From: [redacted]

Submitted on: 20/09/2022

Dear DECC

It will be useful to address security of supply for heat and power in a holistic way, principally by coupling the two sectors and by using long term heat storage. Both must be provided soon from renewable sources, wind, solar, geothermal, and bioenergy. The bioenergy resource on the island is constrained and will be needed for industrial uses and for synthesising liquid fuels. Wind and solar energy resources are substantial and geographically well distributed, so their contribution to heat supply must be maximised. The geothermal resource consists most immediately of low grade heat at depth, but also of the capacity for long duration heat storage,.

[This thermal storage capacity has huge potential for storing 'coolth' generated by solar energy in hot countries, so the demonstration of this technology has critical applications beyond these shores.]

There are prospects for increased electricity supply*, but prospects for increased gas supply via Green Hydrogen also rely on increased electricity supply, so markets for this should be expanded now. *Dropping costs for solar electric systems, offshore wind, flow battery systems, the possibility of nuclear fusion. The market for variable renewable power supply can be expanded rapidly by opening the market for heat to variable renewable power.

A quick way to do this is via tariffs that enable the electric immersion heaters installed in many homes to use renewable electricity to displace the use of gas and oil boilers when possible. Another is to support Air Source Heat Pump / boiler 'Hybrids'. These turns kerosene storage in the tanks in gardens and in depots, and gas storage, into a 'virtual flow battery' for renewable electricity.

However, the major opportunity requiring policy support is to use heat networks coupled to long term heat storage to increase energy supply security, by storing peak renewable power inputs as heat. For larger settlements and cities, this can be done underground, increasing the size of the heated volume so that the ratio of storage mass to perimeter heat losses falls away. Inter-seasonal summer to winter heat storage is already done in other European countries, but with Ireland's wind resource being larger in winter, storage is more effective.

These are not new ideas, the potential benefits in coupling the heat and power sectors, and in energy storage have already been documented. e.g., Combined Heat and Power gas engines can initially complement the use of large electric heat pumps to supply urban heat networds, using the same power connections. One benefit of large-scale heat storage is increasing Ireland's capacity to contribute to Europe's security of supply, by exporting more and 'firmer' wind energy.

Below are some references relevant to these opportunities.

Good luck.

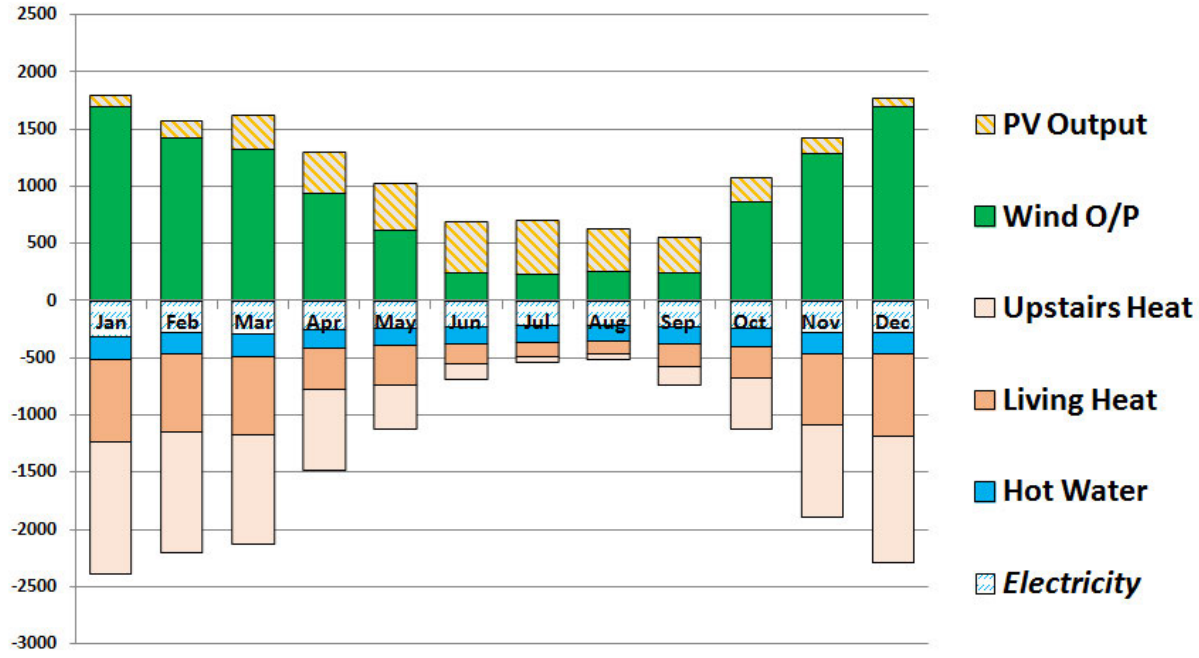
[redacted]

