW. Wind generation from more than 5000 MW of installed wind generation capacity came to 10 MW[1] – less than 0.2% of total electricity demand. The reason for this was simple: the wind wasn't blowing.

[1] EirGrid Dashboard. https://www.smartgriddashboard.com/#all

For the 24-hour period prior to 19.00 on 25th March 2022, renewables in total provided less than 3% of system demand. Natural gas provided 63% and coal 20%.

> *Whether Ireland expands its wind generation by 5000 MW or 25,000 MW over the next decade doesn't matter from the point of view of system adequacy.*
>
> *Under either scenario there will be times in 2030 when wind generation - regardless of installed wind generation capacity, will meet less than 1% of instantaneous electricity demand and there will be days when it meets less than 5% of* demand *over a period of 24 hours.*

Natural gas will be required in Ireland for decades to come to ensure a stable electricity supply at times of low wind generation[2]. The peak daily gas volumes required for electricity generation will increase – even as annual volumes decrease - due to the move away from other fossil fuel sources for power generation.

Against the background of a potentially escalating worldwide economic war, it is important that all sectors of the community unite to suggest solutions to the truly enormous problems facing Ireland. We think it is a time for constructive debate, not criticism. Compromises of a type not seen for decades, if ever, will be necessary. From our current situation not all decarbonisation targets will be met and it will be necessary to ameliorate the economic pain to a tolerable level in the short and medium term.

Given the exceptional level of uncertainty at present, this short paper from the Irish Academy of Engineering does not offer simplistic answers as there aren't any. Rather it suggests the likely magnitude of the many problems now confronting the country in the energy sector as well as the measures that might reasonably be adopted in the short to medium term to minimise the economic downside.

We hope it will encourage and stimulate constructive debate on the issues and help to identify possible solutions.

The paper looks at the short term (next two years or so), the medium term (to 2030) and beyond 2030.

[2] http://iae.ie/wp-content/uploads/2021/09/IAE_Sustainable_Electricity_in_2030-1.pdf

The Short Term (next two years)

Oil prices have greatly increased since the start of the Ukraine war. This is to be expected. The current oil market is highly volatile, and prices may increase significantly further as global oil supplies adjust to the refusal of many countries in the democratic world to import Russian oil.

Fig 1. Oil Prices (Brent)

There is little Ireland can do about this. The government is reducing some taxes on oil products for obvious social reasons. This in itself is already a compromise with the decarbonisation agenda which requires taxes on fossil fuels to be progressively increased.

Decisions on such compromises rightly belong at government level.

There is however a reasonable prospect that oil production and consumption will be balanced within the medium term and that prices will at least stabilise if not reduce.

30% of Ireland's diesel, DERV and gasoil requirement is produced from crude oil at the Whitegate Refinery; the remaining 70% is imported, mostly from the UK.

Following a series of refinery closures 60% of UK's diesel requirement is imported, with 40% coming from Russia, primarily directly but some indirectly.

In a market with heavy supply constraints, Ireland currently has an indirect but significant dependency on Russian diesel supplies.

In accordance with EU policy, the National Oil Reserves Agency (NORA) maintains a 90-day supply of oil products, mostly on the island of Ireland. This strategic storage becomes more important by the day as sanctions on Russian supplies are escalated.

It should be noted that with the exception of stocks held at Whitegate, Irish storage locations have limited road tanker distribution capacity because of their location. Stocks may therefore have to be reshipped to commercial distribution hubs if higher drawdown volumes are required.

The situation with European gas supplies is much more problematic. Europe obtains 40% of its gas from Russia, much of it over long pipelines. There seems little prospect of replacing all this gas in the short term; some rationing of the fuel may well be introduced at EU level in the very near future if Russian supplies are disrupted for commercial or other reasons.

