Energy Strategy Call for Evidence

Response Template

How to Respond

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

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

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

Please send your response to:

energystrategy@economy-ni.gov.uk

Or alternatively by post to:

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

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

1. General Information

1. **Name (required)**

[redacted]

2. **Are you responding:**

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

   [redacted] **on behalf of an organisation / company (please complete 6 to 8 below)**

If you are responding as an individual:

3. **E-mail address**

4. **Address**

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

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

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

6. **Organisation / Company**

Centre for Advanced Sustainable Energy

7. **Position within Company / Organisation**

[redacted]

8. **Contact details**

   a. **E-mail address**

[redacted]

   b. **Address**

[redacted]

2. Energy in Northern Ireland

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

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

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

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

Q1.

- Northern Ireland needs to study those countries that are ahead on their decarbonisation journeys, and examining what actions they have taken, and which of these actions are applicable in Northern Ireland. Not every action will be replicable here.
- For example, Sweden has the largest share of renewable energy in the EU. By 2017 Sweden achieved 54.6% of total energy consumption from renewable sources. This was achieved through both significant deployment of wind turbines, but also through exploiting organic resources – which also contributes to the decarbonisation of their agriculture sector. High renewable production is driven by high penetration of biogas powered vehicles and district heating schemes[1].
- Scotland is the closest UK comparator for this region, and there is scope to work with the Scottish Government for benchmarking purposes as well as collaborative work on issues such as high penetration of wind energy and the development of a hydrogen economy.

Q2.

- Data analysis is required to more accurately benchmark the current position, identify the low hanging fruit, and develop a holistic plan for decarbonisation. All actions detailed in this plan should have a clear scientific basis and make use of the knowledge base of the two universities and further education colleges in collaboration with strategic industry partners through mechanisms like CASE. This will develop the evidence base required for the creation of policy and legislative measures.
- Northern Ireland operates as part of an all-Island gas and electric grid and this

[1] Werner, S. (2017) https://www.sciencedirect.com/science/article/pii/S0360544217304140

will continue beyond the Brexit transition. NI is unique in that respect, with respect to the rest of the UK and this introduces both opportunities and challenges in transitioning to zero carbon.

Q3.

- There is no disagreement with any of the key recommendations from CCC report. The implementation of this report should proceed as a matter of urgency, recognising that the greatest effort is required on heat, transport and agriculture – the sectors where the least progress has been made.
- The CCC have however called for CCUS to be implemented in NI and this is not believed to be a cost-efficient option. Alternative CCS using nature-based strategies is expected to deliver better economic and environmental benefits within NI given its agricultural assets.

Q4.

- The plan for 30-year timeframe with 5-year review points is sensible for assets which are replaced within that time period (e.g. vehicles). Challenges here are mainly due to economics rather than technology. Decarbonising assets which have longer lifetimes (e.g. housing stock) is significantly more complex. There is a need for the initial focus to be on the low hanging fruit, allowing the majority of decarbonisation to be achieved within the first 10 years. Targets need to be set dependent on application (i.e. different targets for phasing out of ICE vehicles, home heating boilers etc.).

3. The Energy Transition in Northern Ireland

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

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

Q5.