http://www.sdewes.org/jsdewes/pid8.0340
"decarbonisation of the example district's power and heating energy can be reached even without the availability of biomass, if sufficient Power to Heat (XXL Hpumps) and Power to Gas capacity is

integrated to the District Heating grid, and sufficiently more wind- and solar power is installed“ e.g. Using existing power connections.

https://www.escubed.org/articles/10.3389/esss.2022.10047/full “Heat Battery”
https://www.seai.ie/data-and-insights/national-heat-study/ Lots of documentation
Cambridge Econometrics study:
https://europeanclimate.org/resources/renovating-and-and-electrifying-buildings-strengthens-europes-economy-and-energy-security/
Geothermal Heat Storage potential:
https://www.heatstore.eu/documents/HEATSTORE_UTES%20State%20of%20the%20Art_WP1_D1.1_Final_2019.04.26.pdf
Drakes landing solar community https://www.dlsc.ca/

Correlations of MONTHLY energy demands and renewable electricity output:



which is also well distributed geographically.

Coupling the two sectors can radicall

[redacted] Response

Submitted on /10/2022

Dear Decc

Security of heat and power supply can best be assured by creating interfaces between different energy sources so that the amount of supply from each can be varied in time. Geothermal heat, wind and solar electricity are locally available, and heat sufficient for very long periods can be stored underground. Oil can be economically stored for long periods or extra supplies imported, and can substitute for gas used for electricity generation when heat pumps connected to a national grid are

added to oil boilers. Such 'Hybrid' systems can also be set up and controlled dynamically in 'Smart' ways to use local wind or solar energy preferentially, whether boilers are oil or gas-fired.

The state should consider setting up a national system of heat metering to support the rollout of heat network systems. Heat networks can dramatically reduce emissions and gas imports by storing and using heat produced by wind energy or geothermal or waste heat from industry or power generation (or in a supply emergency, from oil or stored biomass).

Over a large dispersed area, and when complementing an integrated low carbon energy system, heat metering can be considered to be a 'natural monopoly' like water gas power and sewerage systems, and could be added to the regulated asset base of electricity companies. Relatively small low carbon systems can benefit from the economic availability of heat metering. e.g. New apartments built to the latest Building Regulations taking heat from boreholes re-heated by low cost solar thermal/ PV panels and electric heat pumps. The economics of locally produced 'Green' hydrogen and of electricity generating fuel cells can be improved when waste heat can be metered and sold. It is not clear that it will economic or even safe or to use hydrogen for combustion at homes, pointing to a much bigger role for metered heat networks primarily heated by large electric heat pumps.

Networks for decarbonised heat can reduce the need to superinsulate urban homes and also meet the energy needs for heating ventilation air and domestic hot water. By using power at different times from heat pumps at rural and dispersed properties, they can reduce the use of inefficient gas fired plant at the winter peak.

Large scale central thermal storage systems connected to heat networks can make a continued expansion of wind energy supply more economic. Adding heat networks can re-use existing power connections at buildings to operate large heat pumps when wind energy and off-peak grid capacity is available, producing heat that can transferred to re-heat a very large central thermal store for winter use.