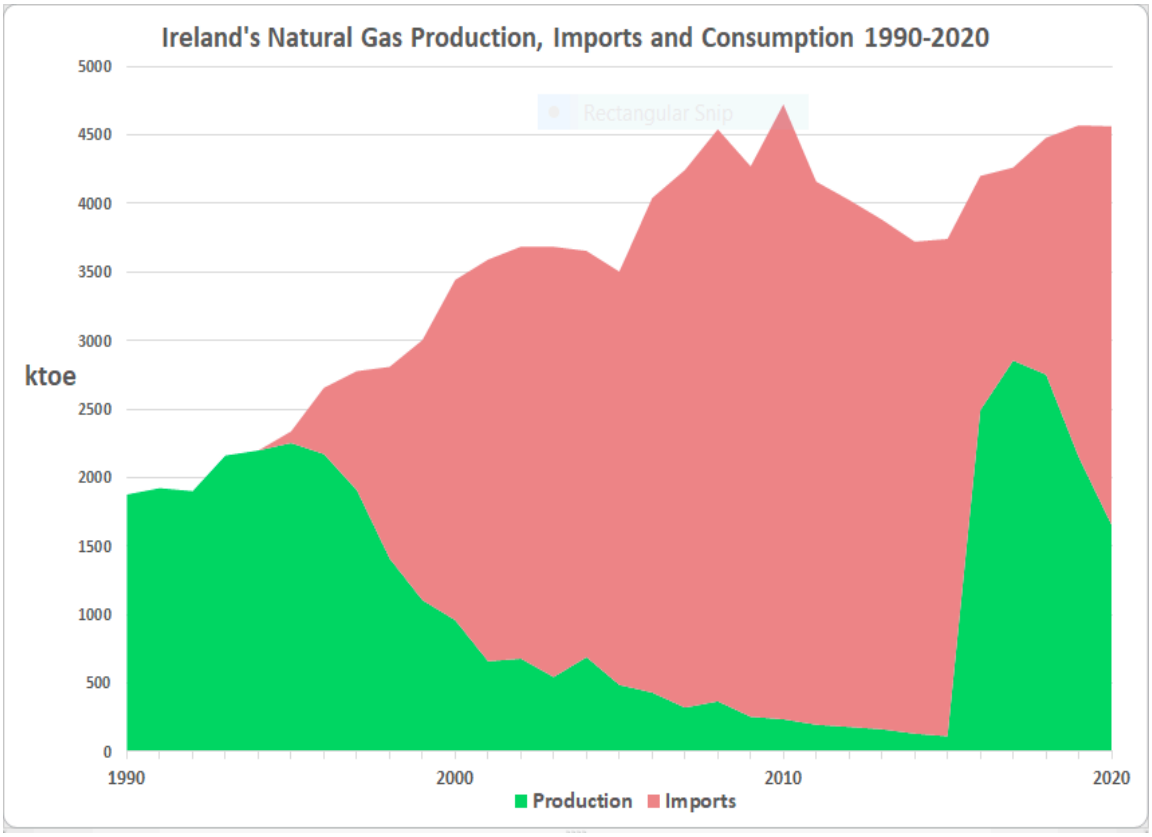

Fig 2. Natural Gas production and imports

How Ireland would fare in that situation is unclear but worrying, as the country no longer has a direct connection to the EU gas grid.

Ireland has the 6th highest natural gas usage per capita in the EU, mainly because of its use in power generation. Gas supply from its only domestic production facility, at Corrib, has peaked and will continue to decline, over the next five years.

In 2021 Corrib supplied 30% of Ireland's natural gas: by 2030 the country will be almost entirely dependent on imported natural gas supplies.

These imports currently come from Scotland and are supplied from extensive and varied North Sea (UK, Norway) reserves, i.e. from outside the EU. UK reserves are declining and 50% of its gas consumption is now imported. This is projected to rise to over 75% by 2030.

Reliable sources estimate that up to 16% of UK natural gas imports were supplied from Russia in 2020[3], primarily by pipeline via the Netherlands. Given these links, Ireland is effectively currently importing significant quantities of Russian gas via the UK.

In the short term, Government may have to adopt one or more of the following policy options:

- Accept that electricity generation using heavy fuel oil (HFO) at Tarbert power plant must continue until the crisis subsides; Tarbert is the only remaining HFO fired station in Ireland;

- Accept that coal fired generation at Moneypoint may have to continue past the planned retirement date of 2025;

- Switch from gas to distillate (refined) oil for powering some or all existing gas fired units;

- To facilitate the latter, plans would need be put in place to:

    - manage the transport logistics for plants that do not have piped delivery of distillate;

    - accelerate projects to provide distillate pipeline feeds to Aghada and West Dublin generating stations;

[3] https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-full-report.pdf

- obtain derogations on EU mandated SO_2 and NO_x emissions standards, in order to facilitate new and existing plant to operate on oil; and

- extend capacity payments for Moneypoint beyond the 2025 date, mandated by the EU

- It may also be necessary to consider re-commissioning recently decommissioned peat plants in the Midlands, using imported biomass fuel.

