Energy Strategy Call for Evidence

Response Template

How to Respond

This template replicates the questions asked in the Call for Evidence found at: https://www.economy-ni.gov.uk/energy-strategy-call-for-evidence

It is recommended that you should read the full consultation document before completing your response. Please note that the text boxes used throughout this template can be expanded to accommodate your response – there is no character limit.

For further information on how we handle your personal data please read our Privacy Notice

Early responses are encouraged but all responses should arrive no later than **5pm on 20 March 2020.**

Please send your response to:

energystrategy@economy-ni.gov.uk

Or alternatively by post to:

Energy Strategy
Department for the Economy
Netherleigh
Massey Avenue
Belfast
BT4 2JP

Quote the reference "**Energy Strategy Call for Evidence 2019**"

1. General Information

1. **Name (required)**

[redacted]

2. **Are you responding:**

   ☐ **as an individual (please complete 3 to 5 below)**

   ☐ ✔ **on behalf of an organisation / company (please complete 6 to 8 below)**

If you are responding as an individual:

3. **E-mail address**

4. **Address**

5. **If you are responding as an individual, please read the Privacy Notice and tick the statement below as applicable.**

   ☐ **All responses will be published on the Department for the Economy website following completion of the Call for Evidence process. Please tick if you are content for your name to be published alongside your response.**

If you are responding on behalf of an organisation / company:

6. **Organisation / Company**

Granville Ecopark Limited

7. **Position within Company / Organisation**

[redacted]

8. **Contact details**

   a. **E-mail address**

[redacted]

   b. **Address**

[redacted]

2. Energy in Northern Ireland

Q1. What lessons can we learn from elsewhere in addressing energy within an overarching climate action framework?

Q2. What are the key considerations for decarbonising Northern Ireland's energy sector given existing linkages to other jurisdictions?

Q3. To what extent should Northern Ireland implement the key energy-related recommendations from the CCC 'Reducing Emissions in Northern Ireland' report?

Q4. Do you agree with the 30-year timeframe? If not, please state your preferred approach and reasons.

Q1 What lessons can we learn from elsewhere in addressing energy within an overarching climate action framework?

The role of the gas network in decarbonising energy supply has been overlooked within the Energy Strategy Call for Evidence and the CCC "Reducing Emissions in Northern Ireland Report". Across Europe there has been significant investment into using the gas network for providing a fuel for heat and transport fuel. The natural gas network can be decarbonised by injecting renewable gas (biomethane and hydrogen) into the grid. The Call for Evidence has only one reference to biomethane and has ignored the significant decarbonisation effect that biomethane can provide. The Call for Evidence also ignores the incentivisation available under the Renewable Transport Fuel Obligation (RTFO) managed by the UK Government Department of Transport. This provides a UK wide incentive for utilisation of Compressed Biomethane (CBM) as a transport fuel. This could play a role in stimulating investment in AD capacity at a time when there is no other subsidy mechanism in Northern Ireland.

The Consozio Italiano Biogas (CIB) have proposed that Europe has the potential to produce 98 billion m^3 of biomethane by 2050[1].

In a recent email (12-Mar-20) from the Anaerobic Digestion and Biogas Association (ADBA) it was indicated that the UK government have outlined an ambition to triple the biomethane in the gas grid by 2030. A new Green Gas Levy (GGL) will be introduced as the primary mechanism to stimulate biomethane production. The expected impact is relatively small; around £1 a year on the average household energy bill, rising to around £5 by 2025; that's c.0.5% of an average household's dual fuel bill. This would require an additional 1.6 billion m^3/yr of biomethane gas to be injected and require approximately 330 new biomethane-to-grid plants over the next ten years.

Development for biomethane projects with grid injection is proceeding at pace and is a mature, proven technology which is ready for deployment.

- UK – 2.1TWh, 108 biomethane injection plants (80% of AD plants however are electricity generation, 993 MW_e)[2]
- Ireland – Targeting 11TWh biomethane in the gas network by 2030[3]
- France – 107 Biomethane plants injecting into the grid (1.8 TWh/year), 3 new biomethane plants per month in 2019. Goal of 12TWh by 2023. Potential for 460TWh by 2050 based on three technologies AD, gasification, power to H2/CH4 [4]
- Germany – 10TWh biomethane injection (2017)[5]
- Denmark – 2TWh biomethane injection (2017)[5]
- Netherlands – 0.7TWh biomethane installed (2017), 1.1 TWh commissioned[6]

There are also approximately 3,500 Natural Gas Filling Stations in Europe in 2017. Italy uses 1 billion m^3 of natural gas/yr in transport with 1,350 CNG filling stations, fuelling 1 million natural gas vehicles. This has achieved 15% CO_2 reductions in transport from using liquified natural gas compared to diesel, 70% NOx reductions and 99% PM reduction[1].

Rapid decarbonisation of the various energy sectors is needed immediately if we are to keep global warming below a 1.5°C temperature increase. A key requirement of decarbonised energy sources is the efficient storage and transport from the point of generation to the end user. European countries have recognised that gas transport is the cheapest and most efficient form of energy transport:

- Electricity – 1GW cable capacity, 260km, 600 million euros = 230 euros per kW/ 100km[6]
- Gas – 20GW pipe capacity, 230 km, 500 million euros = 11 euros per kW/ 100km[6]

The natural gas network also provides a cost-effective means of storing energy. Gas stored within the high-pressure gas system in the NTS (National Transmission System) is on average 3,743GWh. In 2017 the gas network in the Republic of Ireland transported over 56,000GWh of energy, almost double that conveyed by the electricity grid at approx. 28,000GWh[3]. The gas network can therefore deliver large capacity for energy storage at a much lower cost than from deployment of battery storage for intermittent renewable electricity sources. Intermittent electricity should therefore be used to generate hydrogen which can then be stored within the gas grid.

Blending up to 20% hydrogen means existing natural gas burning appliances can be utilised. If a 20% hydrogen blend was rolled out across the UK it could save around 6 million tonnes of carbon dioxide emissions every year, the equivalent of taking 2.5 million cars off the road. The CCC suggests that most of the hydrogen production will come from reforming natural gas[7].

The gas network within Northern Ireland is a modern, world class network which can play a major role in immediate, near term decarbonisation efforts. By 2022 60% of NI households and businesses will have access to natural gas across a network spanning 6,247kms[8]. The infrastructure is in place and is already providing decarbonisation benefits but policy needs to support further decarbonisation measures.

We need to emulate the experience of other developed European countries and extend the gas network to as many customers as practical. Switching to natural gas from kerosene for heating and diesel vehicle fuel will provide instant carbon dioxide emissions savings.

- CNG:0.18385 kg CO_2e/kWh[9]
- Kerosene: 0.25676 kg CO_2e/kWh[9]
- Diesel 0.24675 kg CO_2e/kWh[9]

Decarbonisation of the gas grid can then be progressively implemented with biomethane which is technology mature and already widespread in Europe.

The ADBA highlights that AD, the technology used to generate biomethane, has wide reaching benefits, contributing to at least nine of the UN's 17 Sustainable Development Goals. AD also provides significant carbon dioxide savings from other associated areas[10].

TABLE 1.4.1: CARBON SAVING BROKEN DOWN BY COMPONENT BENEFIT OF AD

	CARBON SAVING, $MtCO_2$-eq	EQUIVALENT TREES PLANTED[7]
Displaced fossil gas (heat & transport)	0.42	6,944,000
Displaced fossil-based electricity	1.70	28,109,000
Displaced artificial fertiliser	0.46	7,606,000
Prevented methane emissions from…		
…farm waste	0.22	3,637,000
…food waste	0.69	11,409,000
…sewage	1.58	26,125,000
Total	**5.07**	**83,767,000**

NB: total equivalent trees planted do not sum due to rounding.

Biomethane is not an option. It is a necessity[10]. Hydrogen injection can then be introduced as the technology becomes market ready to provide further decarbonisation benefits.

References

1. Gaseus and liquefied biomethane for sustainable transport, CIB, Presentation Future of Biogas Europe 13 – 14 November

2. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf Pg 15

3.https://www.gasnetworks.ie/vision-2050/future-of-gas/ GNI_Vision_2050_ Report _Final.pdf

4. French Biomethane Sector: State of Play & Future Development – GRDF, Presentation Future of Biogas Europe 13 – 14 November
5. Invest Insight: Securing Finance for Growth in the Biogas Market – Swen Capital Partners, Presentation Future of Biogas Europe 13 – 14 November
6. The Realistic Role of Bio-methane in the Dutch Energy Grid – Gasunie, Presentation Future of Biogas Europe 13 – 14 November
7. https://www.theccc.org.uk/publication/hydrogen-in-a-low-carbon-economy/#key-findings-and-recommendations
8. https://www.uregni.gov.uk/market-overview-1
9. https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019
10. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf Pg 7
11. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf Executive Summary ii

Q2 What are the key considerations for decarbonising Northern Ireland's energy sector given existing linkages to other jurisdictions?

Northern Ireland shares interconnections with the natural gas networks in GB and RoI. These other areas have already expanded the gas network to connect more customers and in GB many biomethane injection projects are operational.

Biogas/Biomethane has the opportunity to provide a pathway to decarbonise transport as a transport fuel within CNG vehicles. In the Anaerobic Digestion and Biomethane Association (ADBA) Report Biomethane: The Pathway to 2030 the potential benefits of AD for the UK energy sector are as follows[1]:

- 30% of the saving needed to meet the 5th carbon budget for 2030
- 6% reduction in total UK emissions in the hardest to decarbonise sectors
- 27 million tonnes CO_2 equivalent saved
- 6.4 million homes heated
- 8 billion m^3 of biomethane generated
- 30,000 direct jobs across the country
- £20 billion investment into UK industry
- 170 million tonnes of organic waste recycled through AD

In RoI Gas Networks Ireland has an ambition to be a net zero carbon gas grid by 2050. Gas Networks Ireland is targeting 11TWh/annum renewable gas in the network by 2030 (20% of current demand). The volume of renewable gas and hydrogen in the gas network will increase over time to 50% by 2050. GNI forecast that most of this renewable gas initially come from injection of biomethane (early 2020) into the gas grid supported by hydrogen injection starting 2034. Biomethane is targeted to be at 23% of total gas volume by 2034[2].

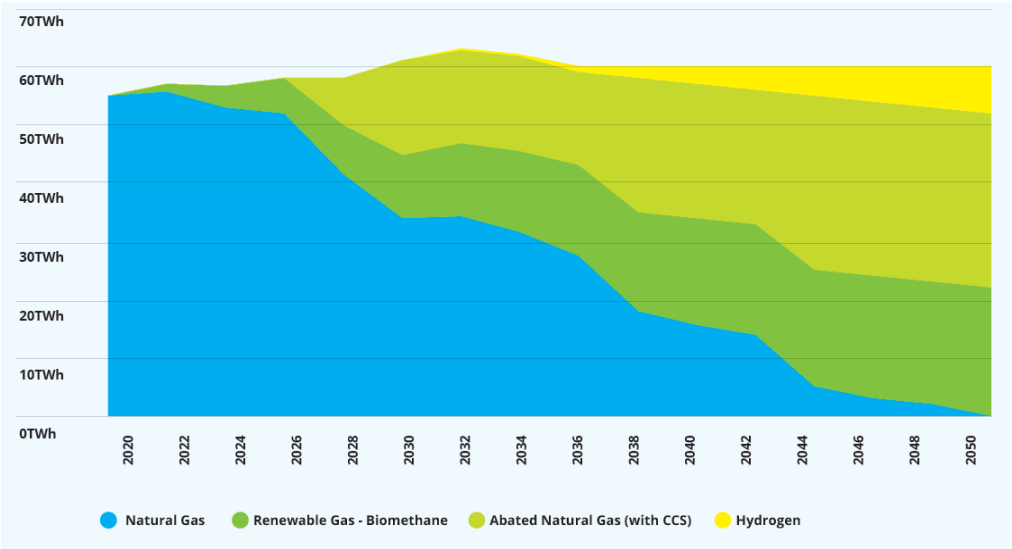


Figure from GNI Report[2].

GNI anticipate development of 340 AD plants to deliver the biomethane gas for injection into the grid.

Modelling by KPMG indicated the scale of the plants to be developed along with a pathway for development.

