20220616-KerryMaterialAlterations

Planning Policy Unit
Kerry County Council
Rathass
Tralee
Co. Kerry

Submitted via online portal

16th June 2022

Re. Proposed Material Alterations to the Draft Kerry County Development Plan 2022-2028

A Chara,

An Taisce welcomes the opportunity to comment on the Proposed Material Alterations to the Draft Kerry County Development Plan 2022-2028.

Amendment Ref. 12.1

We note the addition of "sustainable" in relation to the expansion of the gas network. As preliminary matter, no definition is provided as to what constitutes a "sustainable" expansion of the gas network. Regardless, it is submitted that there is no capacity under national, EU and international climate policy for further fossil fuel exploration/extraction or further development of the gas network. Fossil gas must be phased out of our energy mix as rapidly as possible if we are to reach our Paris-aligned targets to limit warming to 1.5C and the legal emissions reduction obligations stipulated by the Climate Action and Low Carbon Development (Amendment) Act 2021. The Act stipulates that Ireland must achieve net zero emissions by 2050 (climate neutrality) and a 51% reduction in emissions by 2030 relative to 2018 levels. In furtherance of these statutory obligations, the Climate Act requires the development of five-year carbon budgets and sectoral emissions ceilings. To achieve the Climate Act's 2050 net zero obligation, Ireland's energy system will have to be fully decarbonised.

Gas is often touted as a 'clean' fossil fuel, however, this statement is profoundly misleading. While gas has lower emissions at the point of combustion than other fossil fuels, the methane emissions released throughout the supply chain (extraction, processing, transport, etc.) entail that gas ultimately has no benefit over fuels such as oil and coal. Crucially, this is the case for conventional gas in addition to fracked gas[1]. If we are to meet our emissions

[1] Howarth, R. W. (2015). Methane emissions and climatic warming risk from hydraulic fracturing and shale gas development: implications for policy. Energy and Emission Control Technologies, 3, 45-5.

reduction obligations under the Paris Agreement and associated EU and national laws, gas use must rapidly decrease. It is not an appropriate 'bridge' or 'transition' fuel.

With regard to energy security, Ireland is already heavily reliant on natural gas. Increasing reliance on it will introduce further security of supply issues while also failing to realise the level of rapid decarbonisation and emissions reduction needed to meet legal emissions reduction targets.[2] Further expansion of gas networks also risks that infrastructure becoming stranded assets as Ireland makes the required transition away from fossil fuels.

Additionally, it is submitted that the "*facilitation of a gas importation facility in the Tarbert/Ballylongford Landbank*" is incompatible with the legal obligations of the Climate Action and Low Carbon Development (Amendment) Act 2021. We would also highlight the following statement from the 2020 Programme for Government:

> "*As Ireland moves towards carbon neutrality, we do not believe that it makes sense to develop LNG gas import terminals importing fracked gas. Accordingly, we shall withdraw the Shannon LNG terminal from the EU Projects of Common Interest list in 2021. We do not support the importation of fracked gas and shall develop a policy statement to establish that approach.*"

Following that, in May 2021 the Government published the Policy Statement on the Importation of Fracked Gas. This provided for a review of Ireland's energy supply security, specifically in relation to electricity and natural gas. Crucially the Policy Statement concludes that: "*Pending the outcome of the review of the security of energy supply of Ireland's electricity and natural gas systems, it would not be appropriate for the development of any LNG terminals in Ireland to be permitted or proceeded with.*" The review of energy security has commenced but is not due for completion until well into 2022, potentially as late as July. It is premature to assume that the review will result in a reversal of current policy.

Please see the attached submission made to the Commission for Regulation of Utilities on Gas Networks Ireland's Draft Ten-Year Network Development Plan for further details.

On the basis of the above, it is submitted that there is no case to made for a "sustainable" expansion of the gas network and that Objective KCDP 12-3, as amended by Amendment Ref. 12.1, should therefore be removed in its entirety.

Amendment Ref. 2.16

We note the addition of a new objective to "*Support the continued cutting and distribution of turf in order for people to heat their homes.*"

It is submitted that this objective is incompatible with the legal obligations of the Climate Action and Low Carbon Development (Amendment) Act 2021 and should therefore be removed. Rather, it is submitted that an objective is needed to urgently support and

[2] McMullin, B.; Price, P.; Carton, J. & Anderson, K. (2018) "Is Natural Gas 'Essential for Ireland's Future Energy Security'?: A Critical Response to the Irish Academy of Engineering." Stop Climate Chaos.

resource a just transition in relation to the retrofit of home heating systems so that the burning of turf is no longer required.

Climate Act Obligations on Public Bodies

We would highlight Section 15(1) of the Climate Action and Low Carbon Development (Amendment) Act 2021 which details the obligations of public bodies, including Local Authorities:

> *"A relevant body shall, in so far as practicable, perform its functions in a manner consistent with—*
>
> > *(a) the most recent approved climate action plan,*
> > *(b) the most recent approved national long term climate action strategy,*
> > *(c) the most recent approved national adaptation framework and approved sectoral adaptation plans,*
> > *(d) the furtherance of the national climate objective, and*
> > *(e) the objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State."*

Yours sincerely,

Phoebe Duvall
Planning and Environmental Policy Officer
An Taisce – The National Trust for Ireland

Enclosed: An Taisce to the Commission for Regulation of Utilities on Gas Networks Ireland's Draft Ten-Year Network Development Plan 2019

20200928-CRU-GNITYNDP2019

Commission for Regulation of Utilities
PO Box 11934
Dublin 24

Sent by email to: Amber Raut, araut@cru.ie

28th September 2020

RE: Submission to the Commission for Regulation of Utilities on Gas Networks Ireland's Draft Ten-Year Network Development Plan 2019

To Whom It May Concern,

An Taisce welcomes the opportunity to comment on the Gas Networks Ireland (GNI) Draft Ten-Year Network Development Plan 2019 (TYNDP). We wish to make the following submission.

1. LEGAL CONSIDERATIONS

The determination of Ireland's future use of the fossil gas pipeline system and any sustainably sourced biomethane needs to be subject to Paris Agreement action, EU Directives and policy, the European Green Deal and national legislation, in particular the Climate Action and Low Carbon Development Act 2015.

Consideration of any plan needs to be subject to an Aarhus-compliant process of public consultation, Strategic Environmental Assessment, and consideration of Habitats Directive impacts.

This draft circulated for consultation by the Commission for Regulation of Utilities (CRU) on 31st August 2020 is out of date on multiple grounds. There have been major changes of circumstances since the revised draft TYNDP and associated projections were prepared by GNI in September 2019, for example in legal case outcomes and in the content of the June 2020 Programme for Government,

GNI has a vested interest in perpetuating increasing gas use. The fossil gas industry, both globally and in Ireland through GNI, is greenwashing fossil gas as "clean" or even "green". This is distracting from the development of alternatives to gas-based energy solutions including for use of sustainably produced hydrogen.

1.1 Gas Networks Ireland does not have legal status to determine national energy and climate policy on gas

National climate and sustainable energy policy needs to be determined independently of the State gas infrastructure provider.

The future use of fossil gas, biomethane and the gas pipeline system cannot and should not be allowed to be determined by the main Irish arm of the global gas industry. The State Company, GNI, is perpetuating and indeed increasing a gas combustion based energy system, whether for electricity generation, industry, heating or transport, which is no longer fit for purpose.

GNI, as a subsidiary of Ervia, has endorsed a Vision 2050 net zero carbon gas network for Ireland by mid century. This is a meaningless aspiration since the draft TYNDP is based on continuing gas expansion. A prime recent example of the unsustainable and unjustified extension of the GNI gas pipeline system was that to serve the Centre Parcs tourism development in County Longford, which could have utilised alternative renewable energy sources.

1.2 Continuing increase in gas demand set out in draft plan

The onus is now on the CRU to address the continued unsustainable increase in gas use in Ireland as outlined by GNI:

> *"Annual ROI gas demands for 2019/20 are anticipated to be 2.4% higher than 2018/19 demands. In the power generation sector, annual gas demand for 2019/20 is anticipated to be 2.6% above 2018/19 levels. This follows a 3.5 % increase the previous year. Since 2014/15, power sector annual gas demand has grown by almost 34%."*

The GNI draft strategy projects the continuing growth in Irish gas consumption, with high, medium and low growth scenarios, the medium projection being 23% growth:

> *"In the Best Estimate demand scenario annual ROI gas demand is expected to grow by 23% between 2018/19 and 2027/28 with 4% growth forecast in the Low demand scenario and growth of 39% forecast in the High demand scenarios respectively over the same horizon."*

To seek to address greenhouse gas emissions, the draft strategy proposes a target of 20% injection of primarily animal agriculture-sourced biomethane into the gas pipeline system by 2030, and development of carbon capture and storage (CCS).

If the 23% medium growth scenario were to be modelled for a gas consumption increase to 2030, and even if the 20% biomethane target were to both be reached and allowed to be calculated as zero carbon, this represents only a marginal decrease in current emissions.

The draft strategy furthermore fails to address the issue of gas import from fracked sources, and the higher emission impact of fracked gas extraction.

1.3 EU Directive 2009/73/EC and SI 16 of 2015 on Energy Regulation

This consultation comes under Article 22 of EU Directive 2009/73/EC and SI 16 of 2015 on Energy Regulation.

Article 1(2) of the Directive includes a provision in relation to climate protection providing that:

> "*Having full regard to the relevant provisions of the Treaty, in particular Article 86 thereof, Member States may impose on undertakings operating in the electricity sector, in the general economic interest, public service obligations which may relate to security, including security of supply, regularity, quality and price of supplies and environmental protection, including energy efficiency, energy from renewable sources and climate protection.*"

Article 22(4) contains a specific provision on the consultation process to be undertaken by the regulator to include actual or potential systems users:

> *"The regulatory authority shall consult all actual or potential system users on the ten-year network development plan in an open and transparent manner. Persons or undertakings claiming to be potential system users may be required to substantiate such claims. The regulatory authority shall publish the result of the consultation process, in particular possible needs for investments.*"

A key part of effective climate action and decarbonisation will be the engagement of the public at large and energy consumers in energy efficiency and replacement of fossil combustion with renewables. This is best achieved by promoting the concept of energy citizens instead of consumers. This would allow all energy users to generate and provide surplus renewable energy to the grid through community-based or co-operative partnerships in energy conservation and generation in which the Tipperary Energy Institute has set leadership in Ireland.

It is accordingly submitted that the CRU should reject the GNI draft TYNDP as not fit for purpose.

1.4 Strategic Environmental Assessment Directive 2001/42/EC and Appropriate Assessment under the Habitats Directive 92/43/EC

The GNI TYNDP is a ten-year strategy on gas use and biomethane development with major implications for health, climate action, land use and biodiversity, therefore requiring Strategic Environmental Assessment, and Appropriate Assessment.

The GNI consultants have submitted that the TYNDP should not be subject to SEA.

We note that after the initial lodging of the Draft TYNDP by GNI in 2019, and the submission made by An Taisce to the limited consultation in February 2019, that the CRU commissioned advice on the making of an SEA screening determination from Arup consultants. Their advice was that the CRU evaluation of the GNI TYNDP need not be subject to the SEA process. It is noted that the CRU has yet to make an SEA and Appropriate Assessment screening decision.

There is an onus on consent and regulatory bodies, including the CRU, to comply with EU and national law. This includes direct application where explicit provision is not in place.