Medium Term (next 8 years to 2030)

Natural Gas

The EU Commission has already stated its objective of eliminating all Russian gas supplies over this timescale (i.e. by 2030). Current proposals would significantly reduce Russian natural gas imports even sooner.

Such a policy will completely change the EU gas market and transport logistics.

Russian gas will likely be diverted to China in as much as this is possible. In the short-term this could be via LNG exports and in the longer term by means of a trans-Siberian pipeline.

The EU may encourage some additional production close to its own borders; for example, the eastern Mediterranean holds considerable promise. However, new sources of natural gas will likely be imported mainly through LNG facilities from non-European sources. Germany has already announced that it is planning to construct two new **LNG import terminals** in the short term and is examining the potential for a third terminal.

Italy has announced plans for two Floating Gas Storage and Regasification Units, similar to that proposed for the Shannon estuary, to be deployed in the short term and also plans to resume drilling for gas in the Adriatic.

Norway is an important source of gas imports for the UK (and thus, Ireland). It is conceivable that a proportion of Norway's production may be diverted to Germany, which is facing critical short-term supply constraints and does not currently have adequate LNG import facilities at present.

The UK does have significant LNG import facilities but lacks significant gas storage facilities. This will almost certainly complicate that country's short to medium efforts to increase LNG dependence.

Ireland's problems in respect of these matters are far more acute. By 2030, the country plans to:

- use natural gas in the power industry purely for backup purposes;
- manage its gas supplies without LNG facilities; and
- manage its gas supplies without any significant storage.

The Academy has long expressed reservations[4] concerning the strategic risk that the country is running by not having LNG import facilities. Continued opposition to the construction of such facilities, given the scale and likely duration of the current emergency, seems remarkably foolhardy to say the least.

Gas storage will become an issue of major significance. Large-scale gas storage is primarily secured in suitable geological formations (primarily salt deposits). There are no suitable locations on the island of Ireland with the exception of salt deposits at Islandmagee, Co. Antrim. The Academy believes that Ireland should encourage such a development wherever possible.

With the exception of Corrib, whose daily production rate in 2022 will be limited to approximately one quarter of Ireland's average daily gas requirement, Ireland is entirely bereft of gas storage. The original Shannon LNG proposal included the construction of four large onshore tanks which would have provided significant operational storage (about one month's consumption of Irish national consumption).

The latter project was granted a ten-year permission in 2008. It remained unbuilt at the end of that period and was granted a 5-year extension in 2018 by An Bord Pleanála. The latter decision was the subject of a legal challenge by the Friends of the Irish Environment which resulted in a reference to the Court of Justice of the European Union and the quashing of the extension of time.

A fresh application was made by the developer in 2021 under Strategic Infrastructure legislation and a decision is anticipated later in 2022.

The latter proposed development omits the onshore storage tanks. It is worth noting that the original estimate of capital cost for these tanks was €400m.

[4] http://iae.ie/wp-content/uploads/2018/08/IAE_Natural_Gas_Energy_Security.pdf

Were they to be constructed now the cost would be significantly higher due to subsequent raw material cost inflation.

The use of the smaller depleted gas fields at Kinsale for storage would require the provision of large and expensive amounts of “cushion gas” – in excess of £2.0 billion at April 2022 year ahead prices There is no requirement for “cushion gas” when LNG storage is used.

A significant amount of subsea work would be required, to both replace decommissioned equipment and bring the Ballycotton field, which had not previously been use as a storage reservoir, into service. Together the SW Kinsale and Ballycotton fields could potentially provide the same operational storage capacity as the original Shannon LNG proposal, but their maximum daily gas output would only equate to 60% of average daily requirements.

The capital cost of operational gas storage is estimated at €500m, for either an updated Shannon LNG project or the Kinsale field.

There is a possibility of further marginal **gas finds** in the vicinity of the Corrib field. We believe that government should remove any disincentives to such development.