- Northern Ireland has the highest penetration of renewables onto the grid in comparison to the rest of the UK. In achieving this, the grid is now constrained which places limits on the amount of variable renewable energy that can be connected in the future.
- Recognising the constraints on the Northern Ireland grid, the MATRIX panel commissioned the Sustainable Energy Horizon panel to undertake a foresighting exercise in 2012/13. Outcomes from the SEHP report identified the first mover advantages that Northern Ireland could exploit by developing an Intelligent Energy System[2].
- The population of Northern Ireland is relatively dispersed, with an average density of 137 persons per square kilometre, approximately half of that in the UK. NI also has an above average elderly population.
- Northern Ireland has a more modern gas grid than the rest of the UK, which is currently undergoing expansion. Constructed of modern materials, unlike in GB, this grid can accept biomethane and/or a blend of biomethane and hydrogen.
- The Agri-food sector in Northern Ireland is significant; with an associated huge agricultural/agri-food residue resource available for energy production.
- Northern Ireland has a unique tidal energy resource off the north coast between Fair Head and Torr Head. Crown Estate issued Agreements for Lease in 2013 to Tidal Ventures Ltd and Fair Head Tidal for 100MW of tidal stream energy development each. Whilst a key stakeholder in the Tidal Ventures consortium has subsequently gone into administration (Open Hydro) several £million has been spent by both organisations on surveying in readiness for submission of licence applications. More information on the opportunities for tidal energy in Northern Ireland can be found in the Addendum to this submission and in a separate submission prepared by the UK Marine Energy Council following a meeting with Department for the Economy in early March 2020.
- The region suffers from a high level of fuel poverty (22% in 2016) linked to dependence on heating oil and poor condition of housing stock. Progress on fuel poverty between 2011 and 2016 was mainly attributed to reductions in oil prices.
- To date, there has been no smart metering rollout programme; however

[2] http://matrixni.org/wp-content/uploads/2014/11/MATRIX-Sustainability-Report-February-2013.pdf

Northern Ireland was the first region of Europe to have 100% access to high speed internet.

- NI is part of an all-Ireland network, has a higher fraction of SMEs and a significantly higher agri-tech industry when compared to the UK.

Q6.

- The Centre for Advanced Sustainable Energy (CASE) is funded through Invest NI's Competence Centre programme and aims to transform the sustainable energy sector through business research. CASE was established in 2013 following recommendations from the MATRIX (government science advisory) panel to bridge the gap between academic research outputs and industry research needs. Please see information at Q50 with respect to the operation of the Centre.
- As we secured funding of £3.7m in October 2019 to deliver on the second phase of our research & development programme, we are supporting a wide range of projects that will align with the DfE aims to decarbonise the energy system in Northern Ireland. Our portfolio of projects can be grouped into three main themes; marine renewable energy, bio-energy and energy systems. All 24 projects to date have had a role to play in sustainable energy systems in Northern Ireland and going forward, our research strategy has a stronger focus on decarbonisation. We have engaged with DfE in recent times and aim to ensure that updates to our research strategy fall in line with the Department's new Strategic Energy Framework. We are committed to providing relevant information to Energy branch on the outputs from CASE research and the opportunities that may provide for the NI economy and also for including DfE in dissemination activity going forward.
- A recent example of CASE working with the Department has been a collaboration between CASE, QUB and DfE on a postgraduate (Master's degree) study into the potential for a renewable energy system on Rathlin Island. Other examples of our project research can be found at different sections throughout this call for evidence response.

4. Consumers

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

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

Q9. Is a strategic position of "enable and protect" the correct policy stance?

a) What policies or schemes are needed to enable active consumers?
b) What policies or schemes are needed to protect vulnerable consumers?

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

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

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

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

Q7.

- Affordable energy will require reducing the net product of both demand and cost. Of the two, reducing demand will be more effective in reducing fuel poverty while progressing to climate emission targets.
- Fuel poverty fell between 2011 and 2016, but this was attributed mostly to lower oil prices and the reliance in Northern Ireland on heating heat for space heating. Displacement of heating oil with alternative, fossil-fuel free heat sources which fluctuate less in price should be a priority in order to reduce budgetary uncertainty for domestic customers.
- Social housing represents the largest stock of housing in NI; deep retrofit of these buildings is required and new buildings should be built to more stringent standards. This will cost 8-10% more, and pay back times are long. Government incentives are required to ensure pay back does not act as disincentive.
- The Northern Ireland Sustainable Energy Programme (NISEP); administrated by the Energy Saving Trust on behalf of the Utility regulator is a good example of a mechanism for delivery of retrofit funding. The scheme provides grant funding towards a range of fuel switching, insulation and technology measures

to reduce the energy use of domestic and commercial properties.