In inviting submissions on the Draft TYNDP, the CRU website notice of 31st August 2020 quoted the opening statement in the GNI draft:

> *"The draft TYNDP provides a view of how the gas network may develop over a ten-year period. It is based on current supply and demand for gas, as well as projections for growth in gas consumption and development of infrastructure. The purpose of this paper is to seek comment from any interested party on GNI's draft TYNDP covering the period 2018/19 – 2027/28."*

This represents a prejudicial assumption of consumption and infrastructure increase.

It is submitted that the use of fossil gas and biomethane as a key part of national climate and sustainable development strategy requires SEA, and there is no legal basis for proceeding with the current consultation process, unless subject to SEA, and Appropriate Assessment under the Habitats Directive.

1.4.1 Aarhus Convention requirements

The Decision on conclusion of the Aarhus Convention by the EC was adopted on 17 February 2005 [Decision 2005/370/EC]. The EC is a Party to the Convention since May 2005. Both Directives 2003/4 and 2003/35 contain provisions on access to justice.

Most relevant to the public consultation issues raised by the submission of the GNI TYNDP is Regulation (EC) N° 1367/2006 of the European Parliament and of the Council on the application of the provisions of the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters to Community institutions and bodie**s** (OJ L 264, 25.9.2006, p.13) entered into force on 28 September 2006 and into application on 17th July 2007.

It is submitted that the determination by CRU of the GNI TYNDP constitutes environmental decision making. The public notice and consultation provided by CRU do not meet Ireland's Aarhus obligations.

A major element of the Draft TYNDP is the sourcing of increased production of biomethane

from animal slurry and land-based crops (including grass) to a level of up to 20% content of gas consumption by 2030. This has major implications for biodiversity in increasing pressure for land use change and on habitats and species, nitrate fertiliser impact, and ammonia emissions.

It is submitted that both Strategic Environmental Assessment and Appropriate Assessment under the Habitats Directive are required.

2. CHANGES OF CIRCUMSTANCES SINCE GNI PREPARATION OF DRAFT STRATEGY IN 2019

While reference is made in the GNI draft to the lack of data availability to model the impact of COVID-19 other major changes of circumstances are not addressed. Since this draft strategy was prepared there have been major changes of circumstances relevant to the future use of fossil gas and the gas pipeline transmission network in Ireland.

2.1 July 2020 Supreme Court ruling under Climate Action and Low Carbon Development Act on National Mitigation Plan

In July 2020, following the appeal by Friends of the Irish Environment, the Supreme Court ruled that the National Mitigation Plan did not comply with the Climate Action and Low Carbon Development Act 2015.

The Climate Action and Low Carbon Development Act 2015 Section 15(1)(d) under 'Duties of Certain Bodies' states that a:

> "*Relevant body shall in the performance of its function have regard to a range of considerations including:*
>
> > *(d) the objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the state.*"

The GNI draft gives no consideration as to how it seeks to comply with the provisions of the Climate Action and Low Carbon Development Act 2015. The 2015 Climate Action Plan referenced in Section 4.5 of the GNI draft has no legal status and does meet the level of climate action required

The Climate Action and Low Carbon Development Act 2015 applies to all State and Public Bodies, including the Commission for Regulation of Utilities. While the CRU has been established with a specific statutory remit relating to pricing and regulation, Section 15 of the Climate Action and Low Carbon Development Act 2015 is an overarching obligation to ensure achievement of the low carbon future. Moreover, under the EU Governance Regulation of the Energy Union and Climate Action, published in December 2018: by 1st January 2020 "*each Member State shall prepare and submit to the Commission its long-term*

strategy with a perspective of at least 30 years" and the "*The Member States' and the Union's long-term strategies shall contribute to… fulfilling the [temperature] objective of the Paris Agreement*." This means that Member States and their agencies will need to coherently plan for and achieve substantial and sustained reductions in total annual energy emissions to limit cumulative emissions in line with the Paris objective.

2.2 The June 2020 Programme for Government

The Programme sets out the following which must be considered:

- Adopted a 7% annual greenhouse gas emissions reduction target from 2020 to 2030, a 51% reduction over a decade (see page 32);
- Provided for the decarbonisation of road transport (page 15);
- Withdrew support for the importation of fracked gas and of the Shannon LNG import project from EU Projects of Common Interest (page 36);
- Enhanced retrofitting action to "grow the existing retrofit industry tenfold" (pages 37 and 38);
- Ended the issue of new oil and gas exploration licences (page 36).

3. CRITIQUE OF SECTORAL GAS CONSIDERATIONS SET OUT IN DRAFT STRATEGY

Chapter 4 of the Draft Strategy sets out four headings: CNG, "renewable gas", CCS and Hydrogen.

3.1 Compressed Natural Gas

The development of a CNG gas vehicle infrastructure to substitute for petrol and diesel vehicles is being advanced on the basis of gas being "clean".

Ireland's fossil gas dependence for the power generation industry and heating is already problematic enough without the industry seeking to develop new fossil infrastructure and dependence for transport.

The GNI draft plan states:

> *"Gas Networks Ireland is currently targeting at least 5% penetration of Compressed Natural Gas (CNG) or bio-CNG for commercial transport and 10% of the bus market in Ireland by 2025. By the end of the current NDP period (2027/28), Gas Networks Ireland is expecting to see annual CNG demand of circa 0.8 TWh/yr. Gas Networks Ireland is conducting a project for a nationwide CNG fuelling network, co-located in existing forecourts, on major routes and/or close to urban centres. This will help satisfy the requirements of the EU's Alternative Fuels Directive which aims to establish CNG refuelling facilities along the TEN-T Core Road Network. The initial*

phase of this network rollout is through the Causeway Study which has begun to deliver this essential infrastructure. The CNG Stations will be strategically located to deliver the required outputs of the Causeway Study and to maximise utilisation of the assets".

There is no climate mitigation or business case for promoting or developing compressed natural gas infrastructure. The use of compressed natural gas (CNG) in transport will not achieve the level of emission cuts required. Developing CNG infrastructure would perpetrate the continued extraction and combustion of fossil gas lock-in, and impede the alternative of electric transport from renewable energy generation.

In its own promotional information advocating CNG for transport, GNI is able to claim only a 22% reduction in fossil emissions.

A 2018 report by the European NGO Transport and Environment (T&E), of which An Taisce is an affiliate member, carried out extensive research on the sustainability of CNG and use of biomethane for vehicles[1]. It set out the EU policy background and objectives of the report:

"The EU has agreed to cut its greenhouse gas (GHG) emissions by at least 80-95% by 2050 and was the driving force behind the Paris Agreement which requires net zero emissions by the middle of the century. Climate policy will require a shift away from petroleum which currently provides nearly all of transport's energy needs. Apart from a transition towards zero emission technologies such as battery electric or hydrogen, regulators and governments across Europe are considering what role gas could play in decarbonising transport.

The EU and several national governments support the use of methane in transport through regulations, tax breaks and subsidies. The gas industry - which is faced with stagnating or declining demand in other sectors in Europe – sees transport as a major growth market.

This report compiles the latest evidence on the environmental impacts of using gas as a transport fuel. The report is based on the most up to date literature, test results and data. It builds on a previous report by AEA-Ricardo but analyses in more detail issues such as the role of renewable methane (biomethane and power-to-methane) or the impact of tax policy."

With regard to climate impacts the T&E report states:

"Gas vehicles and vessels have similar performance to other fossil fuelled vehicles and vessels. Based on the latest available evidence fossil gas used in transport has no meaningful - and when including methane leakage and upstream effects in almost

[1] https://www.transportenvironment.org/publications/natural-gas-powered-vehicles-and-ships-%E2%80%93-facts

all cases - no climate benefits compared to petroleum-based fossil fuels.

The overall (well to wheels/WTW) GHG performance identified in this study (with the medium upstream emissions) range from -12% to +9%, depending on the mode of transport. In cars, the GHG savings range from -7% to +6% compared to diesel. In heavy duty, the range is -2% to +5% compared to best in class diesel trucks and depending on the fuel and engine technology. In shipping, the figures are -12% to +9% compared to marine gas oil (MGO) but these figures are highly dependent on methane slip.

We did not find any evidence supporting the theoretical savings of gas vehicles, which are based on the lower carbon content of the fuel. In reality poor gas engine efficiency often offsets the benefit of the fuel already at tailpipe level. This points to the need for policies based on measured performance (through the EU's official tests), not the type of fuel. Uncertainties also exist regarding methane leakage at the vehicle level and the impact of boil-off and venting is not well documented but could have a significant negative impact on gas vehicle's environmental performance.

Methane is a very powerful greenhouse gas. Over a period of 100 years it is 28 times more potent than CO2. In 2010 methane accounted for 20% of global GHG emissions. These (550 Mt) emissions are growing annually by 25 Mt, with 17Mt of the growth linked to fossil fuel extraction.

Methane leakage - i.e. unburnt methane leaking into the atmosphere - occurs throughout the supply chain (extraction, transport, refueling) and has a large and negative climate impact. Currently the average fugitive methane emissions in the supply chain of fossil gas are 2.2% of fossil gas produced, ranging from 0.2% to 10%.

Recent evidence suggests that upstream methane emissions have been significantly underestimated - by up to 60%, making it likely that CNG/LNG upstream emissions and subsequently well-to-wheel or wake GHG emissions are worse than the abovementioned numbers (which are based on 'central' upstream emissions data). Given that methane is a very potent short term greenhouse gas any benefits from gas vehicles would only materialise several decades into the future, well after the EU economy would need to be fully decarbonised."

The report concluded:

"*There are only limited air quality benefits from using fossil gas in road transport. Gas vehicles perform similarly to petrol cars and only marginally better than diesel cars in terms of compliance with the new RDE limits. The European Commission is working on a Euro 7 limit which will further decrease or entirely eliminate any benefit gas has over diesel cars. Far greater air quality improvements could be achieved by switching to zero emission cars.*

For trucks, CNG and LNG offer no meaningful benefits (NOx, PM) compared to vehicles complying with the Euro VI standard. HPDI (high pressure direct injection) truck technology has slightly higher NOx emissions. Particle number emissions are also higher in methane-powered transport, compared to diesel. For ships LNG has a clear benefit compared to heavy fuel oil although similar emissions performance can also be achieved by fitting ships with after treatment systems such as SCR and DPF and using low Sulphur marine gas oil."

3.2 Biomethane ("renewable gas")

GNI, in common with gas industry interests across the EU, is promoting the concept of injecting a quantity of agriculture or crop based biomethane into the existing fossil gas network and branding this "renewable gas".

There is no "renewable" gas source, as all models require a production chain and have an emissions path. Biomethane is not a genuinely renewable energy source whether produced from animal effluent or a crop such as grass, and there is major greenhouse gas (GHG) impact from the fertilisation of grassland or other crops, as well as other emission leakages. Gas produced from waste is not renewable, especially if it monetises unsustainable agricultural practices. In any case, overarching sustainability policy including the UN Sustainable Development Goals provides for the reduction of waste, therefore any by-product capacity from waste will become more limited in the future.

In Ireland, biomethane projections are predicated on maximising nitrogen fertiliser use on land to grow more grass (in addition to the 35% increase in N-fertiliser use already seen since 2010 for herd expansion), thereby increasing nitrous oxide (N_2O) GHG emissions even further. Adding the effect of methane leaks from anaerobic digesters (see section 3.2.4 below) means that the effect of these potent GHGs is likely to greatly reduce or cancel the claimed CO_2 climate benefit of using biomethane instead of fossil fuels.

Internationally, so called renewable gas is also problematic in supply sustainability, competing with food production for land, and will not achieve the level of emission reduction needed to meet Paris Agreement implementation targets. It perpetuates and prolongs a lock-in to fossil gas infrastructural development and consumption, and inhibits investment and deployment of low carbon renewable alternatives, particularly for heating and transport. This is outlined in a Corporate Europe 2018 report[2].