The elimination of Russian gas supplies to Europe will of necessity require the agreement of multiple long-term LNG contracts. The EU is already proposing to coordinate such contractual arrangements. A credible counterparty needs to be established in Ireland for the management of such contracts

BioGas

There is an existing programme to encourage the production of BioGas in Ireland associated with agricultural and food operations. Gas Networks Ireland will connect such facilities to the network and some estimates suggest that up to 20% of Irish gas demand could be met from such sources.

The scaling up of this industry has been left to private investors across hundreds of potential production centres. Progress to date in the Republic has been very slow. Clearly investors are cautious, and financial returns do not look sufficiently attractive. Government intervention to encourage such investment could help to fast track the scaling up of the industry.

Electricity

Government policy seeks the development of 5000 MW of **offshore wind** generation by 2030. The pace of this development is slow; investors

contemplating projects each costing many billions of euros are cautious and have good reason to be given the uneven history of Irish permitting processes.

Just as important is the likely cost escalation of such development and the resulting effect on electricity prices. In 2020/2021 Irish electricity prices (pre-tax) were among the highest in Europe – indeed in the world.

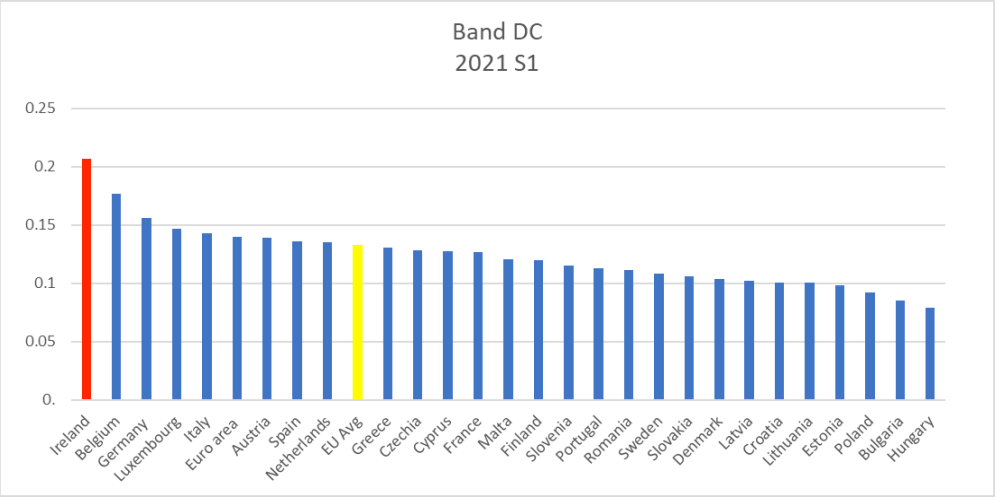

Fig 3: Semester 1 2021[5].
EU Pre-Tax electricity prices. Household Consumption (Medium 2500-5000kWh)

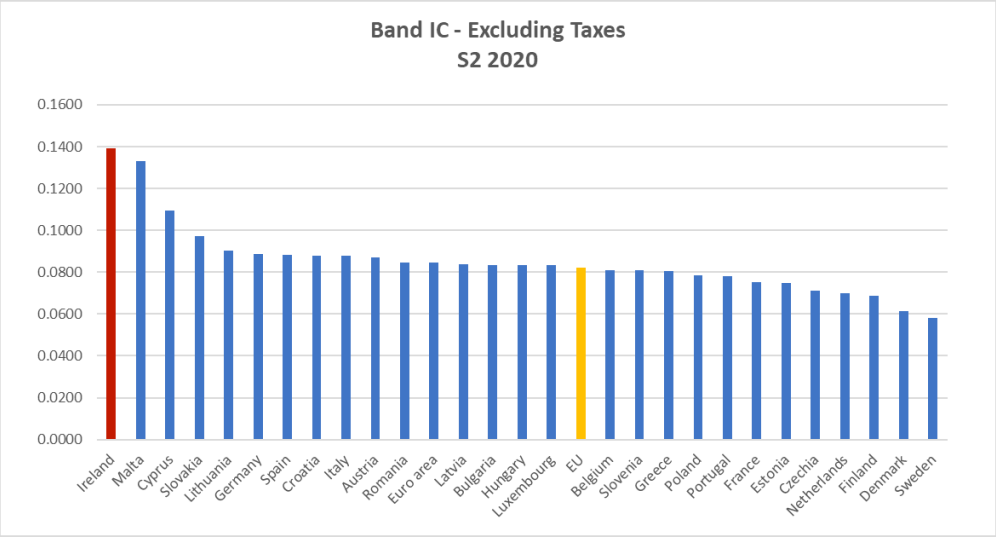

Fig 4: Semester 2 2020[6]
EU Pre-Tax electricity prices. Industrial Consumption (500-2000MWh)