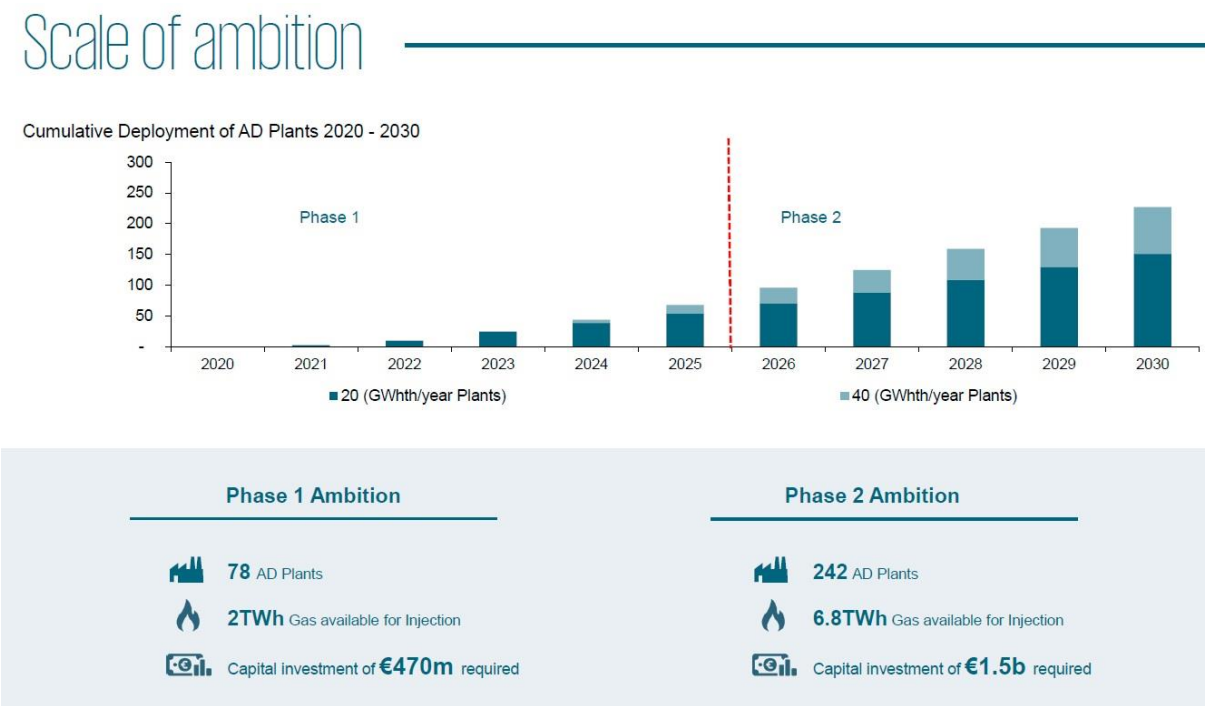


Figure from KPMG Report[3]

Northern Ireland also needs to recognise the huge opportunity that neighbouring jurisdictions have acknowledged by utilising the natural gas grid with progressive decarbonisation. The decarbonised methane can be used by existing customers with no changes to their equipment and impact all three energy sectors, power, heat and transport. The network has the added benefit of providing vast quantities of energy storage and a non-intermittent supply of energy.

References

1. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf Executive Summary ii

2. https://www.gasnetworks.ie/vision-2050/future-of-gas/GNI_Vision_2050_Report_Final.pdf

3. Presentation, A Vertically Integrated Business Case for Biomethane in Ireland – October 2019, KMPG, Irish Gas Forum 2019

Q3 To what extent should Northern Ireland implement the key energy-related recommendations from the CCC 'Reducing Emissions in Northern Ireland' report?

The Report fails to recognise the significant benefit that biomethane (BM) can provide.

- The electricity section mentions the need to manage 'intermittent renewables' but nowhere mentions the role of biogas generation as a 'dispatchable renewable' in achieving this, despite references to fossil gas generation on pg 44.
- There is no mention of biogas generation in the section on local/community power generation.
- The chapter on land use lists policies with multiple benefits but fails to mention AD among these.
- AD is mentioned in the land use chapter in table 3.1, but only in reference to 'manure management'. It does however show a possible negative cost of GHG abatement.
- Within the chapter on heat, figure 4.3 indicates a figure of 20TWh of biogas for the UK by 2030, which is conservative - this is lower than the total potential but it depends on assumptions and policy choices. This is noted to be 5 % of UK gas demand.
- Page 78 does acknowledge the potential of hybrid heat pumps, but only in the context of using H2 for the gas, rather than the more immediate prospect of a hybrid heat pump operating on renewable electricity plus renewable gas.
- Page 79 does acknowledge BM and suggests that 2 TWh is available, however earlier in the report it suggests most of this is from manure as a feedstock, whereas the model shows clearly that the main feedstock is likely to be food waste.
- The report comments that much of the 2 TWh could not be injected into the grid as the NI grid is not very extensive. This overlooks the model of using shared large scale injection points and virtual pipelines, which has been demonstrated to work extremely well by SGN, and which would be very well suited to NI.

- The transport chapter makes no mention of BM at all. However, it should be noted that BM is best targeted at the heaviest vehicles, and the report makes almost no reference to these in any case, so the lack of attention to BM is not surprising. Generally the CCC is opposed to the idea of BM in transport as its models show that BECCS (mainly gasification to produce H2 from biomass, then storing the CO2) is the theoretical lowest cost pathway to the GHG target. This overlooks many practical considerations, and the fact that if biogas is upgraded to BM, the CO_2 is already captured as a pure stream.
- The waste chapter is mainly focused on avoiding methane emissions to atmosphere, overlooking the benefits of actually using that methane to displace fuels in use elsewhere.
- The report proposes that heat pumps are used to provide for heating for homes which are not connected to the natural gas network. This however does not consider that retrofit of a heat pump into an older building is not effective without significant changes to the heating infrastructure. Heat pumps are also suited for providing a lower temperature consistent background heat. Additional peak heating is required for domestic hot water i.e. showers.
- The cost to the consumer is also higher than when using existing oil boilers as shown in the figure below[1].

4 Bedroom house = 1800 L oil/yr @ 10.35 kWh/L					
	2015	**2020**	**2025**	**2035**	**2040**
COP	2.2	2.31	2.43	2.54	2.77
Demand [kWh]	18630	18630	18630	18630	18630
Electricity [kWh]	8468	8065	7667	7335	6726
Electricity (£0.1762)	£1,492.09	£1,421.04	£1,350.87	£1,292.36	£1,185.06
Oil (£384.63/900L)	£769.26	£769.26	£769.26	£769.26	£769.26

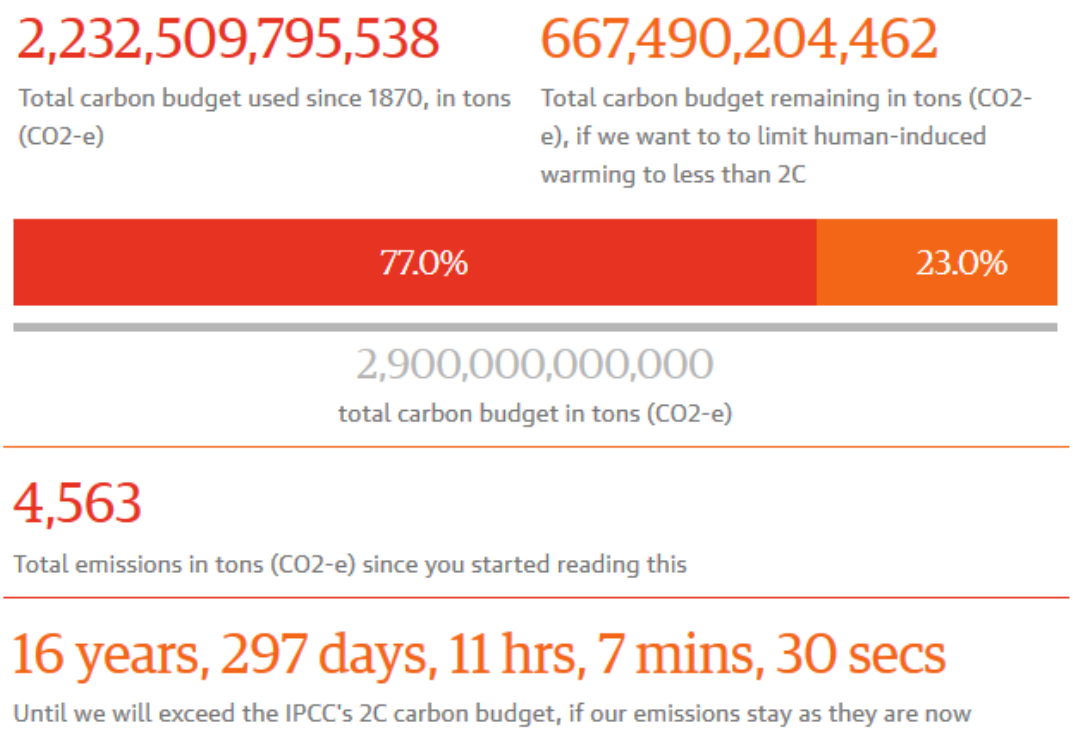
- Under these modelling conditions based on current coefficients of performance householders would pay an additional £416 - £651 per year.
- Heat pumps are a useful low carbon means of providing heat but within the right context such as new energy efficient buildings which are remote from the gas network. We would advocate extension of the gas network throughout the province to connect as many users as practical with a focus on decarbonising the gas within the grid. Switching to a gas boiler is easy and requires no retrofit of the heat delivery system. Biomethane is interchangeable with natural gas and gas boilers can operate with up to 20% blended hydrogen. The customer will recognise immediate carbon savings and also not contribute to an already overburdened electricity grid. Demand on the grid will already increase heavily from electric vehicle charging and customers with no possibility of connection to the natural gas grid.

References

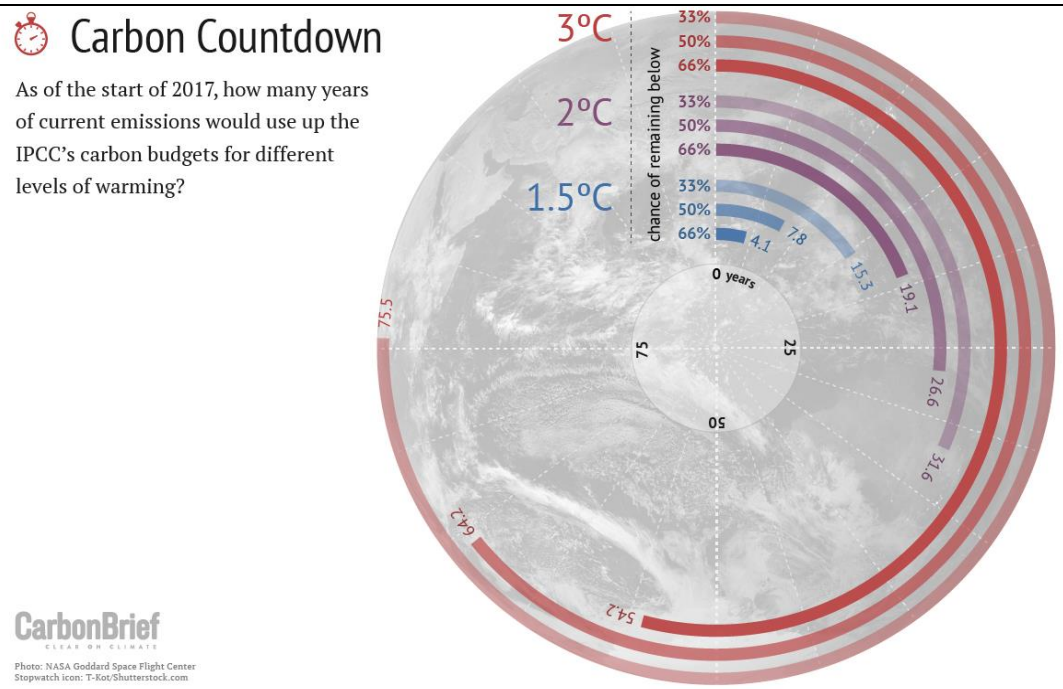
1. Agriculture, Bioenergy and the route to Zero Carbon, Prof David Rooney, Presentation The Energy Transition Conference 27th February 2020

Q4 Do you agree with the 30-year timeframe? If not, please state your preferred approach and reasons.