GNI seeks to address greenhouse gas emissions through the draft strategy's proposition of a 20% target for injection of primarily animal agriculturally sourced biomethane into the gas pipeline system by 2030.

[2] https://corporateeurope.org/climate-and-energy/2018/10/part-1-dangerous-distraction-renewable-gas-keeps-us-fossil-fuel-path

The sustainable use of all bioenergy sources, as much as sustainable production and sourcing, needs assessment for the optimum advancement of decarbonisation.

3.2.1 Sustainable use of biomethane

GNI have not demonstrated the required double sustainability test for biomethane, which applies to end use much as production.

The meeting of climate and other sustainability targets requires substitution of fossil energy including gas for renewables, and substitution of animal-based nutrition for plant-based nutrition. The most effective advancement of decarbonised energy is to achieve complete substitution of a fossil energy source whether for electricity, heating or transport. Dilution whether 10%, 20% or higher is problematic in perpetuating fossil fuel use supporting continued investment in and lock-in to old combustion technologies. The effect it has is to prolong use of fossil fuel whether for electricity generation, heating boilers or internal combustion engine vehicles, thus undermining a full switch to alternative renewable technologies in electricity generation, heating or transport.

The alternative options of using any sustainably produced biomethane in electricity generation, as the sole fuel for HGVs, in local/district heating systems, or in an industrial plant in the local area of its production, to substitute for fossil combustion need to be properly assessed.

The 2018 T&E report[3], in considering the limited availability of sustainably sourced biomechanics, stated in conclusion:

> *What potential exists might be better used to help decarbonise sectors that currently depend on methane (residential, industry, power) and where no new infrastructure and engines are needed. Biomethane in transport can play a niche role in local projects, with vehicles running on 100% biomethane, refueling at local biomethane production sites. A wider shift to methane will almost certainly lead to a transport sector powered by fossil gas, not renewable methane".*

3.2.2 Sustainable biomethane sourcing

There are major issues with the sustainable production of animal agriculture sourced biomethane since the current and continuing increase of the feed import dependent Irish beef and dairy herd is unsustainable on multiple grounds. In combination with pig and

[3] https://www.transportenvironment.org/publications/natural-gas-powered-vehicles-and-ships-%E2%80%93-facts

poultry, it has put Ireland in increasing exceedance of the EU Emissions Ceiling Directive on ammonia since 2016[4].

Climate action, ammonia air pollution abatement, reversal of biodiversity loss, and nitrate and water quality targets require a substantial a progressive reduction in Irish cattle herd numbers in particular. The GNI model of a progressive increase in biomethane production from the expansion of a network of injection facilities from primarily bovine industry anaerobic digestion, are incompatible with these objectives.

There is no potential for biomethane to be either available in the quantity which would be required, or to be sustainably sourced to achieve the level of emission reduction which the Irish Carbon Budget requires.

The potential of sustainably produced biogas of any scale remains unresolved. In the short-term, as with biofuel dilution, there is a risk that the insertion of a "sustainable" bio-gas content into the gas grid could create a new generation of lock-in investment into gas-based technologies, without being able to achieve the progressive real decarbonisation needed thereby impeding alternative technologies including renewable-powered electricity.

GNI's own projections are to achieve a 20% biomethane injection into the fossil gas grid by 2030. The sustainability of producing this quantity of biomethane has not been justified, let alone the progressive increase that would be needed to meet the post 2030 carbon budget. Any consideration of the potential for a percentage biomethane injection as a way to justify maintaining a distributed gas grid and promoting continued use of gas for heating or transport requires vetting of financial, administrative, land use, air pollution and climate impacts. It is important to avoid any misdirected subsidy or energy support as occurred with the Northern Ireland Government's "Cash for Ash" scheme.

The 2018 Transport and the Environment (T&E) report on gas-powered vehicles contains extensive consideration on biomethane. An overview is sent out in the Executive Summary, which states the following:

> *"Biomethane and power-to-methane can have (significantly) lower GHG emissions than fossil gas. However, sustainable feedstocks for biomethane (wastes, residues) are very limited and cannot be sustainably scaled. Even if we assume the maximum sustainable potential is produced and all of it is allocated to transport - this is very unlikely to happen - biomethane could only cover 6.2- 9.5% of transport's energy needs. Currently, only around 4% of gas consumed in the EU is renewable, and this is mainly produced from crops such as maize. The gas grid has just a 0.5% share of renewables, compared to almost 30% of renewables in electricity generation. Less than 1% of biogas produced is currently used in transport.*

[4] EPA 2020. Ireland's Air Pollutant Emissions 1990-2030
http://www.epa.ie/pubs/reports/air/airemissions/irelandsairpollutantemissions2018/EPA-Air-Pollutant-Emissions-website.pdf

3.2.3 Biomethane Capacity in Ireland

There are major sustainability issues raised by GNI projections to achieve a 20% target for biomethane injection into the fossil gas system. This figure does not address the impact of biomethane production on climate. The ammonia, nitrate and general land use impact of Irish bovine agriculture require a reduction in herd numbers.

Adding AD plants to the system may enable waste slurry processing to biogas, but AD has its own serious environmental impacts through ammonia and metals pollution potential from digestate usage (Nkoa, 2014)[5]. Moreover, adding AD plants creates a market for slurry resulting in cost savings that can be used in increasing dairy production through even greater nitrogen usage and pollution. This type of rebound effect is clearly evidenced in Ireland since 2010 (see Figure 1) whereby the savings through efficiency measures such as the Economic Breeding Index have increased dairy profitability thereby increasing coupled total milk, emissions and slurry production with little or no change in GHG or excreted nitrogen efficiency.

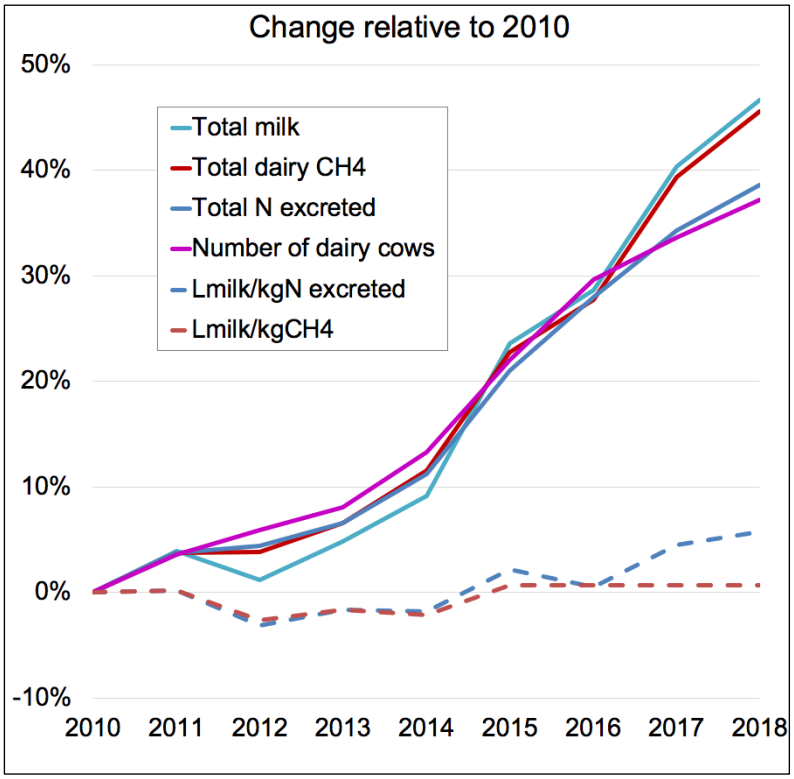


Figure 1. Dairy in Ireland, percentage change in indicators since 2010. Methane and excreted nitrogen (N) efficiency in Litres of milk produced per kg of pollution. Small changes in efficiency are seen in contrast to large rises in total milk, cows, methane and excreted nitrogen. Data from EPA, 2020, Annex 3.3.

[5] Nkoa, R., 2014. Agricultural benefits and environmental risks of soil fertilization with anaerobic digestates: a review. Agron. Sustain. Dev. 34, 473–492. https://doi.org/10.1007/s13593-013-0196-z

The GNI modelling is based on feedstock availability projections combining, food-waste, animal slurry and grass crop biogas, which are not tenable.

FOOD WASTE

Food waste is an unsustainable waste of food nutrition. Enhanced food management is required to reduce current levels of food waste, which would substantially reduce any projection of biogas recovery from food waste. The EU and Member States are committed to meeting the UN Sustainable Development Goals, adopted in September 2015, including a target to halve per capita food waste at the retail and consumer level by 2030, and reducing food losses along the food production and supply chains. Food waste prevention is an integral part of the Commission's Circular Economy Package to stimulate Europe's transition towards a circular economy which will boost global competitiveness, foster sustainable growth and generate new jobs.

For food waste that continues to arise, the most sustainable use needs to be determined. It has not been established that anaerobic digestion is the most sustainable use. There is a need to develop alternative compost to replace the current use of peat in horticulture, and the use of plant-based food waste is a potential alternative[6].

CATTLE SLURRY

Agricultural GHG increased by 2.7% in the most recent EPA reporting period for 2017 resulting from the continuing increases in the bovine herd. Current levels of bovine herd increase are incompatible with climate action, both globally and nationally, which require an increase in plant-based food production and a reduction in the bovine herd because of methane emission impact that is not capable of mitigation[7].

PIG SLURRY

Pig slurry is a major potential single ingredient for anaerobic digestion nationally. Given the concentration of pig farms into larger facilities and their geographic clustering, the first option should be to provide for an AD facility within the pig farm, or in close proximity to a cluster of pig farms and use of the biomethane created for electricity generation. There is a cumulative impact of industrial pig farming in conjunction with chicken farming with that in Northern Ireland exceeding Ireland's ammonia threshold limit, which constrains further industrial farming.

GRASS SILAGE

[6] https://ec.europa.eu/food/safety/food_waste/eu_actions_en

[7] "*Not So Green - Debunking the Myths Around Irish Agriculture*". 2016 Stop Climate Chaos and the Environmental Pillar: http://www.antaisce.org/sites/antaisce.org/files/not_so_green_report.pdf

The sustainability of grass silage cultivation for anaerobic digestion has not been demonstrated. The current bovine herd increase is running into fodder availability limit and given the issues that arose in 2013 with the fodder crisis, and the fodder shortage during the 2018 drought, the reliability of an annual silage surplus for digestion cannot be guaranteed, if existing herd level continue to increase or are even maintained at current levels. Furthermore if grass is to be used as an energy crop it needs to be determined whether it is the most efficient in energy return compared to other energy crops or crops which would sequester carbon such as flax or hemp-based material for building insulation.

INDUSTRIAL FOOD WASTE

As with general food waste, future policy and action is required to reduce current levels of industrial food waste. For industrial food waste that continues to arise the most sustainable use needs to be determined. It has not been established that anaerobic digestion is the most sustainable use. There is a need to develop alternative compost to current use of peat, and use of plant-based food waste is a potential ingredient

3.2.4 Methane slippage

It is crucial to note that the anaerobic digestion (AD) process can *also* emit or merely postpone emission of GHGs and air pollution (Paolini et al., 2018)[8]. Substantial methane (CH_4) leakage (up to 15%) can be lost through 'slippage' from AD plants (Long and Murphy, 2019, p. 8)[9,10]. Even low methane slippage levels can seriously compromise the sustainability of biomethane (Liebetrau et al., 2017, pp. 40–44)[11,12].