Spikes in European gas demand are being driven by the need for cooling in heat waves. Underground thermal storage is already used in hot countries for small scale cooling of homes cf Japan, Indonesia, but large cities in the global south will need to do more of this and at a larger scale where the economics of bulk storage are more favourable. It will help the global total of carbon emission reductions if Ireland can demonstrate effective policy responses to the development of low carbon thermal networks and of thermal storage, whether most power for these electric heat pump systems is from abundant solar or from wind energy.

Recent studies indicate that the total size of gas supply can be reduced when systems for supplying heat and power are well integrated. (see sdewes link)

A general problem in these islands is that energy security costs are loaded onto electricity prices at all times, when the lowest carbon and local supply for both heat and power is available at irregular times and at night. There is a pressing need to change tariff structures and to control electrical loads to use more local winter wind energy for heat in particular.

Thanks for the opportunity to respond to your consultation.

Good luck

[redacted]

https://www.seai.ie/data-and-insights/national-heat-study/

http://www.sdewes.org/jsdewes/pid8.0340
"decarbonisation of the example district's power and heating energy can be reached even without the availability of biomass, if sufficient Power to Heat (XXL Hpumps) and Power to Gas capacity is integrated to the District Heating grid, and sufficiently more wind- and solar power is installed" e.g. Using existing power connections.
https://www.escubed.org/articles/10.3389/esss.2022.10047/full "Heat Battery"

https://www.gov.ie/en/consultation/dbe14-review-of-the-security-of-energy-supply-of-irelands-electricity-and-natural-gas-systems/

[redacted] Response

Received on 23/10/2022

Dear Decc

When the CER undertook cost benefit analysis of Smart Metering for electricity and gas a surprising result was that the result was positive for gas.

(an interesting implication is that it can also be worthwhile for heating oil, with its higher import costs and higher carbon emissions)

It just occurred to me that you have an opportunity to incentivise the substitution of local wind energy for gas imports. This could be achieved by metering gas use at short time intervals. e.g. Quarter hourly, and rewarding the extent to which users reduce their gas use when there is wind energy available.

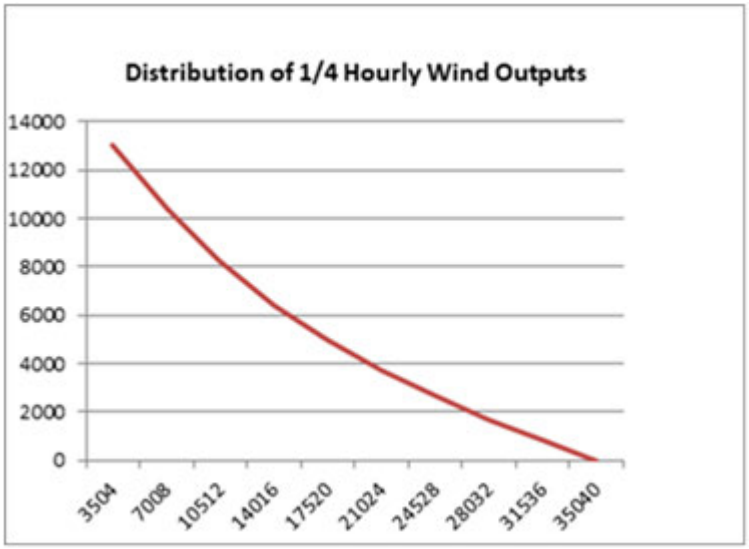
i.e. The extent to which gas (or oil) is only being used to replace 'missing' wind energy, for heat in particular. (areas to the bottom right of the graphed line below)

Introducing suitable incentives could support the installation of heat pumps beside existing boilers, also before homes have additional insulation added. But also a variety of systems in homes, industry, commerce and agrifood that can make use of the lowest carbon generation 'as available'. Using proven and familiar technologies, this enables reserves of fossil fuels to act as massive low cost 'virtual batteries' for some years until other technologies are validated..