Up to last year a steady decline was indicated in the published costs of offshore wind. Evidence is now emerging of a significant reversal in this trend. The cost

[5] https://ec.europa.eu/eurostat/databrowser/view/nrg_pc_204/default/table?lang=en

[6] https://ec.europa.eu/eurostat/databrowser/view/nrg_pc_205/default/table?lang=en

of almost all materials including steel, copper and rare earth minerals, required for these facilities, has rapidly escalated over the past year – by over 50% in some cases – and that was before the Ukrainian crisis and restrictions on the use of Russian minerals emerged.

In addition, interest rates are set to increase significantly. Thus, estimates of costs for offshore wind generation are now highly uncertain, but are likely to be significantly more expensive than had been previously estimated.

The 5000 MW of wind power targeted for completion by 2030 could be constructed much more quickly and cheaper **onshore** - but only if Irish planning legislation is thoroughly revised and adapted to social and community needs. The Academy has already refenced this issue extensively in its recent report on Electricity Transmission.[7]

> The EU Commission, on Mar 8th, 2022, stated that renewable energy projects, together with associated grid works, are considered as being in the overriding public interest and qualify for the most favourable procedure available in their planning and permitting.
>
> https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1511

We believe policymakers and legislators should now grasp this nettle and prepare and enact new legislation that would permit the construction of both the generation and the necessary associated transmission.

Battery storage has been promoted as a solution to electricity storage problems. In the short term such installations are indeed useful for promoting grid resilience. However, the cost of such storage rules it out from the point of view of system adequacy. Using battery cost estimates from the 2021 report *"Cost of Utility Scale Battery Storage*" by the US National Renewable Energy Laboratory[8] (NREL), it would require an investment of approximately $16 billion to store one day's electricity consumption for the Irish system in 2030, based on the projected battery and other costs in that year.

Similarly, **Interconnectors**, while helpful, cannot be relied on to provide adequate capacity at times of low wind output, due to the scale of the associated weather systems – as became all too evident in the past year.

[7] http://iae.ie/publications/the-future-of-electricity-transmission-in-ireland/

[8] https://www.nrel.gov/docs/fy21osti/79236.pdf

Post 2030

In the longer term, post 2030, many new technologies are likely to both greatly enhance energy security and facilitate the decarbonisation effort.

It must be realised that technological solutions such as economic **long-term battery storage**, **hydrogen** production or even **small modular nuclear reactors**, all of which hold out much promise, will not be ready for deployment at any meaningful scale prior to 2030.

Hydrogen storage in pressure vessels is impractical in any significant quantity, for technical reasons. Salt cavern storage is the only proven technology for the large-scale storage of gaseous hydrogen. As indicated earlier, Ireland has very limited suitable salt formations, compared with Continental European countries and Great Britain

The high cost of renewable electricity generation in Ireland when compared to countries with predictable renewable resources, and substantially lower renewable electricity costs, makes hydrogen liquefaction for export, with its very high energy requirement, commercially unattractive here, irrespective of the scale of the potential resource.

Nuclear generation is not a short-term option for Ireland at present as the size and capital cost of the reactors now being constructed in Europe is far beyond what could be considered, for both technical and commercial reasons. Small Modular Reactors could potentially be of interest in the future, if their development proves as successful as their advocates hope.

For further information on this report please contact Don Moore FIAE on +353 87 244 8914, Chair of the Energy and Climate Action Standing Committee of the Irish Academy of Engineering.

The Irish Academy of Engineering

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The Irish Academy of Engineering
22 Clyde Road, Ballsbridge, Dublin 4, D04 R3N2
Telephone: +353 1 665 1337

Email: academy@iae.ie
Website: www.iae.ie