Paolini et al. (2018) state, "*The equivalent CO_2 saving raises considerably if methane slip is limited to 0.05%, [70] while the process results no longer sustainable when methane losses reach 4%.*"

[8] Paolini, V., Petracchini, F., Segreto, M., Tomassetti, L., Naja, N., Cecinato, A., 2018. Environmental impact of biogas: A short review of current knowledge. Journal of Environmental Science and Health, Part A 53, 899–906. https://doi.org/10.1080/10934529.2018.1459076

[9] Long, A., Murphy, J.D., 2019. Can green gas certificates allow for the accurate quantification of the energy supply and sustainability of biomethane from a range of sources for renewable heat and or transport? Renewable and Sustainable Energy Reviews 115, 109347. https://doi.org/10.1016/j.rser.2019.109347

[10] "*The typical technologies being considered by Industry in Ireland are Membrane and Chemical ab- sorption. These have efficiencies of methane loss to biomethane, ac- cording to the literature, in the range of ca. 0.1% and 1–15% respec- tively. It would be extremely unlikely to have slippage of 15%. Typically, either-off gas is recirculated back to the systems or at worst the off-gas is combusted or oxidised to CO2. In practice most methane recovery systems have losses under 2%"*

[11] Liebetrau, J., Reinelt, T., Agostini, A., Linke, B., 2017. Methane emissions from biogas plants. IEA Bioenergy.

[12] *"The results of this modelling exercise confirm that methane losses from the biogas plants are the most significant parameter affecting the GHG emissions of biogas plants running on energy crops or biowaste. In fact, in all the pathways modelled, with the increase of the methane losses, the GHG emissions go from lower to higher than the 30 % FFC limit, therefore the pathways would go from sustainable to unsustainable, according to the EC methodology."*

Grubert (2020)[13] in "*At scale, renewable natural gas systems could be climate intensive: The influence of methane feedstock and leakage rates*" states:

> *"Anticipated leakage is climatically significant: literature estimates for methane leakage from biogas production and upgrading facilities suggest that leakage is in the 2%–4% range (mass basis), up to as much as 15%. Policy makers should consider that under reasonable leakage and demand assumptions, RNG [renewable natural gas] could be climate intensive."*

In a lifecycle analysis of AD plants, Ebner et al. (2015)[14] states:

> *"Emissions of 10% are quite possible through poor system inspection and uncontrolled releases".*

Given Ireland's limited governance capacity for and history of on-farm regulatory enforcement, there is a reasonably high likelihood of poor system inspection and uncontrolled methane releases from the on-farm biomethane plants needed for GNI's ten-year plan.

In a case study Baldé et al. (2016)[15] found that, "*methane emitted from digestate storage was about 12% of the annual quantity of CH_4 produced in the digester*".

Additionally, digestate produced by AD plants may merely postpone the emission of the GHG nitrous oxide (N_2O) as well as methane (CH_4), and, critically, can increase ammonia (NH_3) air emissions (Paolini et al., 2018). Therefore the AD process may not even reduce, let alone eliminate, the climate impact of GHGs and air emissions.

3.3 Carbon capture and storage

While CCS will need to part of the achievement of a zero carbon energy and food system, current international research and development of CCS does not project any significant capacity being achieved by 2030. The GNI TYNDP does not project any CCS offsetting within a 2030 timeframe.

At the same time the prospect of large-scale CCS is being used to justify what amounts to no new reduction of fossil gas use by GNI for the decade ahead.

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[13] Grubert, E., 2020. At scale, renewable natural gas systems could be climate intensive: The influence of methane feedstock and leakage rates. Environ. Res. Lett. https://doi.org/10.1088/1748-9326/ab9335

[14] Ebner, J.H., Labatut, R.A., Rankin, M.J., Pronto, J.L., Gooch, C.A., Williamson, A.A., Trabold, T.A., 2015. Lifecycle Greenhouse Gas Analysis of an Anaerobic Codigestion Facility Processing Dairy Manure and Industrial Food Waste. Environ. Sci. Technol. 49, 11199–11208. https://doi.org/10.1021/acs.est.5b01331

[15] Baldé, H., VanderZaag, A.C., Burtt, S.D., Wagner-Riddle, C., Crolla, A., Desjardins, R.L., MacDonald, D.J., 2016. Methane emissions from digestate at an agricultural biogas plant. Bioresource Technology 216, 914–922. https://doi.org/10.1016/j.biortech.2016.06.031

It is noted that Ervia through GNI is examining the feasibility of using the Kinsale Gas Field for CCS. The future technological development of CCS of any scale and in any immediate timeframe is uncertain. The Intergovernmental Panel on Climate Change (IPCC) is clear in saying that meeting Paris Agreement targets means a global annual emissions reduction of over 7% *now*. Energy policy in accommodating continued fossil fuel in exploration and combustion, and the location of energy intensive industries should not be predicated on uncertain future CCS deployment.

CCS capacity of about 330 $MtCO_2$ at favourable low pressure is potentially available in the nearly-exhausted Kinsale Gas field. However, even if made available before 2030, near-term emissions of oil and gas alone are likely to have already by then used up Ireland's fair share of the global carbon budget for the Paris objective. Levels of fossil gas usage to the level projected by the GNI LTS study would then mean the entire Kinsale Field capacity would be use up by gas CCS within 10 years. International research and information has failed to project any achievable level of carbon capture and storage at the scale of, or within the time frame needed to achieve Paris-aligned decarbonisation unless near-term deep and rapid reduction of fossil fuel combustion is first achieved without delay. The continuation of current levels of fossil fuel consumption and continuing investment in combustion whether for power generation or and of pipe level such as home gas boilers, cannot be justified on the basis of an uncertain future mitigation availability.

3.4 Hydrogen

Hydrogen is one of a number of potential technologies to fill the gaps in intermittent or variable wind and solar power generation. Hydrogen generation requires an energy input and has a pressure with different storage and transport requirements to natural gas or biomethane.

If a cost effective technology can be developed for large scale hydrogen production using surplus, including night-time renewable energy, in comparison to other options, then its optimum use would be as storage for electricity generation in flexible power plants able to meet renewable intermittency gaps. The potential or justification of injecting sustainably produced hydrogen into the gas grid has not been demonstrated.

4. CRITIQUE OF GAS GROWTH PROJECTIONS

In addition to CNG capacity expansion**,** Chapter 8 of the GNI draft plan sets out growth strategy for a number of sectors namely residential heating, industrial, and data centres.

4.1 Heating

The introduction and Chapter 8 of the GNI draft states:

"There are a large number of properties located close to the gas network which are not connected to it. It is estimated that there are over 700,000 households in Ireland using oil for central heating of which 300,000 are located in close proximity to the gas network and could be readily connected to gas resulting in significant benefits from an environmental perspective, considering natural gas emits 23% less CO2 and negligible levels of nitrogen dioxide (NOx) & sulphur dioxide (SOx) versus oil".

The implications of lock-in to fossil gas consumption are not addressed, while the 23% GHG reduction does not resolve the scale of decarbonisation need to be achieved in the decade ahead:

"*The ESRI have carried out research on 'access to and consumption of natural gas: spatial and socio-demographic drivers' and the resultant report recognises that increasing the number of dwellings connected to the gas network has the potential to reduce emissions where dwellings are switching from e.g. coal and oil*".

This is only a short tem benefit and creates lock-in to investing in new gas boiler combusting technology.

In the UK there is a National Infrastructure Commission which evaluates the future of infrastructure. It is independent of the utilities or state body, or corporate interests involved. In its 2018 report the UK National Infrastructure Commission questioned the viability of the use of gas for heating in meeting emissions reduction targets after 2030, with the alternatives of investment in efficiency and renewable electric powered heat pumps or hydrogen replacing fossil gas electricity generation[16].

"There are two potential large scale solutions for low carbon heat, and a range of smaller solutions which may complement one of them. The first option is electrification, using heat pumps to increase the efficiency of using electricity for heating. Alternatively, hydrogen from a zero carbon source (which creates only water vapour when burnt) could be used as a direct replacement for natural gas, fuelling boilers and appliances.

Whilst there are incremental steps that can be taken to address some aspects of the challenge, an incremental approach on its own will not be enough. In the 2020s, decisions will be required on whether the gas network should be maintained and converted, or phased out"

This puts into question any expansion of the gas network or any justification of seeking to attract new gas consumers to lock into fossil combustion heating systems as GNI is doing in its current strategy and advertising campaigns.

The risk of creating new dependence on individual gas boilers is not properly addressed. Current assumptions by GNI that an increasing quantity of "renewable" gas can be inserted into the grid, or that future gas electricity generation can have viable carbon capture, have

[16] https://www.nic.org.uk/wp-content/uploads/CCS001_CCS0618917350- 001_NIC-NIA_Accessible.pdf

not been validated.

Creating a new lock-in of dependence on gas heating, particularly of boilers at individual household level, undermines alternative renewable heating systems, heat pumps and development of district heating, geothermal or other systems.

4.2 Industrial and commercial

Chapter 8 outlines the GNI strategy for industrial and commercial users:

> *"Natural gas is viewed as providing a reliable, convenient, flexible, cost effective, environmentally friendly fuel source and renewable gas also has the potential to offer the additional benefit of carbon neutral emissions, without the need for costly equipment upgrades (the exact same equipment can be used to burn renewable gas).*
>
> *Many I/C customers with thermal heat requirements are actively looking to natural gas and pects to add circa 3.3 TWh/yr of annual demand from the I/C sector by the end of the NDP period."*

This is a strategy for lock-in to continued gas dependence, and the holding out of a unrealistic prospect of "carbon neutral" or renewable gas which there is no capacity to deliver.

4.3 Data centres

GNI is actively seeking to create lock-in to gas use and dependence for data centres without any limit being defined. Section 8.2.1 of the GNI draft states:

> **"***There are a number of key sectors which could potentially influence capacity with their growth demand over the coming years. Data centres for example have emerged as a potential growth sector in Ireland due to its global connectivity to Europe and the Americas, combined with excellent utility infrastructure, moderate climate, stable economic policies and IDA42 support. Data centres are inherently large users of electricity with their annual usage varying from 12 GWhe for a small data centre to a 520 GWhe for a very large data centre. There are now over 50 data centres 43 currently operating in Ireland with substantial future growth predicted in this sector subject to planning. These data centres are already impacting the electricity grid capacity, as the demand for electricity from these mainly Dublin-located centres is putting a significant strain on the Eirgrid infrastructure.*
>
> *Gas Networks Ireland has developed a combined offering of natural gas, renewable gas and dark fibre services through its subsidiary Aurora Telecom to provide the data centre sector with its primary source of energy and fibre connectivity. Natural gas*

can be used for onsite energy generation leveraging the existing reliable gas network infrastructure, offering data centre operators' substantial savings in terms of energy costs and as such Gas Networks Ireland expects the penetration of gas connections in this sector to increase in the coming years."

With data centre development actively promoted by the Department of Enterprise in a policy statement, the oversight that would be expected from the Department of Communication, Climate Act and Environment (in the previous government) over the last five years has not been obvious.

Local Authorities and An Bord Pleanála are granting permission for data centres on a case-by-case basis without addressing the cumulative impact of energy use. The scale of data centre development occurring in Ireland has not been subject to SEA. Individual cases are being determined in a systemic breach of the Environmental Impact Assessment (EIA) process, which requires that direct and indirect impacts as well as cumulative impacts be fully assessed and mitigated for the application in question.

The financial model of GNI is dependent on generating income from new commercial and industrial users with the effect of creating new fossil gas users and dependence.

Because of the burden on the electricity grid, Eirgrid is now requiring data centres to have their own fossil gas power generation on site[17]. There is no independent oversight warning of the fossil gas lock-in this will cause through an increase to our emissions and fossil gas energy use. GNI is pursuing a continued policy of pipelines extensions and expansion of the customer base.