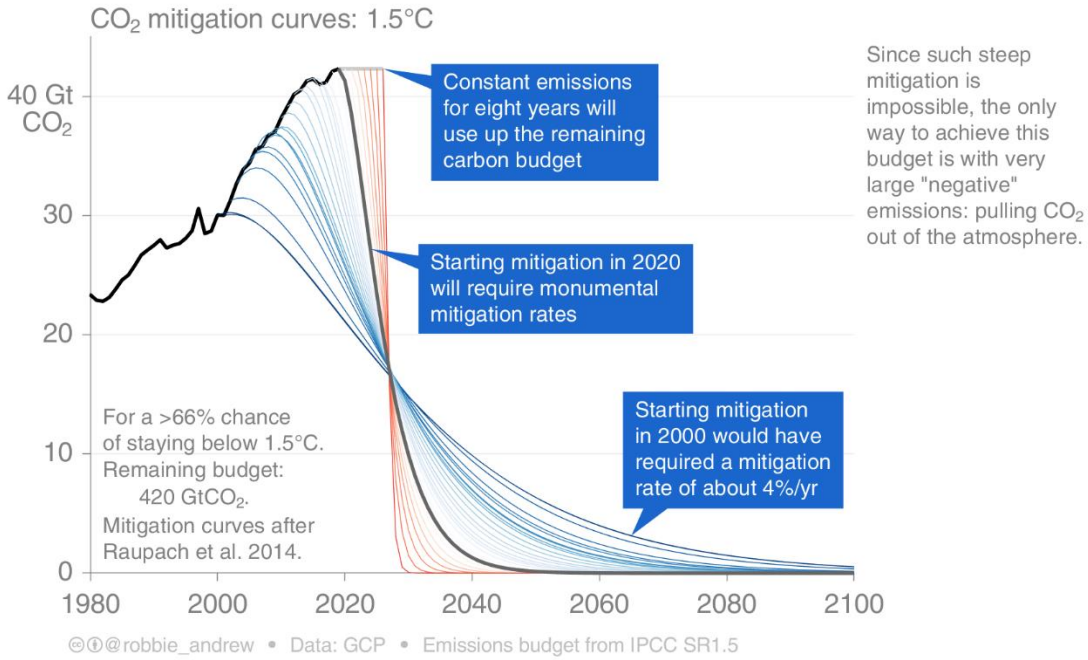
No, the target should be the same as Scotland to commit to a net zero carbon economy by 2045. The global carbon budget is quickly being used up as illustrated below in the Carbon Countdown Clock[1] . This shows the global carbon quota if we want to limit global warming to less than 2ºC. This screenshot was taken 12:52PM on 12-Mar-20.



The Paris Agreement (2015) however pursues efforts to limit the temperature increase to 1.5ºC. Figures from 2017[2] illustrated below indicate that we only had 4.1 years at the 2017 levels of emissions to have a 66% chance of keeping the temperature increase below 1.5ºC .



Interim targets for CO_2 reduction should therefore be highly aggressive as any delay in mitigation measures will require steeper reductions in later years to avoid a 1.5°C temperature increase. This is shown in the graph below taken from the *Figures from the Global Carbon Budget 2019*[3].



Note that the graph is only for a greater than 66% chance that the 1.5°C temperature increase is not exceeded. These projections illustrate that the bulk of the carbon dioxide reductions needs to occur well in advance of the 2050 deadline set by the UK government.

The ADBA reports that we have just 10 years to cut global emissions by 40-60% from 2010 levels to prevent a temperature rise above 1.5°C, above which the consequences of climate change are increasingly catastrophic[4].

A **60% reduction** in CO_2 emissions by 2030 is therefore necessary with significant measures being implemented now in early 2020. This highlights the need for immediate conversions to forms of low carbon energy which are technologically ready and deployable at scale. This reinforces the need to utilise the natural gas network as a transporter of decarbonised energy through injection of biomethane and hydrogen.

References

1. https://www.theguardian.com/environment/datablog/2017/jan/19/carbon-countdown-clock-how-much-of-the-worlds-carbon-budget-have-we-spent
2. https://www.carbonbrief.org/analysis-four-years-left-one-point-five-carbon-budget
3. http://folk.uio.no/roberan/img/GCB2019/PNG/s00_2019_Mitigation_Curves _1.5C.png
4.http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf

1. The Energy Transition in Northern Ireland

Q5. What are the unique characteristics of Northern Ireland that need to be considered in a net zero carbon energy transition?

Q6. Is your organisation undertaking or planning to undertake projects to support the energy transition? If so, please provide further details.

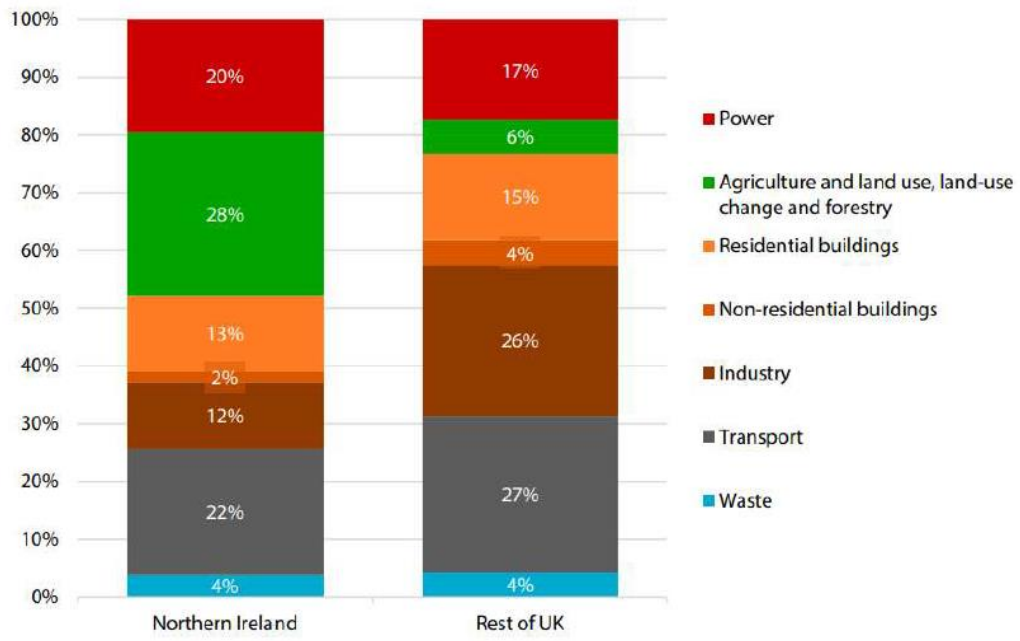
Q5 What are the unique characteristics of Northern Ireland that need to be considered in a net zero carbon energy transition?

The unique features of the NI energy market are:

- No direct access to nuclear power;
- Its more limited options for renewables resulting greater reliance on intermittent renewables; and
- The scale of its off-gas grid area.

Further key differences between Northern Ireland and GB are outlined in the Reducing Emissions in Northern Ireland Report.

- The largest difference is the combined agriculture and land use, land-use change and forestry (LULUCF) sectors which makes up a total of 28% of emissions in Northern Ireland compared to just 6% in the UK.
- In buildings Northern Ireland has a much higher percentage (76%) of homes off the gas grid compared to those in Great Britain (13%).
- Northern Ireland is not likely to achieve this level [35% by 2030] of emission reductions through existing policies. In particular there is a policy gap in transport (0.4MtCO_2e) and agriculture (0.7 MtCO_2e).



Emissions by sector in NI (2016)

The more cost-effective option is to extend the natural gas grid to connect more homes and businesses. This will provide access to a cheaper and more stable price for heat whilst delivering immediate carbon dioxide reductions against the main alternative fuel source (heating oil). Extension of the natural gas grid will also provide more

opportunities for developing compressed natural gas fuelling (CNG) fuelling stations. OEM CNG vehicle technology is ready for purchase and can deliver carbon dioxide reductions of 15% - 25% against diesel fuelling. Development of the gas grid will also provide greater opportunity for connection points for biomethane injection (immediate to short term projects) and renewable hydrogen injection (long term prospect).

The Reducing Emissions in Northern Ireland report by the Committee on Climate Change indicated that Northern Ireland has potential to generate between 130 - 580 million m3 of biomethane per year, which could provide up to 2,000 GWh of heat or electrical energy. Manure has potential to be the largest feedstock source for anaerobic digestion in Northern Ireland, providing 50 - 300 million m3 per year[1]

This biomethane energy could also be used as a potential transport fuel for CNG vehicles. The report also highlighted that Northern Ireland is in a unique position whereby its entire gas network is built out of polyethylene pipe[1]. This type of material is suitable for both future hydrogen and bio methane fuel sources, unlike the iron or steel pipe networks that still exist in GB.

Northern Ireland therefore has a gas grid infrastructure advantage over the rest of GB as decarbonised gases can be readily accepted. Policy needs to be directed to maximise the benefit of being ahead of the curve and make injection of decarbonised gas into the grid a high priority.

The ADBA have also estimated that AD has already directly saved 0.68 MtCO2e from UK agricultural sources (displaced artificial fertiliser, methane emissions from farm waste)[2].

References

1. Reducing Emissions in Northern Ireland, Committee on Climate Change, February 2019, Pg 79.
2. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf

Q6 Is your organisation undertaking or planning to undertake projects to support the energy transition? If so, please provide further details.

Granville Ecopark operate the largest anaerobic digestion (AD) facility in Ireland. Commercial and industrial organic wastes (i.e. food waste) are used as a feedstock for the AD process and biogas is generated. Biogas is rich in methane and is used to fuel 5MW_e of combined heat and power (CHP) units. Generation of renewable electricity from this source is constant, stable and predictable and is sold to grid via an export grid connection. We also have the facility to upgrade biogas to biomethane (99.5% methane

concentration) and transport the biomethane in compressed gas trailers (250bar pressure) to other CHP units to provide renewable electricity and heat generation at various other sites. Biomethane can be used interchangeably with natural gas and therefore can be used as a fuel for heating and also as a transport fuel within Compressed Natural Gas (CNG) vehicles. Biogas/Biomethane therefore have the present-day capability and flexibility to decarbonise all three energy consumption sectors; power, heat and transport.

We have operational projects across the province and are taking delivery of CNG/biomethane fuelled trucks for our vehicle fleet. Granville Ecopark has also installed a biomethane refuelling point at the AD facility. We are also planning installation of a carbon dioxide liquefaction plant to capture and utilise the CO_2 generated from the biogas-to-biomethane upgrading process. Liquified CO_2 will be marketed to commercial users of CO_2 and displace fossil fuel sourced CO_2.

Digestate, a co-product of the AD process, is a source of organic fibre and fertiliser nutrients. This is currently being spread to agricultural land to displace synthetic fertilisers derived from fossil fuels.

Northern Ireland has the capacity for further AD projects using alternative feedstocks such as brown bin, black bin, agricultural wastes (i.e. slurries). This has additional benefits of alleviating other environmental pressures such as fugitive ammonia emissions and nitrate/phosphorous run off into water courses. These projects could largely be funded on the back of the existing RTFO scheme and this needs to be supported with policy to encourage the adoption of CNG/LNG vehicles.

1. Consumers

Q7. How should we ensure that energy remains affordable for domestic consumers? What approach should be taken to eradicate fuel poverty?

Q8. What steps could be taken to improve the relative cost competitiveness of larger non-domestic consumers?

Q9. Is a strategic position of "enable and protect" the correct policy stance?
   a) What policies or schemes are needed to enable active consumers?
   b) What policies or schemes are needed to protect vulnerable consumers?

Q10. What types of advice and information are required by all consumers and what are the best mechanisms for facilitating this?

Q11. Are there examples of successful citizen energy projects in Northern Ireland and elsewhere that have delivered improved energy efficiency and/or clean energy to local communities?

Q12. What opportunities are there in both urban and rural areas for citizen energy communities in Northern Ireland? What role could government have in facilitating these?

Q13. What evidence can you provide that identifies the challenges and opportunities for NI energy consumers in decarbonising energy?

Q7.How should we ensure that energy remains affordable for domestic consumers? What approach should be taken to eradicate fuel poverty?

The current costs for energy on a kilowatt hour basis are as follows:

Table x.x Energy Price Comparison	
Fuel Source	Price
	(p/kWh)
Natural Gas	3.90[1]
Heating Oil	3.84[2]
Electricity	16.69[3]

Natural gas is a lower carbon alternative than heating oil and therefore delivers the most cost-effective option for decarbonisation whilst ensuring that energy remains affordable.

Heat pump technology is recommended as an alternative form of decarbonising heat but the beneficial effects are dependant on heat pump efficiency. This is known as the Coefficient of Performance (COP). The COP indicates the quantity of heat output per

quantity of electricity. Heat pump technology is only cost effective if electricity prices are low.

For Air Source Heat Pumps the efficiency performance tends to decrease during periods of severe cold. For comparison, in mild weather COP can be about 4.0, but when the temperature drops to 0°C, the COP can also decline to 2.5. On average, the COP of typical heat pumps has a seasonal variation of about 2.5-2.8[4].

Even with a high estimated COP of 3, the equivalent cost of heat is equivalent to 5.563p/kWh. Condensing central heating gas boilers achieve an efficiency in excess of 90% which would provide an equivalent cost of heat of 4.33p/kWh. Installation of a heat pump is also a significant retrofit for the heat pump technology and the heating system will likely need to be retrofitted to underfloor heating.