- Any plan for deep retrofit of housing; needs to go hand in hand with improvement in building regulations to ensure the same standard is delivered in new build housing stock.

Q8.

- The impact of carbon taxation is unknown at this time. High energy consumers such as the manufacturing industry already experience energy costs up to 30% higher than the EU average and represent 20% of NI energy bills, despite making up only 1% of customers.

Q9. No comment.

Q10.

- Research is needed to assess and verify the effectiveness of new technologies. For example, academics at Ulster University have significant experience in the use of heat pumps, including work funded by CASE on the potential of supplying significant amounts of thermal energy from the River Bann in Coleraine[3]. Similar bodies of work are needed for verification of every new technology before deployment.

Q11.

- There are limited deployments of community energy projects in Northern Ireland, with the majority being small, single building solar PV installations. Larger community projects, which include district heating networks are more common elsewhere in Europe – for e.g Cloughjordan Ecovillage in Tipperary, Sustainable Clonakilty in Cork and Orkney in Scotland. Of particular relevance to Northern Ireland are schemes in Germany, where farm scale Anaerobic Digestion plants provide heat and power for villages.
- Uptake of electric vehicles is increasing. The significant energy storage available in these vehicles could be used to reduce electricity curtailment and road fuel requirements. Technologies already on the market for vehicle-to-grid and vehicle-to-home cannot currently be deployed in Northern Ireland.

Q12 & Q13. No comment.

- [3] https://www.case-research.net/wp-content/uploads/2019/03/coleraine-microgrid-project-case-research.pdf

5. Energy Efficiency

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

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

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

a) New domestic and commercial buildings by 2050?;

b) Existing domestic and commercial buildings by 2050?

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

Q14.

- A 1.5% improvement in energy efficiency per year should be set for Northern Ireland. This is stretching, but significant and achievable even given the fact that electricity demand will increase as heat and transport are electrified in the future.

Q15.

- A standard methodology must be established for energy efficiency. Every measurement needs to be comparable (kWh most easily understood unit?) and reported in absolute terms rather than just percentage improvement.

Q16.

- Energy efficiency policy (and incentives) to date have focused on consumption point, rather than production e.g. ROCs scheme incentivised biogas to electricity, no use for heat at most biogas plants. A more holistic view of energy efficiency is required, with a shift to measurement of gross energy production. This data can be captured at production sites and reported to OFGEM rather than just electricity production. With respect to zero carbon in new and existing buildings, the government should consider mandating for renewable energy in new Building Regulations and enhancing the overall building efficiency requirements for heat. Existing domestic and commercial buildings are harder to tackle but a deep retrofit programme should be considered with energy efficiency measures incentivised. Where applicable, district heating should be supported, particularly where co-located with heat producers. Expansion of programmes such as the Invest NI energy efficiency loans scheme and the work of the Carbon Trust (over several decades) should be considered here. Carbon Trust funding was cut in recent years. This is anomalous with the decarbonisation agenda outlined in the SEF Call for Evidence document. Examples of innovative retrofitting and human

behaviour in a domestic environment can be seen at the Ulster University's 'Terrace Street'. Two single skin red brick homes were built adjacent to the Centre for Sustainable Technologies in Jordanstown with a view to becoming a living laboratory. The homes are used to retrofit energy efficiency technology and measure adaptation to that technology by the residents.

Q17.

- Government should be leading by example – government buildings, vehicles etc. need to be examples of best practice. A key delivery vehicle for energy efficiency measures could be the NI Sustain Energy Programme, currently run by the Utilities Regulator and funded through the utilities providers. The SEAI perform a similar role in Ireland. This function could be expanded and transferred to the proposed new EPA, with oversight from the regulator. There should be some recognition of the difference between the implementation of energy efficiency technology and human behaviour changes around energy efficiency measures. The human behaviour measures come with significant cost savings. According to Carbon Trust (2016) many SMEs can easily save 20 to 30 percent on their energy costs through behavioural changes such as switching off equipment and closing windows at the end of the day, at the same time as implementing cost-effective technologies with short payback periods, for example LED lighting. The expertise of behavioural scientists at Northern Ireland's universities could be leveraged to help with public education and policy development.