Data centre applications using on-site gas installation proposes to address the GHG impact by the progressive injection of agricultural biomethane into the fossil gas pipeline system, on the basis that it will be certified as "renewable" and with the longer-term promise of CCS.

4.4 Combined heat and power

Section 8.2.2 of the GNI draft sets out consideration of combined heat and power (CHP):

"Growth in the Combined Heat & Power (CHP) sector is another area which could potentially influence capacity in the coming years. The CHP technology combines the generation of electricity at a local level with the use of heat for process use and/or space heating. CHP technology provides distributed power generation, reducing the reliance on the national electricity grid, while providing significant carbon and energy savings versus utilising grid electricity. In 2017 the installed CHP technology in Ireland avoided an estimated 423 ktCO2 emissions (up 16% from 2016) and provided for an estimated 1,887 GWh in primary energy savings. Applications of CHP

[17] http://www.eirgridgroup.com/site-files/library/EirGrid/Data-Centre-Connection-Offer-Process-and-Policy-paper.pdf

technology range from smaller users such as nursing homes, hospitals and hotels up to large industrial applications such as data centres, dairy processing plants and the pharmaceutical sector. In 2017 there was a 2.1% increase in the CHP capacity in Ireland. Natural gas remains the fuel of choice for CHP plants throughout Ireland and accounts for over 90% of the installed operational capacity. The reliability, combined with the high efficiency of natural gas CHP, also offers substantial savings when compared to grid electricity."

This latter consideration does not factor in an effective carbon price for fossil gas or the real cost of biomethane. Grid electricity has much higher achievable renewable energy capacity levels by 2030, in comparison to the 20% dilution of biomethane into the fossil gas pipeline system as proposed by GNI.

The objective of using CHP should be to achieve an overall level of reduction in fossil fuel use and emissions. Instead, GNI considers CHP as another customer growth opportunity rather than its potential integration with a sustainable energy strategy.

The most potentially sustainable CHP developments would be those using a locally supplied renewable energy source, rather than creating lock-in to expanding the gas consumer base.

5. DCU STUDY ON ROLE OF GAS IN IRELAND'S FUTURE ENERGY SECURITY

To be read in conjunction with this submission, we attach an independent expert peer review, "*Is Natural Gas Essential For Ireland's Future Energy Security*", commissioned on behalf or Stop Climate Chaos (Appendix 1). This report was produced in response to an Irish Academy of Engineering report seeking to justify continued oil gas exploration in Irish territorial waters. This includes a critique of the GNI "Long Term Resilience Study" showing projections of fossil (natural) gas and potential biomethane use until 2040.

A preliminary analysis at Dublin City University of its energy and emissions implications finds that:

"*the LTR Study claim that its medium demands scenario is aligned with Ireland reaching long-term decarbonisation targets appears highly questionable in terms of Ireland's fair share carbon quota and even in terms of published least cost analysis.*"

6. CRITIQUE OF GNI FORECASTING MODELS

GNI does not address the global threat to fossil fuel infrastructure in becoming a stranded asset through the combined need for rapid energy decarbonisation, and development of alternative technologies.

GNI's modelling of gas demand as set out in its "*Methodology for Forecasting Gas Demand"* published in 2018 does not represent in any way a sustainability assessment of current, continuing and future gas consumption.

GNI, while State owned and coming under the Minister for Communications, Climate Action and the Environment (under previous government), has a vested interest in expanding the use of fossil gas and is no different to any commercial entity or service provider seeking to maintain and expand its product or service based primarily on maintaining and increasing consumer share and numbers. On behalf of the public good, its forecasting should be treated with due caution by regulators and decision-makers.

For example, in relation to projecting residential use, one of the main considerations in its demand methodology is historic data and "*The new house/apartment split, based on historical trends*". This does not address the higher insulation standards for new housing stock and the alternative of renewably powered electric heat pumps instead of gas boilers, which are major objectives to roll out in the June 2020 Programme for Government.

7. CONCLUSIONS

The focus of the GNI strategy is accommodating current and increased gas demand rather than demand reduction. GNI is an entity whose remit is the maintenance and development of gas infrastructure. Its Draft TYNDP is based on the uncritical assumption of accommodating continued increased gas demand.

The draft plan is based on a ten year time frame only and does not address the level of emission cuts which will be required through to 2030 and beyond to meet Ireland's carbon budget, and the level of fossil fuel emissions reduction which Ireland will need to achieve to meet the commitments made under the Paris Agreement.

GNI is no different to a commercial entity seeking to expand its turnover and market share. It does not address alternative investment priorities, which should be in reducing heating demand and therefore gas consumption through retrofitting and other heating technologies such as electric heat pumps. The overriding need is for a national retrofitting scheme funded by direct grants, tax relief and loans integrated with "pay and save" schemes.

The marketing and branding of GNI repeatedly refers to gas as a clean fuel. This constitutes misleading advertising since it does not address the GHG emissions impact of gas production and combustion, whether it be fossil gas or agricultural or crop-based biomethane. Methane is 75% carbon by mass and unabated combustion of fossil carbon needs to go to zero over the next 30 years. Contrary to this physical climate reality, GNI's LTR study indicates that increased use of fossil gas will in fact maintain energy system emissions at their current very high level. The use of biogas will do little or nothing to assist decarbonisation and is all too likely to act as 'greenwashing' for increased fossil gas use

GNI's assumptions are based on current energy costs and current carbon pricing. GNI is not modelling the decreasing cost of wind and solar technology and international research on emission and cost efficient storage to resolve renewable intermittency.

GNI is promoting the use of gas-based CHP for data centres, which are major energy consumers, with contacts already in place with two data centre operators. The efficiency and emissions impact claims made by GNI need to be externally assessed and comparisons made with a comparable data centre sourcing of wind- and solar-generated electricity from the grid.

GNI has not advanced any sustainability or business cases for gas boilers in new buildings, where insulation standards should obviate the need for gas systems, and heating needs can be accommodated by electric heat pumps or other electric or ground source heat pump technology.

The gas demand projected by GNI to 2027 is based on the accommodation of current market consumptions and promotion of increased demand, for which GNI is carrying out a continuing advertising campaign.

Any projection of demand to 2027 must demonstrate a rapid descent in Ireland's energy and land use GHG emissions. It is not sufficient to just to look to 2027. It is necessary to look beyond that in order to achieve rapid emissions reductions. For this reason the impact of achieving short-term emissions reduction with gas-based technology must be set against the danger of "lock-in" to gas infrastructure which inhibits more sustainable alternatives and does not achieve the progressive emissions cuts needed beyond. This would leave investment in extended pipelines, including at consumption points in heating system and vehicles, redundant.

Post-2030 the main role for fossil gas should be modelled for Flexible Generation gas thermal stations ("FLEX Gen") to resolve renewable intermittency, if other more emission efficient technologies are not viable or in place.

Modelling of increasing fossil gas consumption on 2019 levels and promoting fossil gas for other uses cannot be justified, with a need for a clear date to be established for the progressive reduction of GHG emissions from fossil gas as part of Ireland's overall carbon budget.

The GNI TYNDP is not fit for purpose as it is not based on any external or independent assessment of the sustainable future of gas, sustainable biogas production capacity and the gas pipeline network in a low carbon future.

Please acknowledge our appeal and advise us of any decision made.

Yours sincerely,

Ian Lumley
Head of Advocacy
An Taisce – The National Trust for Ireland

Phoebe Duvall

Planning and Environmental Policy Officer
An Taisce – The National Trust for Ireland

Appendix 1 (attached): *Is Natural Gas "Essential for Ireland's Future Energy Security"?*

APPENDIX 1

Is Natural Gas "Essential for Ireland's Future Energy Security"?

A Critical Response to the Irish Academy of Engineering

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November 2018

An independent expert peer review commissioned on behalf of **Stop Climate Chaos**, a coalition of civil society organizations campaigning to ensure Ireland does its fair share to tackle the causes and consequences of climate change.

www.stopclimatechaos.ie

"Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). ***These systems transitions are unprecedented in terms of scale****, but not necessarily in terms of speed,* ***and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options*** *(medium confidence)..."*

— IPCC Special Report on Global Warming of 1.5 °C, October 2018 (IPCC 2018 Headline Statement C.2, emphasis added)

"The findings of the IPCC highlight that ***only the most ambitious action possible will mitigate the adverse effects of climate change on human health and welfare*** *and that the time left to act is extremely limited.* ***While neither the 1.5°C or well below 2°C targets of the Paris Agreement are wholly consistent with the human rights obligations of States*** *acting together in accordance with the duty of international cooperation, to protect human rights from the adverse effects of climate change,* ***they do represent a ceiling that States have agreed should not be exceeded.****"*

— Statement by the UN Special Rapporteur on Human Rights and Environment, October 2018 (Boyd 2018, emphasis added)

Executive Summary

It is widely recognised that the current Irish energy system carries a significant security-of-supply risk, due to heavy reliance on natural gas, with very constrained diversity and capacity of import supply routes. This risk *may* become even more severe in the years immediately ahead as the only significant indigenous natural gas source (the Corrib gas field) is depleted and the other (even higher carbon intensity) fossil energy sources (coal, oil and peat) are progressively removed from the Irish energy mix. In July 2018, the Irish Academy of Engineering (IAE) published a major report assessing this evolving natural gas security-of-supply risk, entitled "Natural Gas — Essential for Ireland's Future Energy Security" (IAE 2018). The report argued that substantial continued reliance on natural gas in the overall Irish energy system is unavoidable up to at least 2040. On this basis, it recommended a number of major strategic interventions designed to manage the consequently deepening security-of-supply risk, i.e., measures attempting to assure continued access to natural gas.

In this response to that report[1], we present an independent peer evaluation of the basis for these recommendations. We base our analysis on the presumption that Ireland is committed to good faith action consistent with its ratification of the Paris Climate Agreement (UNFCCC 2015): specifically to play its equitable and commensurate part in holding the increase in the global average temperature to *well below* 2°C above pre-industrial levels and *pursuing efforts* to limit the temperature increase to 1.5°C. We assume the IAE shares this premise.

On this basis we find that the IAE analysis is mistaken both in its assessment of the required speed of decarbonisation of the Irish energy system (and therefore the need to rapidly phase out all fossil fuel emissions, *including* from natural gas), and in its discounting of the technical and economic feasibility of such rapid decarbonisation. On the contrary, given Ireland's large natural resource of variable renewable energy (especially wind), and coupling this with the use of synthetic chemical fuels ("electrofuels") for very large scale energy storage, we find that rapid fossil fuel phase out is not only technically feasible, but can progressively *eliminate* the security-of-supply risks associated with all imported fossil fuels, while *simultaneously* decarbonising with the scale and urgency demanded by good faith participation in the Paris agreement — subject, of course, to securing the comprehensive societal support necessary to enable this transformation.

While the electrofuel storage element of this pathway is challenging in terms of technology maturity and immediate investment cost, this is true of *all* decarbonsation pathways that might credibly be commensurate with meeting the Paris climate goals; but this pathway has the unique advantages of high confidence in the effectiveness of decarbonisation and relatively rapid achievement of very high national energy security. Such a rapid fossil fuel phase out would additionally bring very significant co-benefits in balance of payments and overall national social and economic resilience. These findings also decisively contradict the IAE suggestion that continued exploration for indigenous fossil fuels is in the national interest of Ireland.

[1] This response was commissioned as an expert peer review on behalf of Stop Climate Chaos (SCC), a coalition of Irish civil society organizations campaigning for effective climate action. The authors conducted the review independently and on a *pro bono* basis. All material affiliations of individual authors are disclosed in the author information at the end of the document. The content and findings of this review remain the sole responsibility of the authors.