A heat pump manufacturer indicates that *"the outlet temperature from the heat pump can have a significant effect on the efficiency and hence COP of the heat pump. Therefore heat pumps are ideally suited for underfloor mounted in screed which only requires a low inlet temperature of 35°C and how using radiators may result in a lower COP due to the higher flow temperatures they require."*[5]

Modelling by KPMG also indicated that the lowest form of decarbonisation for heating is biomethane rather than electrification.

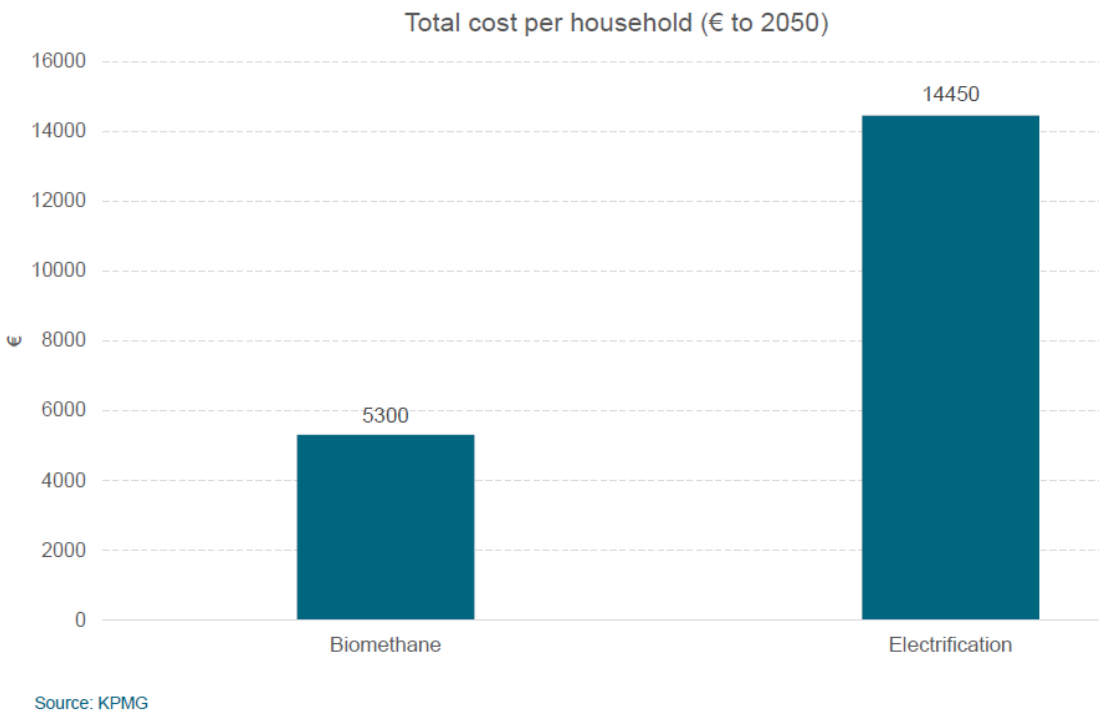


Figure from KPMG Report[6]

Extension of the natural gas grid supported by the decarbonisation strategies discussed previously (biomethane, hydrogen, CCUS) is the fastest option for decarbonisation whilst remaining cost competitive. This will quickly deliver the emissions reductions needed in the short-medium term.

References

1. https://www.consumercouncil.org.uk/sites/default/files/2020-03/Gas%20Price%20Comparison%20Table%20-%20April%202020_0.pdf
2. https://www.boilerjuice.com/heating-oil-prices-northern-ireland/
3. https://www.consumercouncil.org.uk/sites/default/files/2020-02/Electricity%20Price%20Comparison%20Table%20Jan%202020.pdf
4. https://www.greenmatch.co.uk/blog/2014/06/air-source-heat-pump-performance
5. https://www.kensaheatpumps.com/the-technology/compliance/coefficient-of-peformance-cop/
6. Presentation, A Vertically Integrated Business Case for Biomethane in Ireland – October 2019, KMPG, Irish Gas Forum 2019

Q8 – Q11

No response.

Q12. What opportunities are there in both urban and rural areas for citizen energy communities in Northern Ireland? What role could government have in facilitating these?

Partnership between local authority and local farms, with community co-operative investment, to build AD for combined manure and food waste. This could be in conjunction with community-owned wind and/or solar and provide dispatchable generation to help match production and demand.

Q13 What evidence can you provide that identifies the challenges and opportunities for NI energy consumers in decarbonising energy?

Opportunity

- Potential of 130 - 580 million m^3 of biomethane per year[1]
- Manure has potential to be the largest feedstock source for anaerobic digestion in Northern Ireland, providing 50 - 300 million m^3 per year
- 2,000 GWh of potential heat generation[1]

- Intermittent renewable electricity sources (i.e. wind and solar) could be used to generate hydrogen[2]. The natural gas grid can act as an immediate store for this hydrogen and therefore sidesteps the existing barrier for development of electricity grid strength. Storage and transmission of gas is significantly cheaper and more efficient than electricity.

Challenge

- Capturing and making best use of these organic resources for biomethane production
- Extension of the gas grid and construction of gas injection points for biomethane and hydrogen.

References

1. Reducing Emissions in Northern Ireland, Committee on Climate Change, February 2019, Pg 79.
2. https://www.nweurope.eu/projects/project-search/gencomm-generating-energy-secure-communities/

2. Energy Efficiency

Q14. What, if any, energy efficiency target or targets should be set for Northern Ireland?

Q15. How should we define, measure and monitor energy efficiency to optimise its potential in our homes, business, economy and environment?

Q16. What are the most important policy levers for government to ensure zero carbon in:

a) New domestic and commercial buildings by 2050?;

b) Existing domestic and commercial buildings by 2050?

Q17. What should the future of energy efficiency support look like and who should be the key delivery bodies?

Q14 – Q17

No response.

3. Heat

Q18. What is the appropriate pathway and timeline for the decarbonisation of heat between now and 2030, and subsequently to 2050?

Q19. What are the appropriate ways to measure the progress of decarbonising heat?

Q20. What are the most cost-effective and sustainable steps that government might take to accelerate the reduction of the carbon intensity of heating fuels?

Q21. Is decarbonisation of the gas grid a viable option and what evidence can be provided on both the speed and affordability of decarbonising the gas grid?

Q22. What evidence can you provide on the opportunities for district heating schemes in Northern Ireland and where should responsibility lie for facilitating these?

Q23. Can you provide any evidence or information on the opportunities for geothermal heat supply?

Q18. What is the appropriate pathway and timeline for the decarbonisation of heat between now and 2030, and subsequently to 2050?

Decarbonisation of the natural gas grid following the points previously outlined i.e. injection of biomethane and hydrogen coupled with CCUS. This will provide a low carbon energy source which is immediately available for use in existing equipment. This avoids switching technologies and placing capital costs on the end use.

A technology change is not possible in some cases such as for industries requiring high temperature heating.

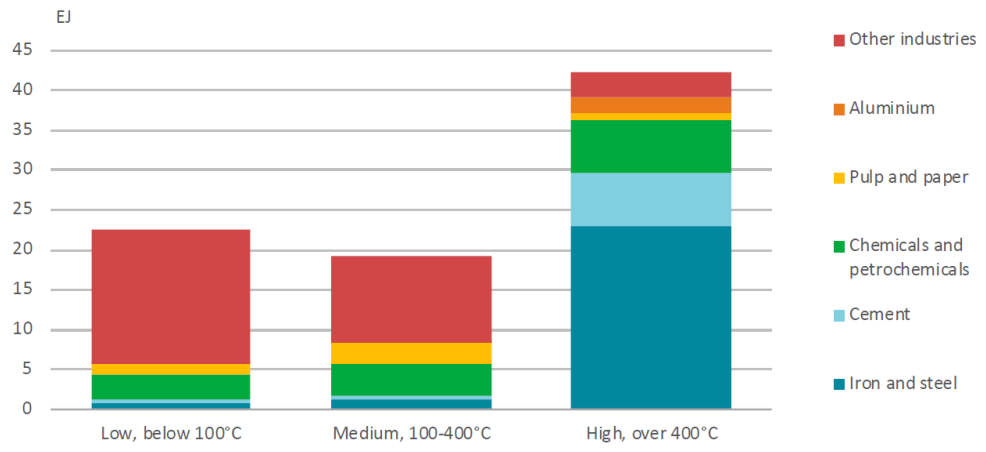


Figure from IEA Report[1]

Support and measures to improve the heat efficiency of homes should be continued to:

- Improve insultation (i.e. loft and cavity wall)
- Replacement of single glazing with double glazing
- Support for new oil domestic boilers in the gas grid area should cease

New houses should conform to higher standards of energy efficiency and prioritise low carbon heating technologies. This should be gas boilers connected to the gas grid which can benefit from a decarbonised gas grid.

In off-grid gas areas other technologies should be utilised such as Air Source Heat Pumps (ASHP), Ground Source Heat Pumps (GSHP) or Solar Thermal. New housing stock in off-grid areas should be designed from the outset to operate on low carbon heating or even passive house standards as this will be cheaper to accomplish rather than a deep retrofit of older housing stock.

References

1. Presentation, The Role of CCUS in meeting climate targets, Samantha McCulloch, IEA, Irish Gas Forum, 23-Oct-19

Q19. What are the appropriate ways to measure the progress of decarbonising heat?

Decarbonisation of the gas grid can be measured by determining the quantity of decarbonised gas (biomethane and hydrogen) which has been injected. Quantities will be recorded by the gas networks for billing purposes and can be provided as part of an annual declaration.

Data could also be correlated from any schemes such as the Green Gas Certification Scheme. Levy programmes will also provide data on decarbonised gas utilised.

The government has announced (March 2020) the introduction of a Green Gas Levy (GGL) on gas suppliers to support green gas injection to the grid. The aim is to accelerate the decarbonisation of our gas supply, by increasing the proportion of biomethane in the grid. This is expected to be implemented in autumn 2021. They expect these costs to be passed onto gas bill payers. The expected impact is relatively small; around £1 a year on the average household energy bill, rising to around £5 by 2025; that's c.0.5% of an average household's dual fuel bill. They said they will implement a robust cost control framework, which includes an annual budget cap to ensure impacts on bills do not rise unexpectedly[1].

Emissions abated natural gas can also be quantified by the gas networks as well as the performance of any CCUS projects.

Data can therefore be captured rapidly and accurately as it is being provided by the network rather than rely on assessment of each individual consumer.

References

1. Budget 2020: ADBA's response email 12-Mar-20

Q20. What are the most cost-effective and sustainable steps that government might take to accelerate the reduction of the carbon intensity of heating fuels?

Please see our response to Q18.

- The natural gas grid is of modern polyethylene construction, which is compatible with decarbonised gases (hydrogen, natural gas and biomethane). This delivers decarbonisation cost savings from utilisation of an existing modern asset.
- Decarbonisation can occur through hydrogen (up to 20%), biomethane without any modification to the end customers equipment. No difference in quality for emissions abated natural gas. No capital cost for new heat technology or retrofit of heat distribution system (i.e. radiators to underfloor). No disruption or lead in/installation timelines for dwellings/businesses. Instant emissions reductions are achieved. Least "cultural or habit change".
- The new proposed Green Gas Levy to support an extra 1.6 billion m^3 of biomethane injection for decarbonisation is only forecast to add £5/yr to a householder's bill.

Q21. Is decarbonisation of the gas grid a viable option and what evidence can be provided on both the speed and affordability of decarbonising the gas grid?

Please see response to Q20.

KPMG also outlined options for decarbonising domestic heating in Ireland (2018 report)[1] and concluded that decarbonisation via biomethane was the lowest cost for decarbonising heat for homes connected to or near the gas network.

Scenario	Technologies Deployed	Financial Impact per Household	CO_2 Emissions Mitigated ('000 tns per annum)	Summary of Feasibility Assessment
1. Gas Decarbonisation (Biomethane)	Biomethane produced by AD as a principal low carbon alternative to natural gas	€5,300 - €7,600* ** Average discounted cost per household between now and 2050 including combination of capex and increased energy costs.*	2,690 (93%)* ** including GHG savings within the biomethane, as well as savings with the agricultural sector.* *Excludes further savings from displacement of synthetic fertiliser, which would provide additional GHG savings* *Refers to percentage saving Vs today's baseline GHG emissions.*	Proven technology, with no change required at consumer or network level compared to existing natural gas usage. Meeting the heat demand of one million homes with biomethane will require considerable waste and grass silage resources that are complimentary with agri-food production (e.g. slurries, crop residues, rotation/catch crops) or increase utilisation of lower productivity grass-land. Significant new AD plant construction and a policy support mechanism would likely be required. Able to meet all current & expected EU GHG efficiency requirements.

Figure from KPMG Repprt[1]

The recent statement by the UK government regarding introduction of the Green Gas Levy will have a minimal impact on householder bills. A robust cost control framework, which includes an annual budget cap will be implemented to ensure impacts on bills do not rise unexpectedly.