- Further education piece(s) are required around on how to advise domestic consumers to reduce use. For example a greater roll out and dissemination of the Energy Wise communications platform[4] would be recommended.

[4] https://www.nidirect.gov.uk/campaigns/energy-wise

6. Heat

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

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

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

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

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

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

Q18.

- There is very limited information on the temporal and spatial variations in heating requirements. CASE has undertaken a project which developed a methodology for the creation of GIS based heat maps as part of a feasibility study of the potential to make better use of waste industrial heat[5]. This methodology could be made available and expanded to produce a heat map for the whole of Northern Ireland, aiding with decision making on suitable decarbonisation approaches.
- Support district heating where applicable including its integration with distributed power to gas technologies.
- Increase penetration of gas into households and phase a transition of this to bio-methane by 2030 and hydrogen/methane by 2050.

Q19.

- Research is needed to identify, assess and verify solutions. Policy based on the evidence provided.
- Couple with electricity usage to measure overall household/user energy demand.

Q20.

- Replace natural gas with biomethane, hydrogen and other zero or near zero carbon fuels.
- Heat pumps should be deployed where appropriate heat sources exist and can be

[5] CASE Heat Maps Project: https://www.case-research.net/projects/case-funded-projects/heat-mapping/

matched to good quality building stock. Hybrid systems combining heat pumps with biofuel combustion can be utilised where required.

- Carbon should be seen as a resource rather than a problem. Technologies should be put in place to capture carbon from agriculture sector to displace fossil fuel carbon. This will deliver decarbonisation to both the agriculture and energy sectors.

Q21.

- The decarbonisation of gas grid is not just viable it is essential. The extra energy required for hydrogen production can be supplied through development of off shore wind farm, tidal and wave energy projects. Renewable hydrogen costs are falling but will remain coupled to electricity prices. As such they will remain higher than imported natural gas.

Q22.

- There are limited examples of heat networks to date, and there is limited information on those that do exist (e.g. Afbi Large Park, Hillsborough). Data collection activities and production of case studies in order to increase the knowledge base and encourage investment in this area.
- Better use must be made of 'waste' heat; matching industrial cooling requirements with domestic heating requirements allowing the development of heat grids. CASE recently submitted a *Strength in Places Fund* Application which plans to deliver a zero carbon manufacturing ecosystem in the Mid & East Antrim Council Area; specifically surrounding Ballymena. Part of the plan presented in this application is the development of a heat network, taking excess heat from industrial premises and supplying it to both domestic users, offices and leisure centres.

Q23.

- There is potential for Geothermal Energy in certain areas within NI. This data is available from the Geological Survey of Northern Ireland. It is however not a low hanging fruit.

7. Power

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

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

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

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

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

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

Q24.

- SONI have carried out some work which presents a decarbonisation scenario of the electricity grid.
- The pathway to decarbonisation should include an appropriate mix of renewable energy technologies, grid support mechanisms and energy efficiency measures. Whilst we are concentrating on power in this section, it is important to note that these things should not be considered in isolation but the energy system – including all energy vectors (power, heat and transport), should be viewed as a whole system. Electrification of heat and transport will significantly increase demand.
- With respect to decarbonisation of the power system, it should be acknowledged that much work has been done to date to achieve 45% renewable energy penetration and also worth acknowledging that the next 55% is likely to be harder to achieve. Things that should be considered include
    - Access of biogas plants to low carbon hydrogen for methanation.
    - Support required for marine renewables, including tidal and offshore wind where Northern Ireland has a particularly strong resource.
    - Support to continue to innovate to provide ancillary services to the electricity grid – storage, demand side management / grid balancing, aggregation etc
    - Renewable energy incentives to validate the decarbonisation effort
- Large scale renewable generation will most likely require the deployment of off-shore technologies. Waters around NI are deeper than those of Dogger bank increasing the requirements for floating turbines.