Key Findings

- The IAE report severely underestimates the rate at which CO_2 emissions from the Irish energy system must now be eliminated — *assuming* good faith action on the basis of the Paris Climate Agreement. This fundamentally undermines the analysis presented.
- We *agree* fully with the IAE that reliance on imported natural gas already raises very serious security-of-supply concerns for the Irish energy system.
- However: any energy policy involving the displacement of other fossil fuels specifically in favour of natural gas, even on a "transitional" basis (a so-called "natural gas bridge"), as suggested by the IAE, would greatly *escalate* that security-of-supply risk while simultaneously *failing* to achieve the required speed of decarbonisation of the Irish energy system. This arises from relying — by design — on a single, high carbon, fuel (natural gas) for critical stability and inter-seasonal balancing of the electricity system, while tacitly assuming progressive electrification of significant proportions of current transport and heating energy demand. Given limited (and rapidly depleting) indigenous natural gas supply, this would introduce, *by design*, a potential single point of failure for almost the entire energy system in the case of any major international natural gas supply disruption, while simultaneously inhibiting the required scale and speed of energy system decarbonisation.
- In contrast, we argue that by far the best way to address both Irish energy security and the pressing need for rapid decarbonisation is to constrain and reduce energy consumption (through efficiency measures and/or absolute reductions in energy services) and to directly exit from the use of *all* fossil fuels, including natural gas, as quickly as is safely feasible, replacing them by indigenous zero- or (potentially) negative-carbon energy resources to the maximum possible extent.
- In the specific case of Ireland, there are clearly identifiable pathways to transition the great majority of its energy requirement to proven indigenous zero- or negative-carbon energy sources (primarily wind, solar, and sustainably cultivated indigenous bioenergy). This does require, inter alia, the development of large scale (multi-TWh) energy storage facilities to buffer variability on at least an annual basis. We find that such energy storage is technically feasible, using well proven conversion and storage technologies, through the use of gaseous and/or liquid "electrofuels": hydrogen, ammonia, possibly synthetic hydrocarbons (with carbon cycling), all produced primarily from indigenous variable renewable energy sources.
- Finally, within the known physical constraints of the Paris Climate Agreement (the "Global Carbon Budget") we find that there is no credible case to be made for bringing *new* fossil fuel resources into production: any such additional production would inevitably add to total global atmospheric concentration of CO_2. Short term, not to say fundamentally misplaced, concerns in relation to national energy security cannot ethically be addressed by compromising climate stability for generations to come (cf. Boyd 2018): therefore neither current energy security concerns, nor, especially, a deliberate choice to further impair future energy security (through a mistaken "gas bridge" decarbonisation strategy) can be taken as valid arguments against the immediate cessation of new Irish offshore fossil fuel exploration which has been proposed in the Petroleum and Other Minerals Development (Amendment) (Climate Emergency Measures) Bill 2018.

List of Abbreviations

AD: Anaerobic Digestion (for biogas/biomethane production)

BECCS: BioEnergy with Carbon Capture and Storage (potential "negative emissions" technology)

CCS: Carbon (CO_2) Capture and Storage

IAE: Irish Academy of Engineering

IEA: International Energy Agency

IPCC: Intergovernmental Panel on Climate Change

LNG: Liquified Natural Gas

NGCCS: Natural Gas with Carbon Capture and Storage

NORA: National Oil Reserves Agency (Ireland)

P2X: Power-to-X technologies, involving the conversion of surplus variable renewable electricity to any of a variety of other energy carriers (such as hydrogen, ammonia or hydrocarbon fuels, all generically denoted "X").

SDS: Sustainable Development Scenario (one of the scenarios presented in the annual World Energy Outlook of the International Energy Agency)

SEAI: Sustainable Energy Authority of Ireland

UNFCCC: United Nations Framework Convention on Climate Change

WEO: World Energy Outlook (published annually by the International Energy Agency)

Introduction

In July 2018, the Irish Academy of Engineering published a major report entitled "Natural Gas — Essential for Ireland's Future Energy Security (IAE 2018). This is a significant contribution to ongoing debate about the evolution of the Irish energy system, especially in the context of required, rapid, decarbonisation. The report contains much valuable information and insightful discussion. Nonetheless, we find that the substantive conclusions are fundamentally mistaken, and would be damaging and counter-productive if applied to Irish energy policy development. We set out here the detailed basis of our critique, and urge further constructive discussion on these critical and urgent issues, including proactive engagement with wider society. The decisions involved will profoundly affect the well-being of all Irish citizens, not just in the decades immediately ahead, but for centuries to follow.

Projecting Future Natural Gas Consumption in Ireland

The specific recommendations of the IAE report which we are concerned with are those in support of the development of import facilities for Liquified Natural Gas (LNG) and of continued exploration for fossil fuels (including, but not limited to, natural gas) in Irish offshore territory.

In the first instance, these recommendations hinge on the projection by the IAE of continued reliance on natural gas for Irish energy needs, a reliance that is anticipated to extend to at least 2050:

> "Based on an examination of long-term energy outlooks from the International Energy Agency and various other organizations, the Academy believes that *natural gas will continue to be a large part of the world's, Europe's and Ireland's energy mix until at least the middle of this century.*" (IAE 2018, emphasis added)

If that projection is accepted, then virtually everything else recommended by the report might arguably follow (albeit, against a background of escalating climate disruption and impacts, both locally and globally). Ireland would indeed be faced with severe concerns over the security of its access to natural gas over the next 30 years (and beyond), and the development of LNG facilities, and the continued support for offshore exploration would appear eminently sensible, if not absolutely essential, things to do.

But is this projection of sustained reliance on natural gas well grounded?

The IAE report provides only limited detail on the background basis of its projection. It explicitly cites the International Energy Agency's World Energy Outlook (WEO) 2017 (IEA 2017). Three WEO scenarios are referenced, ranging from "Current Policies" to the "Sustainable Development Scenario" (**SDS**). The latter is currently the most ambitious WEO scenario in terms of CO_2 mitigation, and is described by the IEA as being "fully aligned" with at least the 2°C temperature goal of the Paris Climate Agreement (UNFCCC 2015). The Academy of Engineering reports says that even under the decarbonisation objectives of SDS, "Gas consumption [globally] in 2040 would be 20% higher than today"; though it does then acknowledge that, for the EU specifically, SDS would require natural gas use to be "20% lower" (compared to 2016). But if we just apply that latter number to Ireland (as a "typical" EU state) that would still seem to imply large scale natural gas usage (~80% of current levels) at least to 2040, even in the case of such apparently "ambitious" climate mitigation.

So: where is our disagreement?

Firstly, the IEA itself has long recognised that natural gas is still a high carbon energy source, and its continued use would inevitably carry significant environmental risks. As far back as 2012, the IEA Chief Economist was quoted as saying that "[a] golden age for gas is not necessarily a golden age for the climate" (Harvey 2012) and, further, that "**[we] are not saying that [this] will be a golden age for humanity - we are saying it will be a golden age for gas**" (Nathanael 2012).

More particularly, while the IEA World Energy Outlook argues that the SDS is aligned with at least the 2°C Paris temperature goal, there is very significant contention around that claim. The current WEO scenarios formally only run to 2040, but in relation to the claim for SDS Paris alignment, the IEA explicitly acknowledge that:

> "Maintaining [the] rate of reduction of energy- and process-related emissions after 2040 [consistent with the Paris temperature goals] will require continued technological innovation, including for carbon capture, utilisation and storage (CCUS) and *so-called negative emissions technologies that allow for CO_2 to be withdrawn from the atmosphere at scale*." (emphasis added)

So, in effect, to adopt the IEA SDS scenario as a basis for policy *up to 2040* would automatically involve a tacit commitment to, and reliance upon, planetary scale deployment of negative emissions (CO_2 removal) technologies *after* 2040. This is not a minor qualification: it calls into question the entire foundation for the use of the scenario in *current* policy development — at least for any country which considers itself as a good faith party to the Paris Agreement. As summarised in the journal *Science*:

> "Negative-emission technologies are not an insurance policy, but rather an unjust and high-stakes gamble. There is a real risk they will be unable to deliver on the scale of their promise. If the emphasis on equity and risk aversion embodied in the Paris Agreement are to have traction, negative-emission technologies should not form the basis of the mitigation agenda. … [Rather] *the mitigation agenda should proceed on the premise that they will not work at scale*. The implications of failing to do otherwise are a moral hazard par excellence." (Anderson and Peters 2016 emphasis added)

Separately, there is a significant question mark over whether the IEA SDS analysis adequately represents the justice and equity aspects of the Paris agreement: in particular, whether that figure of just a 20% fall in EU natural gas consumption by 2040 would represent a "fair" share of mitigation effort by the EU relative to other less developed regions?

Both of these critiques of the IEA SDS are explained in further detail in a recent Oil Change International report, which concludes:

> "… By accepting a mere 50 percent probability of success [in meeting the 2°C limit], by assuming negative emissions technologies will be invented, and by assuming unrealistically low non-energy emissions, the SDS significantly understates the degree of change in energy systems needed to achieve the [Paris Agreement] goals." (Muttitt 2018)

It is worth noting that, coming toward the end of 2018, the current indications from the IEA itself are that global CO_2 emissions are continuing to *increase* (Simon 2018). So any scenario developed in the last few years (such as SDS) should properly be adjusted to meet today's reality and include

reasonable judgements on tomorrow's emissions. Based on the IPCC AR5 carbon budgets (IPCC 2014), we suggest that for energy-only from January 2019 there is only about 550 $GtCO_2$ of emissions "budget" remaining globally for a "likely" chance of limiting global temperature increase to 2°C (and this still relies on very optimistic assumptions about deforestation and process emissions across the century). Current annual (and growing) global CO_2 emissions from fossil energy use are ~37 $GtCO_2$/yr, representing less than 15 years remaining if the current pattern continues. Note that these figures are focussed on a 2°C threshold of global temperature increase, and predate the further analysis presented in the recent IPCC Special Report on Global Warming of 1.5°C (IPCC 2018). Meaningful near term action in support of the 1.5°C limit would, of course, have to be significantly more stringent even than for 2°C. In short, thinking about 2020 and beyond requires us to take account of what is happening now and very likely to occur over the coming few years. Given how small the remaining carbon budgets are for any prudent or even tolerable limit on global temperature rise, future emission space and appropriate technology pathways are highly sensitive to current and very near term CO_2 emissions.

To be clear: regardless of the detailed analysis, for the present purposes it is enough to say that there are very well founded disagreements with the IEA characterisation of the SDS as adequately aligned with the Paris Agreement goals. It was therefore properly up to the Academy of Engineering report both to acknowledge these differing perspectives, and articulate on what basis it then favours the SDS. In fact, the only critical assessment of the SDS offered by the IAE report is to refer to a specific comparison between projections from "many organisations" that was included in "BP's latest World Energy Outlook" and to state that "[a]ll outlooks show global energy demand continuing to grow over the next 20 to 30 years with [natural] gas growing faster than all other energy sources, apart from renewables." But the IAE report omits to say which (if any) of these "many" outlooks are actually compatible with the Paris temperature goals, and the Paris requirements for justice and equity. Absent that information, the relevance of this "comparison" would be moot at best.

While the IAE don't provide a precise reference here, it appears that they are relying on material from pages 114-117 of the full BP Energy Outlook 2018 document (BP 2018). The critical background provided there is:

> "There are many different published outlooks and it is not possible to do a comprehensive survey. To aid the comparison, where possible the external scenarios selected are based on assumptions for policy, technology and social preferences most similar to those underpinning the ET [BP Evolving Transition] scenario."