References

1. https://www.ervia.ie/decarbonising-domestic-he/KPMG-Irish-Gas-Pathways-Report.pdf

Q22 - Q23.

No response.

4. Power

Q24. What is the appropriate pathway for the decarbonisation of power from now to 2030, and subsequently to 2050?

Q25. What target for electricity consumption generated from renewable sources by 2030 is ambitious, achievable and affordable?

Q26. How can the new infrastructure necessary to meet a new renewable electricity target be delivered in a timely, affordable and acceptable way for consumers and society?

Q27. What innovations and solutions could contribute to meeting a new renewable electricity target?

Q28. What market incentives and support are necessary for investors to deliver the investment in renewable generation assets at a scale that will achieve a new renewable electricity target?

Q29. What steps need to be taken by Government to facilitate investment in offshore and marine renewables for NI?

Q24. What is the appropriate pathway for the decarbonisation of power from now to 2030, and subsequently to 2050?

Decarbonisation of the natural gas grid following the points previously outlined i.e. injection of biomethane and hydrogen coupled with CCUS. This will provide a low carbon energy source which is immediately available for use in existing equipment. This avoids switching technologies and placing capital costs on the end user.

The natural gas network provides flexibility as it can supply all three energy sectors (electricity, heat and transport). Electricity generation from natural gas provides for peak power demand during cold winter periods when there is low wind speeds and thus a deficit from wind turbines. The gas grid can be progressively decarbonised to transition to net zero by 2050 as per previous examples cited.

Q25. What target for electricity consumption generated from renewable sources by 2030 is ambitious, achievable and affordable?

Northern Ireland should at least be aiming for a similar increase in renewable electricity generation to other regions within the UK. Scotland and Wales are aiming for a 22% increase on their present levels by 2030. The comparable increase for Northern Ireland to Scotland and Wales would be 67% (two thirds) based on a current base line of 44.9% electricity from renewable sources.

Q26. How can the new infrastructure necessary to meet a new renewable electricity target be delivered in a timely, affordable and acceptable way for consumers and society?

Biogas/biomethane can provide a fuel source for consistent, reliable and predictable load via combined heat and power. Incentives for electricity production are no longer available for new CHP projects however the Green Gas Levy for biomethane to grid injection will help to provide a route for decarbonising the gas grid. CHP fuelled by a decarbonised gas grid could then be deployed to provide local generation and grid support where the electricity network is struggling to meet demand. CHP could be installed at large industrial users or within a local community to provide onsite co-generation of heat and power.

This would also help alleviate the cost and time pressure for delivering transmission system upgrades for connection of more intermittent renewable wind projects. This could deliver decarbonisation benefits within the short term and allow for larger electricity infrastructure projects to be completed.

Electricity from intermittent renewable energy sources could be converted to hydrogen gas through electrolysis as a longer-term goal. The gas can then be injected and stored within the gas grid. This will help to decarbonise the overall gas grid and reduce emissions from existing gas power stations. Green hydrogen from electrolysis costs around $3.5/kg but needs to get to $2/kg to compete with generation from fossil fuels[1]. However, as the hydrogen economy develops the costs will come down. Cost reductions have been achieved through mass production of lithium ion batteries where costs have fallen by more than 80% per kilowatt hour since 2010[1].

References

1. Financial Times Article - Hydrogen company stocks jump back on to “hype cycle” Henry Sanderson, 26-Feb-20

Q27. What innovations and solutions could contribute to meeting a new renewable electricity target?

Please see response to Q26 regarding biomethane CHP and hydrogen. The rationale is that both gases act as an efficient store of decarbonised energy which can then be utilised in any of the three energy sectors. Electricity can then be produced through existing technologies using a decarbonised gas as the fuel source.

Q28. What market incentives and support are necessary for investors to deliver the investment in renewable generation assets at a scale that will achieve a new renewable electricity target?
No response.

Q29. What steps need to be taken by Government to facilitate investment in offshore and marine renewables for NI?
Offshore and marine renewables development is constrained by agreement on which government will provide leasing/permission for installation of equipment on the seabed. The government needs to address this issue and provide clear guidance on how projects achieve necessary permissions and provide a time commitment for responding once applications are submitted.

The NIRO is also closed to new projects and therefore no financial incentive mechanism exists for supporting the development of new offshore renewable electricity projects. Technology costs for the sector are high, particularly for tidal, as they did not achieve the magnitude of installation experienced by onshore renewables under the NIRO. The market and supply chains are therefore not developed and costs are not as competitive with other onshore technologies.

5. Transport

Q30. What would be an appropriate pathway to decarbonised energy for transport to 2050?

Q31. What role should active travel have in the decarbonisation of the transport sector and what should government do to support this?

Q32. What energy infrastructure is needed to facilitate the uptake of electric vehicles in line with UK Government's 'Road to Zero' targets?

Q33. How will transport integrate with other energy uses (e.g. homes with solar generation, battery storage, EV charging) and what can government do to optimise the opportunities represented by this integration?

Q34. To what extent can alternative low carbon transport fuels contribute to decarbonisation of the transport sector?

Q35. Do you have any data/research to help inform and reduce the carbon intensity of our transport energy in order to achieve net zero carbon by 2050?

Q30. What would be an appropriate pathway to decarbonised energy for transport to 2050?

The appropriate pathway to decarbonise energy for transport is to use compressed natural gas (CNG) as a means of immediately reducing the CO2 emissions from transport. CNG can then be decarbonised by injection of renewable gases such as biomethane and hydrogen. CNG is an excellent alternative for diesel in Heavy Goods Vehicles (HGVs) and Buses. The longer distances, localisation at hub points and often predictable routes taken by HGVs is suited to CNG/biomethane as refuelling points can be located along key transport corridors and high densities of customers. HGV's and buses are generally part of vehicle fleets and therefore affecting change to low carbon transport options requires a smaller number of actors than for private domestic customers. CNG will provide security of supply for a vehicle fuel and biomethane can quickly deliver the decarbonisation benefits. Biomethane is a ready to use transport fuel which has the potential to reduce emissions by 60-80% when compared to gasoline, diesel or LPG.

Anaerobic digestion sits at the centre of the circular economy of organic material recycling. When organic matter is processed at an AD plant, biogas is produced and captured, and a nutrient-rich organic matter, known as digestate, remains. The biogas produced is made up of a mixture of biomethane, bio-CO_2 and small amounts of other gases. The biogas can then be used to fuel a Combined Heat and Power (CHP) generator, or upgraded to biomethane, which is equivalent to fossil natural gas, by separating the methane from the bio-CO_2 and other gases.

This is a circular process as the organic wastes that we produce, from food manufacturing and processing, farming and household waste among others, can be recycled through AD plants. Processing organic materials in this way means that the methane emissions, 28 times more harmful than CO_2 and classed as a short-lived climate pollutant, that would otherwise be released from the organic waste streams breaking down in landfill or elsewhere where the gases are not collected, are avoided.

The ADBA reports the following:

- There are 672 AD plants in the UK, with an installed capacity of 992 MW_e[1].
- 108 are biomethane plants, in which the biogas is upgraded to biomethane, which has the same chemical structure as natural gas, so it can be injected into the gas grid or used as **transport fuel**, with a total installed capacity of over 85,000m3/hr, equivalent to the gas demand of Edinburgh[1].
- The sector is currently injecting 2.1 TWh of biomethane into the grid each year, which is enough to heat more than 170,000 homes[1].

The ADBA reports the following on the benefits of biomethane as a transport fuel:

- Using biomethane to fuel HGVs can reduce well-to-wheel emissions by up to 81%, compared to diesel28 – even low blends of biomethane into the fuel gas mix can offer significant reductions to GHG emissions. The same trial also demonstrated that HGVs fitted with LNG systems offered similar miles per gallon-equivalent to diesel, and up to 45% further range on a full tank (spark-

ignition engines only). Benefits of biomethane and gaseous fuels are not limited to GHG savings: drivers reported increased comfort while driving, quieter engines, and increased engine braking, without compromising overall vehicle reliability. While these systems may be more expensive to install, significant savings from gas prices mean costs can be recovered after just 2 years of operation (160,000 miles per year)[2].

TABLE 3.2.1: COMPARATIVE WELL-TO-WHEEL GHG EMISSIONS OF DIFFERENT ALTERNATIVE FUELS COMPARED TO FOSSIL-BASED TRANSPORT FUELS.

	kg CO_2 (e) per kWh		kg CO_2 (e) per kWh
Biomethane	0.0004	Electricity (grid average)	0.2556
Bioethanol	0.0014	Electricity (coal)	0.3056
Biodiesel	0.0035		
		Natural gas	0.1844
Hydrogen (electrolysis)	<0.1000	LPG	0.2145
Hydrogen (bio-gasification, no CCS)	0.1100	Petrol	0.2410
Hydrogen (stream reformation, no CCS)	0.3000	Diesel	0.2527

Data taken primarily from BEIS (2019) greenhouse gas conversion factors[46]; figures relating to hydrogen taken from Houses of Parliament (2017)[47].

Figure from ADBA Report[3]

Demand for renewable biomethane compressed natural gas (Bio-CNG) has increased by 800% in the UK thanks to companies adopting alternative fuels.

A bus operator First West of England announced plans for a fleet of 77 new biomethane powered buses. In January 10 buses were operating, with another 27 in February with the remaining 40 to be on the road by April. A new gas filling station was constructed to provide 100% compressed biomethane to fuel up to 100 buses[4].

The Leyland CNG filling station was opened in February 2016 and is connected to the national high-pressure grid. The station is capable of refuelling 500 trucks per day with an approximate refuelling time of 4 minutes per truck. Compressed Biomethane Methane is also sold through this station via the Green Gas Certification Scheme.

Waitrose has introduced two new dedicated gas-fuelled Scania tractor units into its distribution fleet operation where there are already 44 dual fuel trucks which use a mixture of gas and diesel. The two dedicated gas-fuelled trucks will operate at a range of 350 miles and will be used to deliver products to stores throughout northern England, the north Midlands and north Wales. Operating on a return-to-base duty cycle and refuelling from the gas station in Leyland.

A new refuelling station has been opening in Warrington UK (Europes biggest station and Northampton and are capable of refuelling more than 1,000 HGV's per day. CNG Fuels plans to open another six to eight CNG stations over the next 12 months[5].

Other companies switching to biomethane include:

- John Lewis Partnership has committed to replace its diesel HGV fleet with 500 biomethane vehicles by 2028
- Hermes is replacing 200 diesel trucks

- Other companies including Home Bargains, ASDA, Argos, Royal Mail, DHL and Cadent are adopting biomethane

This indicates that the direction of travel in the UK for the AD sector has been AD Biomethane for injection into the natural gas grid.

Decarbonisation of the natural gas grid is also a high priority for the Republic of Ireland. This is outlined within the Gas Networks Ireland Vision 2050 report and aims to accomplish a net zero carbon gas grid with a combination of:

- Abated Natural Gas with Carbon Capture and Storage (CCS) – 50% CO_2 savings
- Hydrogen Injection – 13% CO_2 savings
- Biomethane Injection – 37% CO_2 savings

A key sector for realising emissions savings is within transport as they envisage usage of biomethane and emissions abated CNG as a vehicle fuel. Emissions savings of 2.8 million tonnes CO_2 are projected for the transport sector (based on 24% HGVs + 13% buses using Bio-CNG from 170 refuelling stations). A further emissions reduction of 2.4 million tonnes CO_2 comes from within agriculture via associated manure management and cultivation practices.

Gas Networks Ireland is targeting 11TWh/annum renewable gas in the network by 2030 (20% of current demand). The volume of renewable gas and hydrogen in the gas network will increase over time to 50% by 2050. GNI forecast that most of this renewable gas initially come from injection of biomethane (early 2020) into the gas grid supported by hydrogen injection starting 2034. Biomethane is targeted to be at 23% of total gas volume by 2034.