This can help to fund consumers' transition to zero carbon, but importantly, achieving quicker reductions in annual emissions sooner slows the accumulation of CO2, which is what matters. Opening the heat market to electricity seems to be key to realising these potentials. e.g. Perhaps brief low cost periods where using even cheap resistance/ immersion heaters could pay. Monitoring actual temperatures in homes and hot water cylinders can also indicate when pre-heating with renewable electricity is economic, spreading the times that REe can be useful and promoting investment in additional generation.

All the above points to using more bytes instead of therms to build security of supply.

[redacted]



[redacted] Response

Received on 22/10/2022 13:34.

Dear Decc

Security of heat and power supply can best be assured by creating interfaces between different energy sources so that the amount of supply from each can be varied in time. Geothermal heat, wind and solar electricity are locally available, and heat sufficient for very long periods can be stored underground. Oil can be economically stored for long periods or extra supplies imported, and can substitute for gas used for electricity generation when heat pumps connected to a national grid are added to oil boilers. Such 'Hybrid' systems can also be set up and controlled dynamically in 'Smart' ways to use local wind or solar energy preferentially, whether boilers are oil or gas-fired.

The state should consider setting up a national system of heat metering to support the rollout of heat network systems. Heat networks can dramatically reduce emissions and gas imports by storing and using heat produced by wind energy or geothermal or waste heat from industry or power generation (or in a supply emergency, from oil or stored biomass).

Over a large dispersed area, and when complementing an integrated low carbon energy system, heat metering can be considered to be a 'natural monopoly' like water gas power and sewerage systems, and could be added to the regulated asset base of electricity companies. Relatively small low carbon systems can benefit from the economic availability of heat metering. e.g. New apartments built to the latest Building Regulations taking heat from boreholes re-heated by low cost solar thermal/ PV panels and electric heat pumps. The economics of locally produced 'Green' hydrogen and of electricity generating fuel cells can be improved when waste heat can be metered and sold. It is not clear that it will be economic or even safe or to use hydrogen for combustion at homes, pointing to a much bigger role for metered heat networks primarily heated by large electric heat pumps.

Networks for decarbonised heat can reduce the need to superinsulate urban homes and also meet the energy needs for heating ventilation air and domestic hot water. By using power at different times from heat pumps at rural and dispersed properties, they can reduce the use of inefficient gas fired OCGT plant at the winter peak.

Large scale central thermal storage systems connected to heat networks can make a continued expansion of wind energy supply more economic. Adding heat networks can re-use existing power connections at buildings to operate large heat pumps when wind energy and off-peak grid capacity is available, producing heat that can transferred to re-heat a very large central thermal store for winter use.

Spikes in European gas demand are being driven by the need for cooling in heat waves. Underground thermal storage is already used in hot countries for small scale cooling of homes cf Japan, Indonesia, but large cities in the global south will need to do more of this and at a larger scale where the economics of bulk storage are more favourable. It will help the global total of carbon emission reductions if Ireland can demonstrate effective policy responses to the development of low carbon thermal networks and of thermal storage, whether most power for these electric heat pump systems is from abundant solar or from wind energy.

Recent studies indicate that the total size of gas supply can be reduced when systems for supplying heat and power are well integrated. (see sdewes link)

A general problem in these islands is that energy security costs are loaded onto electricity prices at all times, when the lowest carbon and local supply for both heat and power is available at irregular times and at night. There is a pressing need to change tariff structures and to control electrical loads to use more local winter wind energy for heat in particular.

Thanks for the opportunity to respond to your consultation.

Good luck

[redacted]

https://www.seai.ie/data-and-insights/national-heat-study/
http://www.sdewes.org/jsdewes/pid8.0340
"decarbonisation of the example district's power and heating energy can be reached even without the availability of biomass, if sufficient Power to Heat (XXL Hpumps) and Power to Gas capacity is integrated to the District Heating grid, and sufficiently more wind- and solar power is installed" e.g. Using existing power connections.
https://www.escubed.org/articles/10.3389/esss.2022.10047/full "Heat Battery"

https://www.gov.ie/en/consultation/dbe14-review-of-the-security-of-energy-supply-of-irelands-electricity-and-natural-gas-systems/