So, the baseline for *all* the scenarios in this comparison is the BP "Evolving Transition" scenario. The key, relevant, characteristics of this scenario are well captured in the refreshingly clear and candid commentary from Mr. Bob Dudley, BP Group Chief Executive, on page 5 of the same document:

> "The third, and most important, takeaway ... from this year's Outlook is the need for more downward pressure on carbon emissions. The Outlook's **Evolving Transition** scenario suggests that a continuation of the recent progress and momentum in policies and technologies is likely to cause the growth in carbon emissions to slow markedly relative to the past. But this slowing falls well short of the sharp drop in carbon emissions thought necessary to achieve the Paris climate goals. We need a far more decisive break from the past." (BP 2018)

Thus, the "many projections" cited by the IAE report as providing the fundamental basis for their entire subsequent analysis were explicitly selected for their similarity to a scenario that, by the testimony of BP's own Group Chief Executive, *"falls well short of the sharp drop in carbon emissions thought necessary to achieve the Paris climate goals"*.

There is therefore a clear difficulty with the IAE assessment of the trajectory of natural gas usage in Ireland over the coming decades, and considerable doubt over whether what the report has assumed is meaningfully consistent with the Paris Agreement. To the very limited extent that it addresses the Paris Agreement temperature limits at all, it considers only the 2°C goal; but even since the publication of the IAE report itself, this position has been superseded by the new IPCC Special Report on Global Warming of 1.5°C (IPCC 2018), which makes clear the critical implications and importance of taking action on the basis of that more stringent objective of the Paris Agreement. For all these reasons, recommendations based directly on the natural gas consumption projections adopted by the IAE cannot be regarded as sound.

Natural Gas as an Irreplaceable Backstop to Intermittent Renewable Electricity Generation?

The IAE report goes on to identify another different but complementary argument for a continued critical *reliance* on natural gas in the Irish energy system, specifically in electricity generation. This complementary argument might therefore still support the final recommendations, even if it were conceded that overall Irish energy system decarbonisation has to happen significantly faster than the report has envisaged.

The report essentially asserts that there are hard limits to how much of Ireland's energy needs can practically be serviced by intermittent renewable electricity. Specifically, it states (p. 7) that: "... [r]enewables will account for a growing share of Ireland's electricity supply in the next 20 to 30 years. Wind and solar generation are expected to provide up to a half of Ireland's annual electricity. Fossil fuels will be needed to generate the other half." Given both the essential enabling role of electricity in overall societal energy use, and the likelihood of significant further electrification of the currently largely non-electrified transport and heat energy sectors, this assertion that no more than ~50% of electricity generation can be met by intermittent renewable sources is then critically important. If that assertion is correct then that indeed leaves a gap of ~50% that has to be fulfilled in *some* other way. Further, unless that gap is filled, even access to dynamically available intermittent renewable generation could potentially be compromised due to challenges of stable system operation. Ireland has (pro tem) rejected the deployment of nuclear generation within its jurisdiction, and natural gas, although a very high carbon energy source, is still the least carbon intensive of the fossil fuel options. Thus, the IAE argument is that the bulk of that generation gap will *have* to be filled by natural gas. Such a reliance on natural gas in electricity generation, more or less to the exclusion of other fossil fuels, coupled with progressive electrification of heat and transport, would then make Ireland's overall energy security even more precarious than it is now.

The report does acknowledge that this "residual" (but indefinitely sustained?) reliance on natural gas would then pose a serious difficulty with the goal of achieving progressively deeper decarbonisation (whose *ultimate* necessity is not disputed). Once gas has displaced all other fossil fuels there would be no further "easy", lower intensity, substitute fuel available. The report suggests that this might be addressed through some combination of partial displacement of

natural (fossil) gas by "renewable gas" and the continued use of natural gas but with substantial emissions mitigation via carbon capture and storage (CCS) technology. We will consider each of these in turn.

While "renewable gas" is not precisely defined in the report, the discussion is focussed exclusively on indigenously produced biomethane and concludes that the contribution from this source, within the next two (critical) decades, will be very modest, at best:

> "Biogas from renewable sources has the potential to supply some of Ireland's gas needs. Gas Networks Ireland estimate that up to 20% of Ireland's gas demand could potentially be met from renewable [primarily biomethane?] sources. However, there are significant challenges to be overcome – planning and permitting, public acceptance, scale and costs of infrastructure needed, gas quality control etc. It is likely to take several decades to develop a large-scale renewable gas industry in Ireland. *In the Academy's view, renewable gas will account for only a small part of Ireland's gas supply by 2040.*" (emphasis added)

As an aside, it is important to note that the overall climate mitigation benefit of bioenergy relative to fossil fuel use is highly variable at best, and may even be non-existent for some specific production pathways (EEA-SC 2011). In the case of biomethane from anaerobic digestion (AD), the risk of methane leakage to atmosphere – itself an extremely potent greenhouse gas – means there is a requirement for extremely robust (and potentially costly) independent regulation and monitoring of production sites (Liebetrau et al. 2017). Separately, in considering AD pathways, it is essential to account fully for any additional use of nitrogen fertilizer – which would inevitably lead to increases emissions of N_2O, another potent and long-lived greenhouse gas. We would therefore agree with the Academy conclusion that bioenergy can be prudently relied upon only for a relatively small contribution to overall energy system decarbonisation (in Ireland and globally).

So we are left with the second option, continued large scale use of natural gas electricity generation, but with carbon capture and storage (NGCCS), as apparently being essential to achieving deep decarbonisation of electricity (and the wider energy system) in Ireland. In this case, based on the Academy's assessment, natural gas would still account for something like ~40-50% of Irish electricity use at least to 2040 (and, by extrapolation of asset lifetimes, would suggest continued significant natural gas usage well into the second half of the century). Penetration of natural gas in the energy system as a whole would depend on the degree of electrification of heating and transport, and the continued role of natural gas in the remaining non-electrified energy use; but overall penetration could hardly be much less that that indicated for electricity alone (assuming higher emission fossil fuels are already displaced in all uses). In such a scenario, Ireland would indeed be acutely exposed to disruption of natural gas supply (or, equivalently, to severe constraints on CO_2 emissions arising from mandatory international action — e.g., imposed at collective EU level). Any such disruption could fundamentally compromise the entire energy system. Indeed, absent other measures, even the intermittent renewable electricity elements might only operate provided that there is a significant, dispatchable, backstop, which, in this scenario, must come primarily or solely from natural gas power plants. In case of serious natural gas supply disruption there would be a real danger of losing almost *all* societal energy services (transport, heating, and all "conventional" electricity use).

The key point here is that, even if it is conceded that much faster decarbonisation is necessary, the logic of the IAE analysis is *still* that (absent nuclear power and with only limited bioenergy availability) Ireland would continue to require a very significant and critical role for fossil natural

gas. In this approach, the *only* substantive implication of faster decarbonisation would be that the deployment of CCS in natural gas electricity generation would have to be greatly accelerated (along with associated electrification of heating and transport to shift unabated fossil fuel consumption in those sectors to electricity instead). However, the *relative dependence on imported natural gas, and the energy security risk associated with that, would be just as severe, if not more so* — precisely because Ireland would be focusing down on natural gas, to the exclusion of other fossil fuels, even more quickly. *If* that is the scenario Ireland is necessarily navigating toward, then it would appear that the central IAE recommendations (LNG import, and continued promotion of indigenous fossil fuel exploration) all still follow.

Of course, quite aside from this continuing, and indeed intensifying, natural gas supply security issue, there would be other very significant problems with such a strategy for (rapid) decarbonisation: problems that the IAE recommendations (which deal only with supply security) do not consider or even acknowledge. Specifically, there is the 5-10% of CO_2 emissions that CCS may not feasibly capture, the energy penalty of CCS (therefore requiring more fuel combustion for given delivered electricity), and the significant challenge of upstream emissions associated with natural gas extraction, processing and transport, again including direct methane leakage to atmosphere (Gibon et al. 2017; Anderson and Broderick 2017). Separately, there is potentially very limited capacity for geological storage of CO_2 within the jurisdiction.

Some of these issues *might* be eased, to an extent, by further technology development. For example, the so-called Allam Cycle gas turbine technology may feasibly and efficiently allow almost 100% CO_2 capture of power station emissions in the specific case of natural gas electricity generation (Allam et al. 2017). Or, applying CCS to even the modest available biomethane supply might — arguably — yield some nett CO_2 removal from the atmosphere (Price et al. 2018) which could conceivably compensate for residual positive emissions from natural gas CCS. Similarly, if indigenous Irish CO_2 storage sites proved unsuitable or inadequate, CO_2 might be transported by ship for geo-storage in other jurisdictions (Skagestad et al. 2014); indeed, it has been reported that Norway has an active interest in delivering such internationally traded CO_2 storage services (Tannenberg 2017). But the timeframe for such developments (at relevant scale) is likely at least two to three decades, which is not aligned with the rate of decarbonisation now immediately required; and in any case, they would still not address all the specific challenges (such as continued "upstream" emissions of both CO_2 and methane) which such a natural gas CCS "decarbonisation backstop" pathway would present.

The IAE report does consider, but quickly dismisses, one other route to energy decarbonisation that *would* in principle allow the progressive elimination of more or less all fossil fuel use, even including natural gas, and thus also defuse the intensifying gas security challenge. This route is for a transition to a predominantly electrified energy system, primarily supplied by indigenous intermittent renewable resources (mainly wind), but with the addition of sufficient (dispatchable) energy storage to allow full compensation for both short-term (inter-hour, inter-day) and long-term (inter-season, inter-year) fluctuations in supply. Just two potential storage technologies are (briefly) considered: battery and pumped hydro. However, based on an assessment that neither of these can conceivably function at the required scale (an assessment which we would agree with), this section of the report then concludes: "The Academy does not believe that electricity storage is a realistic solution to the problem of intermittent renewable electricity supply… in the Academy's view Ireland will continue to depend on fossil fuels for electricity generation, especially natural gas, until at least the middle of this century."

So, to summarize this central argument of the IAE report, it appears to reduce to the following:

- There is "no alternative" to indefinite reliance on substantial (~40-50%) natural gas use in electricity generation (with or without CCS) because of the fundamental intermittency, specifically on inter-seasonal timescales, of the main indigenous renewable sources (primarily wind).
- This strategy can (somehow!) be reconciled with the rate of decarbonisation required to limit risk of climate disruption and impacts to "tolerable" levels (locally and globally) — even though this assumption is *prima facie* entirely inconsistent with the best available scientific assessments (IPCC 2014, 2018); or, alternatively, that local impacts in Ireland will be minimal, and Ireland will be somehow decoupled from widespread impacts elsewhere.
- But this comes at an (unavoidable?) price of deepening natural gas security-of-supply risk and *therefore:* all feasible measures must be taken to secure natural gas supply.

Our critique, in response, is then two fold:

- For the reasons already described, the implied natural gas CCS rapid decarbonisation "backstop" pathway is itself just as impractical, both technically and economically, as any of the options otherwise dismissed by the IAE (nuclear, bioenergy, variable renewables coupled with battery or pumped hydro energy storage); worse, it is highly uncertain in its climate mitigation effectiveness while committing either to deepening energy insecurity or high cost counter-measures (or both).
- There is, in fact, an alternative and feasible strategy, that *can* reliably address all the issues identified, *specifically including national energy security,* and also the need for rapid deep decarbonisation: this is firstly to to constrain and reduce energy consumption (through efficiency measures and/or absolute reductions in energy services), and secondly to shift the bulk of the (reduced) supply requirement to variable renewables coupled with large (multi-TWh) scale energy storage *based on one or more synthetic chemical fuels ("electrofuels") as the energy carrier* (so-called Power-to-X or P2X technologies). But the IAE report does not substantively consider the possible roles of either consumption constraint or the large scale use of electrofuel based storage (unless very obliquely through ambiguity in the use of the term "renewable gas").