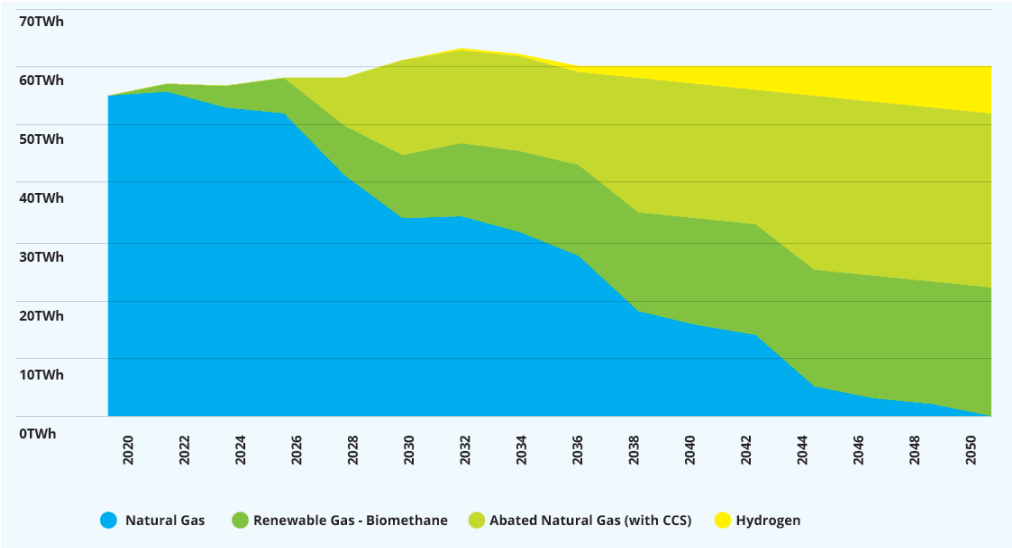


Figure from GNI Report[6]

GNI anticipate development of 340 AD plants to deliver the biomethane gas for injection into the grid[6].

Virginia Transport, a haulier within the RoI operates a fleet of 120 trucks and they are now in the process of converting their vehicle fleet to CNG. They had previously been operating two diesel trucks converted to CNG and recently took them out of commission after 1.5 million km. They have 22 CNG trucks on order and anticipate a gas demand of 5 – 6GWh in 2020 for their vehicles. They are planning to build a filling station at their HQ and have contracted to take 14GWh of natural gas for fuelling.

By contrast, Northern Ireland does not have any biomethane injection facilities but one AD facility (Granville Ecopark) has installed a refuelling point for biomethane. There is a total of 89 AD plants within Northern Ireland. Planning consent has also been given to an additional 63 sites. Many of these are farm scale plants which produce electricity using a 500kW$_e$ CHP (combined heat and power) unit. There are a small number of Industrial/utility scale AD plants in operation that are using 1-5MW$_e$ CHP units and some smaller units that have 150-200kW$_e$ generators. The larger industrial/utility scale sites are producing electricity for export to the grid.

The Reducing Emissions in Northern Ireland Report by the Committee on Climate Change has indicated that Northern Ireland is not likely to achieve this level [35% by 2030] of emissions reductions through existing policies. In particular, there is a policy gap in transport (0.4 MtCO_2e) and agriculture (0.7 MtCO_2e)[7].

AD Biomethane has a key role to play for both sectors by producing a renewable transport fuel (which could also be used in tractors) and also capturing emissions from agricultural wastes (i.e. manures, slurries etc) which could be used as a feedstock. 63 AD sites have received planning permission but have not been developed predominantly due to the closure of the Northern Ireland Renewables Obligation which formed the backbone of the business case in electricity generation through CHP. Some of these sites could be repurposed to generate biomethane for injection into the grid or for use as a transport fuel.

Key Benefits of CNG/Biomethane as a Transport Fuel

- CNG and biomethane are a complementary decarbonisation pathway.
- CNG provides a secure, reliable energy source which is already deployed at scale in one of the most modern gas networks.
- CNG has 25.5% lower associated CO_2 emissions than diesel[8]. (CNG 0.18385 kg CO_2e/kWh versus Diesel 0.24675 kg CO_2e/kWh). Biomethane has well-to-wheel GHG emissions of 0.0004kg CO_2e/kWh[9]
- CNG can be increasingly decarbonised in the near term through injection of renewable biomethane as shown by the current and future developments within mainland UK and the Republic of Ireland. Hydrogen can then be injected as the hydrogen generation technology reaches maturity.
- The normal fill time for a CNG HGV is 3-5 minutes from empty which is comparable to diesel.

- The first public access station has been constructed at the Circle K Service Station in Dublin Port, one of the busiest HGV refuelling stations in the country. Capacity to refuel up to 70 HGVs per day.
- CNG Fuel's Leyland CNG filling station has been supplied with 100% renewable gas (Bio-CNG) since September 2016.
- CNG is a proven technology with over 26 million CNG vehicles in use worldwide. The use of CNG in HGVs and buses can provide an immediate and significant emissions reduction, including harmful emissions such as particular matter, SO_x and NO_x, compared to diesel. The use of CNG will therefore significantly enhance air quality and reduce serious illnesses.

Compressed Natural Gas and Biomethane also have an important role to play in decarbonising shipping as well as road transport.

Barriers to Development in Northern Ireland

The Energy Strategy Call for Evidence recognises that the regulatory environment in NI does not currently facilitate injection of biomethane or hydrogen into the gas grid. This needs to change to provide parity with mainland GB and the Republic of Ireland.

The Hub and Spoke injection model has been used within the UK where biomethane is transported short distances to a common injection point.

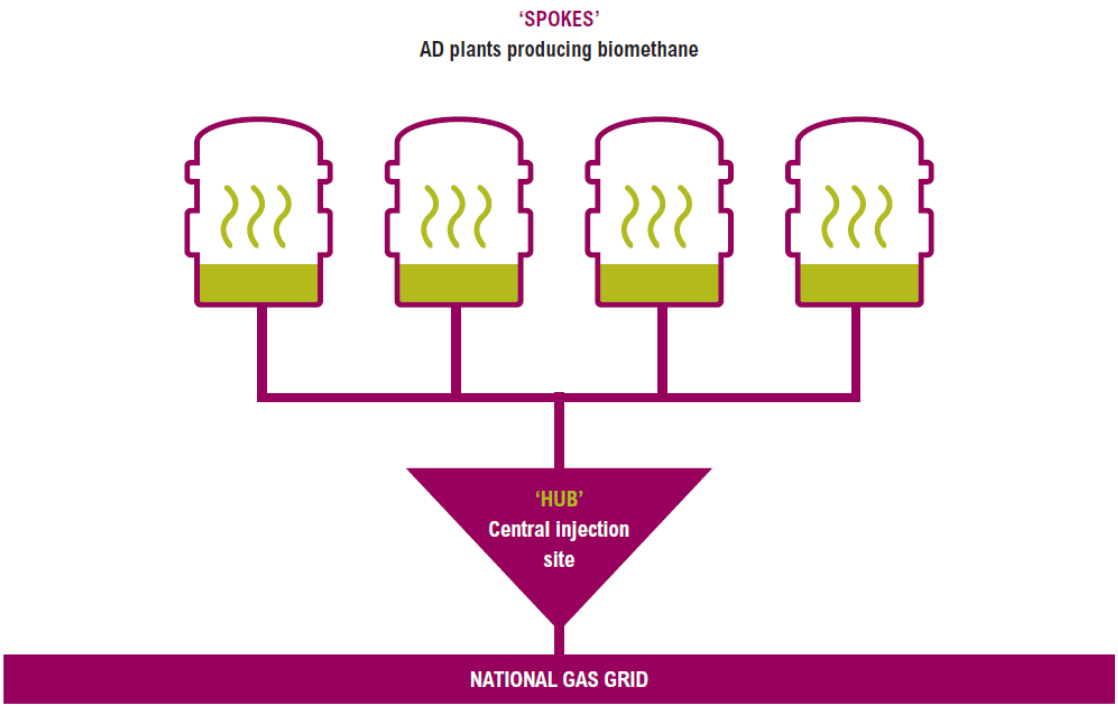


Figure from ADBA Report[10].

SNG's Portsdown Hill Gas Injection Facility based on this model was commissioned in 2014 and when operating a full capacity can supply enough energy to meet the equivalent heat demand for up to 27,000 customers. This has allowed injection of

biomethane into the gas grid without further enrichment with propane to increase the calorific value (typically 4%). The propane cost is £150,000 per year at a scale of 250m^3/hr (1MW capacity)[10].

Incentives through the Renewable Transport Fuel Obligation (RTFO) Order are already available for biofuel, biomethane and hydrogen producers. These incentives can support further growth in the AD sector and will increase the availability of renewable gas for transport. The RTFO scheme needs to be extended beyond 2032 this will:

1. Provide stimulus to the AD sector and confidence to fleet operators that biomethane supplies will be available beyond 2032.
2. The hydrogen economy is very early in its development and may only be getting established by late 2020. Extending the RTFO will ensure that the developing hydrogen economy for transport will receive benefit from the scheme.

A price guarantee for the RTFO will increase confidence for investors and fuel users.

References

1. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf Page 7
2. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf Page 15
3. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf Page 20
4. https://www.endswasteandbioenergy.com/article/1673950/ biomethane-powered-bus-scheme-launched?bulletin=biogas-energy-bulletin&utm_medium=EMAIL&utm_campaign=eNews%20Bulletin &utm_source=20200220&utm_content=EWB%20Biogas%20Energy%20(7)::&email_hash=
5. https://www.bioenergy-news.com/news/biomethane-demand-increases-by-800-thanks-to-major-uk-companies/
6. https://www.gasnetworks.ie/vision-2050/future-of-gas/GNI_Vision_2050_Report_Final.pdf
7. https://www.theccc.org.uk/publication/reducing-emissions-in-northern-ireland/
8. https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019
9. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf pg 20
10. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf Pg 29.

Q31. What role should active travel have in the decarbonisation of the transport sector and what should government do to support this?

Active travel is an important component of the decarbonisation of the transport sector however the applications are limited by several factors including:

- Distance of daily commute. Outside of the major population centres many people have a long commute to work which is not feasible by walking or cycling.
- Impractical in bad weather
- Difficult for the rural community
- Cycle lane infrastructure is not well developed within Northern Ireland

Government support should be targeted at improving cycle lanes within urban areas and by improving public transport links between commuter towns and larger hubs i.e. Belfast, Lisburn, Londonderry etc. Where active travel is not applicable the government should be encouraging people to use public transport. Public transport should operate on a lower carbon or decarbonised fuel source such as compressed natural gas augmented with biomethane and/or hydrogen. Hydrogen buses will be operating within Belfast but the supply chain for hydrogen gas is not fully developed whereas construction of refuelling points along the natural gas network can be started immediately and provide security of supply for a fuel source.

Q32. What energy infrastructure is needed to facilitate the uptake of electric vehicles in line with UK Government's 'Road to Zero' targets?

A significant expansion of the electric vehicle charging network is required to facilitate uptake of electric vehicles. E-car NI indicates that there are only 181 public charging points within Northern Ireland[1].

Funds for maintenance of the charging network are essential as in the past users reported that many charging points were in disrepair or non-functional. This must be accompanied by a strengthening of the electricity network to be able to handle the higher peak demand from vehicle charging. Fast charging stations could require 22kW$_e$ of peak electricity demand which can quickly result in very large import capacities required for multiple charging facilities. A barrier to development would be in the grid connection charges particularly for businesses looking to install fast charging for employee cars. Slow charging options exist but this will require an EV to occupy the charging point for long periods reducing the number of potential cars which can be charged. Additional charging points will therefore need to be deployed to meet with demand.

The recommended option is for HGV's, public transport and refuse collection lorries to convert to CNG with a decarbonised gas grid as the gas storage capacity within the grid can handle peaks in demand and refuelling can be accommodated within a short space of time i.e. 10 – 20 minutes rather than hours. Electric vehicles would be suitable for private car owners where slow charging could be achieved at home overnight augmented by faster charging points in key locations i.e. park and ride facilities, train stations, public car parking. Emphasis should also be on usage of an electric vehicle to reach a public transport option such as a bus or train. This will help to reduce congestion

on the roads and minimise the concentration of EVs requiring charging within a small urban area.

References

1. http://www.ecarni.com/charge-point-map?54.8016813,-6.2464289,10z,SC97,569st

Q33. How will transport integrate with other energy uses (e.g. homes with solar generation, battery storage, EV charging) and what can government do to optimise the opportunities represented by this integration?

Government could assist by introducing policy measures to make it attractive to connect an EV to a home charging point during periods of low electricity demand on the network such as through the night. EV's could be used as a distributed energy storage system to help balance intermittent renewable energy generation from sources like wind. EV's could also be used as a means of demand side response where electricity is drawn from the vehicle during times of high grid demand but low generation. Accomplishing will require communication between the electricity grid and the electric vehicle to determine if there is capacity for storage/discharge. The consumer should then be paid an appropriate tariff for providing this energy flexibility. Controls will need to be in place to allow the EV owner to not dispatch electricity to the grid preventing them from completing their onward journey.

Q34. To what extent can alternative low carbon transport fuels contribute to decarbonisation of the transport sector?

Alternative low carbon transport fuels are critical. Given vehicle replacement cycles, even with Internal Combustion Engines (ICE) car sales banned in 2035, there will still be a lot of ICE cars on the road in 2050, and even more ICE commercial vehicles. An increasing blend of biofuels (bioethanol, biodiesel and HVO) will be needed, along with biomethane for a 100% bio option earlier on for the largest vehicles. A move towards series hybrid powertrains combined with range extenders running on these fuels will be an essential bridge to full electrification or possibly hydrogen fuel cells as an end game.