The specific option for Irish energy supply based primarily on variable renewables, with a dispatchable storage backstop using large scale synthetic electrofuel (produced during periods when variable renewable supply exceeds demand), has, in fact, been already extensively modelled and evaluated (Connolly and Mathiesen 2014). That particular study argued that "... a 100% renewable energy system [for Ireland] can provide the same end-user energy demands as today's energy system and at the same price." That study envisages separate large scale storage of liquid and gaseous synthetic hydrocarbon fuels (respectively methanol and/or dimethyl ether/DME, and methane). This particular approach does raise detailed issues around carbon (re-)capture and recycling; but in fact, small scale, turnkey, closed-carbon-cycle energy storage has already been demonstrated (Goodall 2017). Alternatively, targeting of non-hydrocarbon electrofuels (avoiding any overhead of carbon recycling) is also feasible. Detailed (positive) assessment of hydrogen based storage systems is provided by, for example, (Steward et al. 2009; cH2ange 2018). The commissioning of the world's largest hydrogen storage facility has recently been announced in the US (Air Liquide 2017). This is currently supplied from a high-carbon H_2 pathway but nonetheless

fully demonstrates the technical and economic feasibility of such very large scale H_2 storage systems. Ammonia is another emerging non-hydrocarbon electrofuel candidate (Wang et al. 2017), with a pilot demonstrator already in commissioning (Evans 2018). Additionally, both hydrogen and ammonia based systems offer the possibility of early "drop in" end-use decarbonisation of significant transport and heating applications, with some round-trip efficiency gain, and without relying on prior end-use electrification (as they would not require or rely on carbon recapture/re-cycling at the point of use). It is of note, for example, that hydrogen fuel cell passenger trains have already entered commercial service, offering an additional pathway to rail decarbonisation that does not rely on line electrification (Agence France-Presse 2018). Similarly, a large scale deployment of fuel cell based heavy goods vehicles has recently been announced in Switzerland (Wiseman 2018). Quite aside from their specific suitability for heavy transport applications, deployment of hydrogen fuel cell vehicles may represent a beneficial diversification from exclusive reliance on full battery electric vehicles where rapid global scale-up may be specifically constrained by lithium and cobalt supplies (Andrews 2018). It is also significant that extensive elements of the existing Irish natural gas network could be re-purposed for hydrogen use, thus protecting against early stranding of this critical public asset through the decarbonisation transition.

Separately from these various approaches to electrofuel energy storage and end-use, there may also be a practical and economic role for large scale inter-seasonal thermal energy storage (e.g., Lund et al. 2014). Recent research strongly supports integration of electrofuels (P2X), battery electric transport and long-term thermal energy storage as offering the most cost effective routes to deep decarbonisation of energy systems in Europe, and especially so under conditions of relative geographical isolation/limited electricity interconnection such as typified by Ireland (Brown et al. 2018).

The technical and economic feasibility of inter-seasonal energy storage via *liquid* electrofuels is already fully demonstrated in Ireland by the holding of strategic stocks of liquid *fossil* fuels. NORA, the Irish National Oil Reserves Agency, maintains a strategic reserve, primarily within the island of Ireland, sufficient to supply current national demand for those fuels for at least 90 days. As noted in the IAE report itself, while Ireland does not currently operate any large scale facility for *gaseous* fuel storage, the Southwest Kinsale reservoir was previously used to provide natural gas storage with capacity equivalent to about 18 days' supply, and other countries in Western Europe operate gas storage facilities with an average capacity equivalent to 100 days' supply. While there would be, of course, detailed design differences between gas storage facilities according to the specific target fuel (hydrogen, ammonia, methane etc.) the general technical and economic feasibility of very large scale (inter-seasonal) gaseous fuel storage is not contested by the IAE.

This does highlight the one point of at least partial agreement with the IAE: of the report's three main recommendations (LNG import, offshore fossil fuel exploration, and large scale natural gas storage), large scale chemical fuel storage of some sort is clearly intrinsic to the scenarios outlined above.

In relation to indigenous energy *supply* potential, the Sustainable Energy Authority of Ireland (SEAI) has estimated availability of Irish wind energy alone (onshore plus offshore) as being at least 140 TWh/yr (SEAI 2011). The most recent (2016) figure for total primary energy requirement in Ireland is 168 TWhr/y, fulfilling final energy consumption of 136 TWh/y (SEAI 2017). Allowing for continuing technological improvements in wind generation, for additional supply from solar and bioenergy sources, and for significant available energy efficiency gains, there is clearly the potential for the great majority of Irish energy needs to be met from indigenous renewable energy sources.

We acknowledge that the inherent inertia represented by our existing energy infrastructure, and the need to maintain essential societal energy services during the decarbonisation transformation, will require *some* ongoing transitional combustion of natural gas (and other fossil fuels): and for that (limited) transitional use, there may be an argument to minimise the associated CO_2 by deploying CCS in carefully targeted cases. CCS can also usefully support immediate mitigation of critical non-energy CO_2 sources (such as cement manufacture), and in building expertise and capability for future CO_2 *removal* from atmosphere (the success of which should not be *relied* on in current policy, but can certainly be a target of prudential preparation and active development).

Much more detailed technical planning and design, and a programme of very significant capital investment (both public and private) will be required to realise the rapid transformation to a fully fossil-free energy system as outlined above; but this would be entirely consistent with known general conditions for optimal climate mitigation investment (Vogt-Schilb et al. 2018). As noted, and given the short time now available, significant *reductions* in some energy uses will likely also be an essential intervention until decarbonisation is substantially complete (Grubler et al. 2018). Significant investment is certainly implied by all conceivable energy system decarbonisation pathways that would now be at all commensurate with the climate change challenge, based on good faith action in accordance with the Paris Agreement.

One preliminary but useful upper bound on likely levelized costs of electricity (which reflects investment costs) in such decarbonised energy systems, across a range of European countries, has recently been published based specifically on hydrogen electrofuel as the storage energy carrier (Brown 2018). While significant, even this upper bound (estimated at c. €87/MWh by 2030, in Ireland) would still be well within the range of economic feasibility. Moreover, these costs must be compared to the substantial ongoing investment that conventional high carbon energy systems require anyway (including, for example, the specific interventions positively recommended by the IEA).

The key point is that even at the very highest estimates of practical energy system decarbonisation costs, this transformation will still be immeasurably cheaper than continued use of fossil energy, once climate “externalities” are accounted for. See, for example Steffen et al. (2018) for the existential scale of what is now at risk. Most importantly, precisely because the approach outlined here localises the great bulk of Irish energy supply to entirely indigenous, sustainable and renewable sources, it would, at one transformational stroke, decisively resolve the chronic energy supply insecurity that has dogged Ireland virtually since the foundation of the state. Finally, this transformation would of course carry with it the potential for significant additional economic co-benefits in terms of indigenous employment and favourable trade balance.

Conclusion

> "If a country brings any additional fossil fuel reserve into production, then in the absence of strong climate policies, we believe it is likely that this production would increase cumulative emissions in the long run. This increase would work against global efforts on climate change." (MacKay and Stone 2013)

Returning to the core point of the IAE report: it does provide an excellent presentation of the acute energy security risks that *would* attach to prolonged and progressively more concentrated reliance on natural gas as essentially Ireland's single dispatchable electricity source (as well as, currently, an essential component of meeting direct heat demand). But the report then fails to follow the logic of its own analysis. Its prescription is, in effect, to fatalistically *accept* that such dependence on natural gas is "inevitable", to fundamentally understate the climate change implications of such continued dependence, and then consider progressively more problematic ways to shore up security of natural gas supply (LNG, offshore exploration).

The alternative, of course, is to attack the (genuine) energy security problem at its source, and proactively identify ways of avoiding having natural gas (or any other imported, high carbon, energy source) play a central role in Ireland's overall energy system. And given that there are realistic, affordable, pathways of doing that, which are well understood, already proven at the technology level, in the process of scaling up, and much better aligned with commensurate climate action, we conclude that the report's specific recommendations for locking in continued reliance on natural gas are without satisfactory foundation. Instead, the IAE recommendations present steps effectively leading in quite the wrong direction, undermining precisely those alternatives that would genuinely address the challenges of *both* decarbonisation and energy security.

Of course, it may be suggested that the huge scale and speed of change envisaged in the early elimination of all fossil energy is simply "unrealistic", that wider society is not ready or willing to endorse it, and that, above all, we must not "allow the perfect to be the enemy of the good". In response we would contend that the truly "unrealistic" path now is the one that imagines consigning to young people of today the burden of severely compromised planetary support systems that have been critically, perhaps irreversibly, undermined by a (lack of) decisive action today (Hansen et al. 2017; Spratt et al. 2018). As the meteorologist and commentator Eric Holthaus has recently remarked: "A livable world achieved through incremental changes may have been possible in the 1980s, but it's a fantasy now" (Holthaus 2018). Forget the "perfect": our true challenge now is to prevent the (superficially) "good" being the enemy of the desperately *necessary*.

Finally, we must comment on the following brief (but nonetheless deeply significant) remark, which appears on page 24 of the IAE report:

> "Banning [fossil fuel] exploration in Ireland will not reduce Ireland's gas consumption or greenhouse gas emissions. On the contrary, it would result in more gas imports and less energy security. It would result in an increase in greenhouse gas emissions as the imported gas is likely to be transported over very large distances, as well as increasing Ireland's cost of imports."

This appears to be a tacit, but clearly critical, comment by the IAE on proposed legislation currently before the houses of the Oireachtas, namely the Petroleum and Other Minerals Development (Amendment) (Climate Emergency Measures) Bill 2018 (Oireachtas 2018). That Bill does, in effect, propose precisely such a ban on further fossil fuel exploration in the national territory (onshore or offshore).

While there is much more that could be said about this Bill, for the purposes of this particular discussion, we will just emphasise that the critique presented above fully addresses the specific points raised in this IAE report. That is, provided that rapid energy system decarbonisation is given the policy priority that is now absolutely essential (cf. McMullin 2018), then there is no contradiction whatever between that Bill and achieving *both* radical emissions reduction in the short term *and* profound energy security for generations to come. Combining these imperatives offers a genuinely *inspirational and attainable* vision for Ireland's energy future, and we have no hesitation in commending enactment of this Bill as soon as possible, as one key measure to catalyse this essential transformation.

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About Stop Climate Chaos

Stop Climate Chaos is a coalition of civil society organizations campaigning to ensure Ireland does its fair share to tackle the causes and consequences of climate change, in line with the best available scientific evidence and on a basis of global equity and solidarity. The following is the full list of organisations currently affiliated with Stop Climate Chaos:

> Afri,BirdWatch Ireland, Christian Aid Ireland, Comhlámh, Community Work Ireland, Concern Worldwide, Cultivate, Cyclist.ie, Dublin Friends of the Earth, Eco Congregation Ireland, ECO UNESCO,Feasta, Fossil Free TCD, Friends of the Earth, Good Energies Alliance Ireland, Self Help Africa, Jesuit Centre for Faith and Justice, Just Forests, Kimmage Development Studies Centre, Latin America Solidarity Centre (LASC), Liberia Solidarity Group, Methodist Church of Ireland – Council of Social Responsibility, Mountmellick Environmental Group (MEG), National Youth Council of Ireland, Oxfam Ireland, Peoples Climate Ireland, Presentation Ireland, Tearfund Ireland, Trócaire, An Taisce, VITA V.O.I.C.E., and Young Friends of the Earth.

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