Figures have been obtained below from the Department of Infrastructure on the number of HGV's registered in 2019.

Table 1.1 Heavy Commercial Vehicles by Wheel Plan – Licensed as at 30th September 2019	
Wheel Plan	Heavy Goods Vehicles
2 Axle Artic	1,382
3 Axle Artic	6,479
Multi Axle Artic	32
2 Axle Rigid	11,787
3 Axle Rigid	2,539
Multi Axle Rigid	2,228
Non-Standard	75
Total	**24,522**

Smaller goods vehicles are shown below.

	Table 1.2 Light Goods Vehicles by Gross Vehicle Weight (Kg)								
	Up to 500	501 - 1,000	1,001 - 1,500	1,501 - 2,000	2,001 - 2,500	2,501 - 3,000	3,001 - 3,500	Missing	Total
Total	16	97	571	10,928	12,652	30,187	42,728	25,777	122,956

The total annual mileage and fuel use for these types of vehicles are shown in table 1.3.

Table 1.3 Total Annual Mileage and Fuel use		
Vehicle Type	Average Mileage (miles/yr)	Fuel use (litres)
10-12T box/curtain	50k	17,485
16-18T box/curtain	60k	22,730
3 axle rigid	60k	27,276
44T artic & trailer	85k	47,123

Manufacturers are developing electric versions of most goods vehicles but not for artics over 41t. This is therefore the primary target market for CNG/biomethane fuelling. CNG vehicles are also available in all categories of gross weight 3.5 tonne and above. An approximate rule of thumb is that 1 litre of diesel is replaced by 1kg of CNG/CBM. Table 1.4 shows the biomethane required to fuel HGV's.

Table 1.4 Biomethane Required for HGV's	
Estimated 41t HGVs	7,893
Approximate Annual Mileage (mile/yr)	85,000
Fuel Use (litres/yr)	47,123
Biomethane Needed (kg/yr)	47,123
Total Biomethane Needed (kg/yr)	371,941,839
Biomethane Energy Content (kWh/kg)	13.9
Biomethane Energy Required (TWh/yr)	**5.17**

Fuelling can be accomplished by CNG in the immediate term with progressive decarbonisation from biomethane and hydrogen.

Feedstocks from untapped sources could be used to provide additional biomethane for fuelling. These include:

- Agriculture
- Municipal Wastes

Additional benefits could be achieved by dealing with other harmful emissions from these sources.

Feedstocks from Agriculture

Agriculture in NI is dominated by livestock, with very little arable farming. Total area farmed in 2018 has reduced to 1,022,400 hectares was farmland 1,068,370 hectares (2.64 million acres).

Table 1.5 Livestock Numbers by Year				
('000 head)	1868	1918	1968	2018
Cattle	694	770	1,207	1,630
of which are Cows	n.a.	n.a.	382	567
Sheep	321	409	962	2,006
Horses	114	n.a.	n.a.	9
Pigs	119	115	1,012	634
Poultry	2,050	5,772	12,059	26,031

The population of cattle in Northern Ireland has increased significantly over the past 50 years but has remained consistently at around 1.6 million since 2013 however there has been a huge increase in poultry numbers but a significant reduction in pig numbers in recent years. These high livestock numbers present a real problem with regards to production of harmful greenhouse gas emissions and to managing animal waste safely.

Despite only having 3% of UK population and 6% of the land area, Agriculture in NI is responsible for 12% of UK output of Ammonia, 91% of NI ammonia emissions come from agriculture. Cattle are responsible for around 70% of ammonia emissions from agriculture with the more intensive pig and poultry sectors accounting for 20% of emissions. Handling and storage of manure is responsible for 44% of all emissions[1].

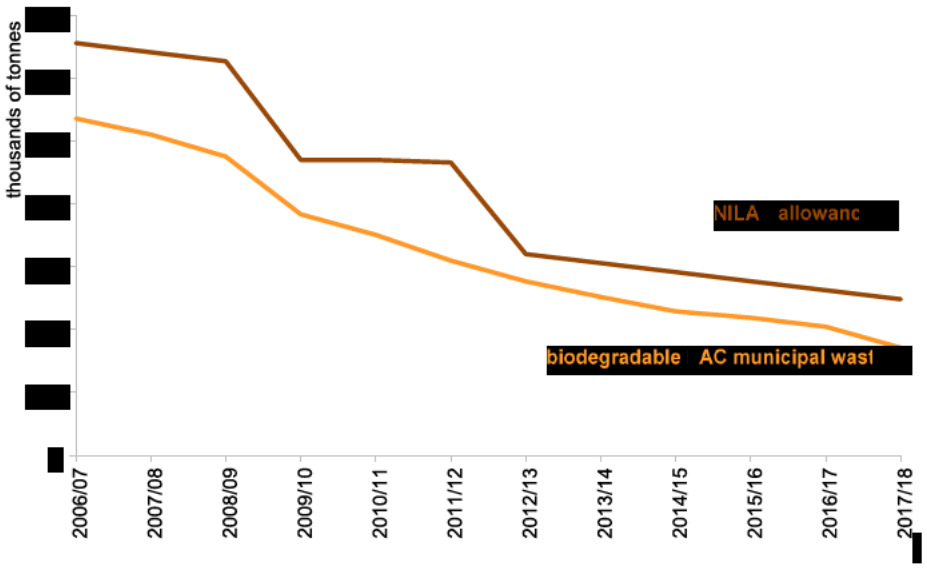
Ammonia emissions will cause the subsequent deposition on land of various nitrogen compounds.
These deposits of nitrogen aid the growth of some plant species, but they can have extremely negative consequences for some plant species. Emissions which are subsequently deposited as nitrogen, can also indirectly lead to emission increases in nitrous oxide from wet soils. Nitrous oxide is a potent greenhouse gas with a Global Warming Potential 298 times greater than carbon dioxide. In addition, climate change, in itself, is likely to make the task of mitigating ammonia more difficult as ammonia is highly temperature reactive and increases of 5°C will double ammonia emissions

Municipal waste

- Northern Ireland also has a major problem in managing municipal waste with tonnage on the increase year on year.
- In 2017/2018 Northern Ireland's councils collected 977,817 tonnes of LAC (local area councils) municipal waste. Household waste accounted for 89.4% of total LAC municipal waste.
- In 2017/18, 48.1% of household waste was sent for preparing for reuse, dry recycling and composting, 3.7 percentage points higher than the 2016/17 rate

of 44.3%. At council level, rates vary from 42.2% in Causeway Coast & Glens to 54.3% in Mid Ulster.

- The landfill rate for household waste recorded a new low of 32.0% in 2017/18, a drop of 4.7 percentage points on the 2016/17 rate (36.7%) and a fall from 72.3% in 2006/07.
- Under the Northern Ireland Landfill Allowance Scheme (NILAS) regulations councils have been allocated a number of allowances (each allowance represents 1 tonne of BLACMW (Biodegradable local authority collected municipal waste)) for each year until 2019/20
- There were 171,295 tonnes of BLACMW sent to landfill during 2017/18, This was 16.2% lower than the 204,380 tonnes sent in 2016/17, and 69% of the allowance used compared to 78% in 2016/17.
- The 2017/18 NILAS allowance (248,570 tonnes) was 5.4% lower than the 2016/17 allowance (262,857 tonnes).



The above illustrates that a significant amount of municipal waste is being sent to landfill, much of which (171,295 tonnes) is biodegradable. Landfill gas presents a real environmental issue. At closed landfill sites gas is now being captured and used for power generation and heating where possible. Diversion of the biodegrable elements of the municipal waste to AD facilities either as a source segregated food waste or to a specialist AD facility to treat MSW would capture the benefit.

The CCC Report on Reducing Emissions in Northern Ireland estimated between 130 – 580 million m^3/yr of biomethane. Table 1.6 shows the potential energy value.

Table 1.6 Estimated Biomethane Potential

	Low	High
Estimated Potential Production (m^3/yr)	130,000,000	580,000,000
Energy Content Biomethane (kWh/m^3)	10	10
Energy Available (TWh/yr)	**1.3**	**5.8**

Biomethane therefore has the potential to meet all the demand for HGV's alone whilst reducing the emissions impact from agriculture and municipal waste to landfill.

References

1. https://www.daera-ni.gov.uk/articles/ammonia-emissions-northern-ireland

Q35. Do you have any data/research to help inform and reduce the carbon intensity of our transport energy in order to achieve net zero carbon by 2050?

Please see previous responses.

- CNG has 25.5% lower associated CO_2 emissions than diesel[1]. (CNG 0.18385 kg CO_2e/kWh versus Diesel 0.24675 kg CO_2e/kWh). Biomethane has well-to-wheel GHG emissions of 0.0004kg CO_2e/kWh[2]

References

1. https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019
2. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf pg 20

6. Other Issues:

a. Security of Supply

Q36. What specific risks to security of energy supply are likely to emerge as a result of our changing energy mix, and what actions can be taken to mitigate these?

Q37. What measures or indicators could be adopted or developed to monitor energy security of supply?

Q36. What specific risks to security of energy supply are likely to emerge as a result of our changing energy mix, and what actions can be taken to mitigate these?

There seems to be a tendency to focus on electrification of all energy supplies such as heat pumps for heating and electrification of transport (EVs). Reliance on one energy source and one energy transmission system presents a risk to security of energy supply. This is particularly evident as we have only achieved 43.7% renewable electricity deployment onto the electricity grid (2019 average). Most has been generated from an intermittent renewable source (84.5% from wind turbines)[1].

Having a diverse mix of decarbonised energy sources which can be easily and economically stored is preferable since energy demand, particularly heat, experiences seasonal variations and significant inter-daily demand.

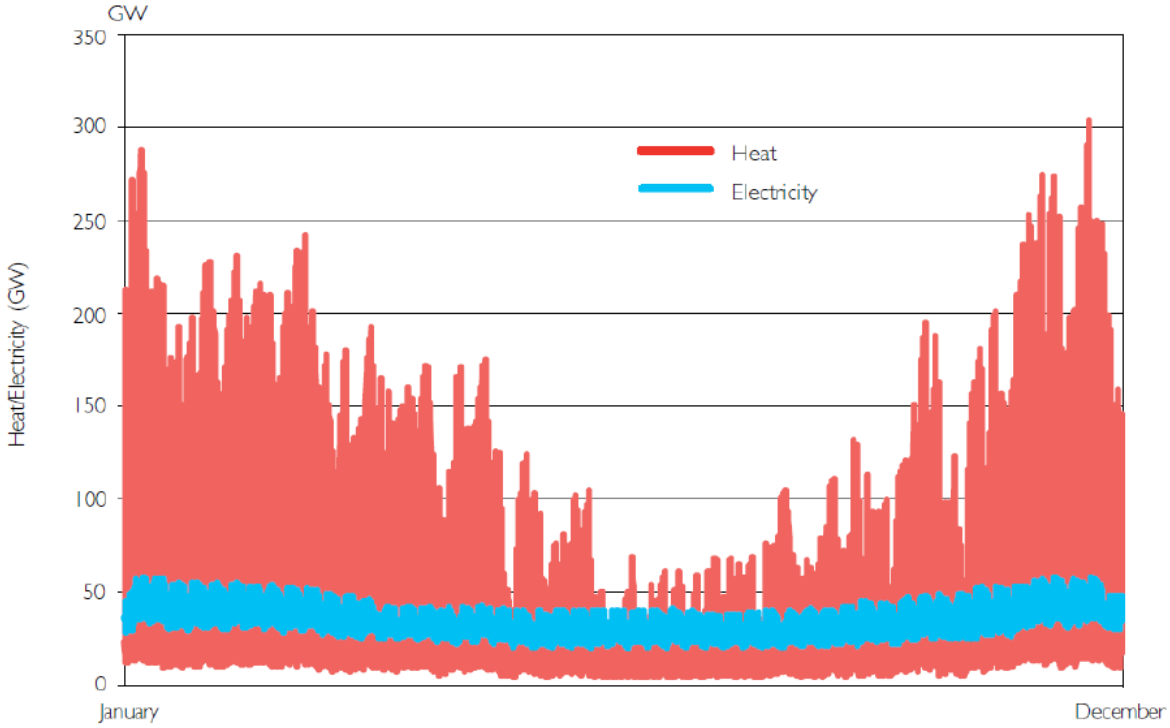


Figure from AECOM Presentation[2]

Generation of electricity from gas to be transmitted to generate heat is not efficient

- 3 units of gas to electricity and transmitted within the electricity grid = 1 unit of heat

- 3 units of gas transmitted within the gas network to a boiler = 2.7 units of heat

Electricity output from wind is entirely dependent on wind speeds and the electricity transmission network can be affected by outages during storm and other serious weather events. The natural gas network is less affected by weather factors. Disruption has been confined to small localised areas with no interruption to the Transmission network.

References

1.https://www.economy-ni.gov.uk/articles/electricity-consumption-and-renewable-generation-statistics
2. Presentation Vision 2050, Decarbonising Heat, AECOM, Dr Andrew Cripps 11-Sep-29

Q37. What measures or indicators could be adopted or developed to monitor energy security of supply?

The Department for the Economy capture statistics on the quantity of renewable electricity on the system as well as the mix of renewables used. Data should be captured on the levels of decarbonised gas injected into the grid, CCUS performance and alternative fuels used for transport. The mix of renewables and decarbonised should be outlined for each sector as well as the transmission method to ensure that a risk based approach is taken towards energy supply.

b. The Role of Data

Q38. What is the most cost-effective method of capturing consumer energy usage data in electricity and natural gas (where meters are in place)? In heating oil (where there is no metering obligation)?

Q39. What concerns need to be addressed regarding data privacy, security and/or ownership?

Q40. What are your views on applying the key recommendations of the Energy Data Taskforce for NI?

Q41. What organisations or businesses do you see as having a key role in optimising the value of data? How will they do this?

Q38 – 41

No response.

c. Carbon Capture and Storage

Q42. What steps, if any, should NI policy-makers consider with regard to the development or implementation of CCUS in NI?

CCUS will play a critical role in achieving global emissions reductions.

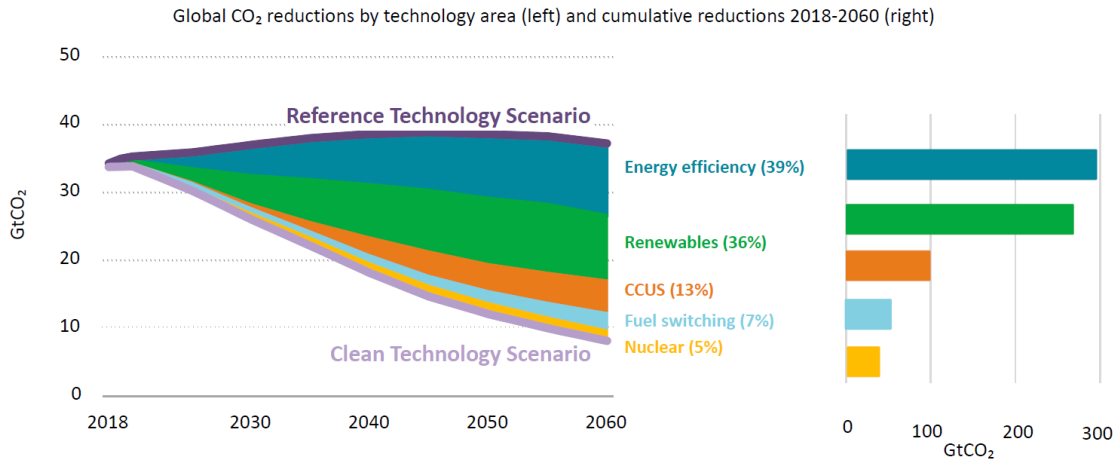


Figure from IEA Presentation[1]

CCUS makes the third largest contribution to cumulative CO_2 reductions in the International Energy Authority (IEA) Clean Technology Scenario.

Carbon capture, utilisation and storage is a key component of any decarbonisation strategy. CCUS allows for natural gas supplies to be decarbonised. This would extend the operating life for existing natural gas power stations 1,010MW_e[2]. These are essential for providing a non-intermittent source of electricity.

A CCUS package could be installed beside existing natural gas fired power stations. Decarbonisation at the source of generation should provide economies of scale with the benefits flowing to the end user with no significant change in technology. Carbon dioxide could be captured and sold to local customers such as greenhouse growers i.e. plants, salad crops and flowers. An alternative could be to provide it to the concrete manufacturing industry to incorporate it into pre-cast concrete products. A market could be developed for captured CO_2.

Biomethane and hydrogen injection can provide a significant element of decarbonisation but will not be capable of fully decarbonising the gas grid within the short timelines for preventing global warming by more than 1.5^{o}C. CCUS therefore is an essential bridging step to starting the decarbonisation process and preventing a massively steep decarbonisation step in the late 2030's and 2040's.

Government support and incentivisation is required for the capture and utilisation of carbon dioxide and to assist with implementation of this technology. CCUS

should have policy milestones and be included in action plans as part of the energy strategy.

References

1. Presentation, The Role of CCUS in meeting climate targets, Samantha McCulloch, IEA, Irish Gas Forum, 23-Oct-19
2. Reducing Emissions in Northern Ireland, Committee on Climate Change February 2019 Pg 31.

d. Energy and the Economy

Q43. What specific economic opportunities will arise from the decarbonisation of energy?

Q44. What skills are needed to realise the potential economic benefits of energy in the future?

Q45. What are your views on the future of overall energy demand in NI and how can we ensure that any potential demand growth aligns with our net zero carbon target?

Q43. What specific economic opportunities will arise from the decarbonisation of energy?

For usage of

- Fuel duty savings for usage of CNG, biomethane and hydrogen (57.3% compared to diesel)[1].
- RTFO Incentive payments for usage of biomethane and hydrogen as a transport fuel. 55p per litre equivalent with diesel when biomethane from waste sources is used[2].
- At a UK level realising the full potential of AD is estimated to provide 30,000 jobs across the country[3].
- £20 billion investment into UK industry[3].

Projections for growth in the hydrogen industry show a wide range of sectors which could be new markets.

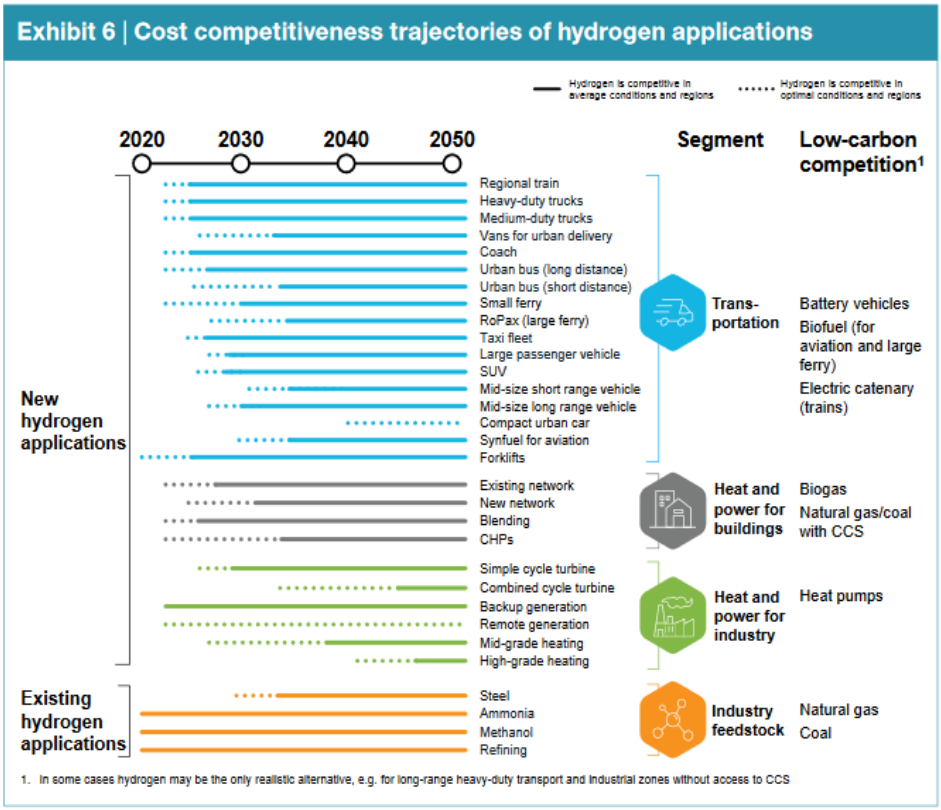


Figure from Hydrogen Council Report[4]

References

1. https://www.nextgreencar.com/car-tax/fuel-duty/
2. RTFO Guidance Part One Process Guidance2019: 01/01/19 to 31/12/19
3. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf
4. https://hydrogencouncil.com/wp-content/uploads/2020/01/Path-to-Hydrogen-Competitiveness_Full-Study-1.pdf

Q44 What skills are needed to realise the potential economic benefits of energy in the future?

- At a UK level realising the full potential of AD is estimated to provide 30,000 jobs across the country[1]
- Supply chain and maintenance for CNG/Biomethane vehicles
- Training and education around the hydrogen economy, renewable energy development, carbon capture and storage, energy storage.

References

1. http://adbioresources.org/docs/Biomethane_-_Pathway_to_2030_-_Full_report.pdf

Q45. What are your views on the future of overall energy demand in NI and how can we ensure that any potential demand growth aligns with our net zero carbon target?

SONI estimates that the electricity demand will increase by 10.0 -11.5 TWh (+20% increase) by 2040[1]. We need to ensure that this growth is supported by the implementation of decarbonised energy capacity and that the energy transmission systems are adequately sized to handle the profile of generation from renewable sources.

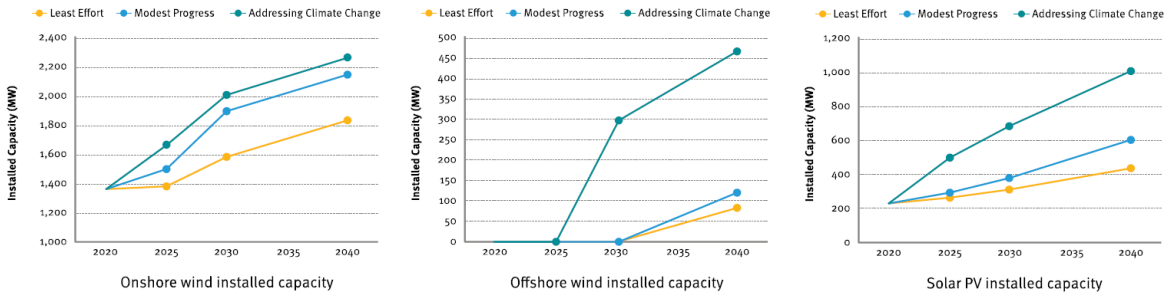


Figure from SONI Presentation[1]

Levels of projected intermittent renewable generation is shown to increase substantially by 2040 in order to achieve decarbonisation. Production of renewable hydrogen with injection into the grid could provide an efficient energy store. This decarbonised gas could then be used within existing gas-powered appliances and power stations to deliver emissions savings reductions. A decarbonised gas grid could also provide fuel for local sources of demand response generation. This would help to provide a low carbon backup electricity supply to balance variations in grid electricity demand/supply for wind generation which is directly connected to the grid.

1. Presentation Whole Energy Systems Transition, Jo Aston, SONI, Vision 2050 Conference 11-Sep-19.

e. Delivery Framework for an Energy Strategy

Q46. Do the existing division of responsibilities and powers across government enable the most effective approach to the overall aim of decarbonising energy? If not, what are your suggestions for improvement?

Q47. What are the opportunities for local government to contribute to the delivery of the net zero carbon target?

Q48. What are your views on how statutory duties and accompanying legislation and regulatory frameworks would need to change to facilitate the transition to net zero carbon by 2050?

Q49. Is there a need for a dedicated organisation to champion, lead and deliver sustainable energy interventions? If so, what should this look like?

Q46. Do the existing division of responsibilities and powers across government enable the most effective approach to the overall aim of decarbonising energy? If not, what are your suggestions for improvement?

Policy co-ordination with other departments will be required to achieve decarbonisation goals. Key features will be :

- Energy efficiency in public housing stock, planning controls on new developments and refurbishments and a redesigned incentive programme with a particular focus on ending kerosene reliance;
- Food waste regulations;
- Public transport transformation and promotion;
- Public charging point network for ULEZs; and
- Ammonia Strategy and Anaerobic Digestor expansion.

Q47. What are the opportunities for local government to contribute to the delivery of the net zero carbon target?

Several local councils are actively considering opportunities for decarbonisation ahead of the new energy strategy. This includes the adoption of CNG vehicles for their fleets (i.e. refuse collection vehicles and goods vans). CNG will be delivered by the gas pipeline to a refuelling point, either on site or at an off-site forecourt. Compressed Biomethane is also being investigated as a means of further decarbonising their fuel supply. CBM may be delivered via a gas trailer prior to availability within the natural gas grid.

All councils could adopt this strategy for their vehicle fleet and decarbonise other vehicles by switching to ULEV's.

Q48 – Q49
No response.

7. Additional information

Q50. Is there anything else you would like to add in response to this Call for Evidence?

No response.