- Increasing interconnection to Scotland and RoI is required to access low carbon power from other regions.
- Load balancing will be critical over a wide range of timescales to maximise the use of the infrastructure. This will be required at domestic/industry/local and regional scales.

Q25.

- 2030 target – 75% renewable target achievable given the right support – no new fossil fuel production etc. Getting to 100% cannot be achieved without tidal and off-shore wind and the required investment to integrate into the grid. Consideration should be given to banning of diesel standby balanced against grid stability and the limited carbon impact. Agree with the NIRIG suggestion that net zero carbon power can be achieved by 2040.

Q26 & 27.

Consideration should be given to making the most of / enhancing existing assets, for example:

- Extraction of the optimum energy from AD plant(s) – consider incentives for biogas conversion / clean up and use as an alternative energy vector – the simultaneous clean-up of biogas and production of methanol from the removed carbon dioxide has been investigated by CASE researchers[6].
- Use of Northern Ireland Water assets for renewable energy generation purposes ·
- Consideration of circular economy opportunities wherever they may occur – eg. can agricultural waste arisings be utilised for energy generation purposes? Can other waste materials be used for energy generation purposes?
- Create community clusters which should ultimately reduce grid constraint
- Demonstrate new technology within existing Estate(s) eg. University and /or Health & Social Care Trust Estates
- ICT and communications infrastructure is likely to require investment as remote access to the energy system is part of the decarbonisation pathway. Whilst it is inevitable in the short term that the decarbonisation of the energy system will increase consumer costs, a full circular economy approach to energy infrastructure should ultimately provide cost efficiencies – reduction in waste on one side and decarbonised energy on the other. [NB. The largest contributor to the fuel poverty issue in Northern Ireland is oil central heating. The replacement of oil with cheaper and carbon zero alternatives (including electrification) should redress some of these issues in the longer term].

[6] CASE BioMethanol Project: https://www.case-research.net/projects/case-funded-projects/renewable-methanol/

- The new infrastructure required to meet a new renewable target can take time to develop. Consideration should be given to using data to manage the electricity in a smarter and more efficient way where possible. These smart solutions in many cases may be an interim measure that can facilitate the connection of renewable generation and allows time for any significant network reinforcement to be constructed.
- Deployment of power to gas technologies, mid and larger chemical energy storage solutions and household storage.
- Post introduction of smart meters introduce more flexible pricing for consumers which encourages load balancing (e.g. EV night rates etc.)

Q28.

- Consideration should be given to the introduction of a new renewable energy incentive which might be best aligned to the UK programme of CfDs. At this point it is important to note that emerging technology (which will ultimately be required to support a net zero carbon target) will need a greater level of incentivisation as it is less able to compete with established technologies such as onshore wind. Note the recent British Government consultation on round 4 of the CfD scheme with an allowance in 'Pot 2' for less established technologies[7].

Q29.

- There is a pressing need to ensure the development of the marine renewable energy resource in Northern Ireland, specifically tidal energy and offshore wind2. Please refer to the Addendum at the end of this document and the separate response from the UK Marine Energy Council.

[7] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/869778/cfd-ar4-proposed-amendments-consultation.pdf

8. Transport

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

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

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

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

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

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

Q30.

- Government must lead on transport decarbonisation. Public transport and other government vehicles should be transitioned to zero emission as soon as it practicable.
- High levels of Electric Vehicle ownership is only possible with the development of infrastructure and is only valuable if accompanied by reductions in carbon intensity of the electricity that supplies this infrastructure.
- Heavy transport and logistics can switch to bio or synthetic methane (or ammonia) using available technologies. Infrastructure would need to be built to support this including increasing power to gas and/or AD plant and refilling stations.

Q31.

- The link between air quality and impacts on public health should be used to promote transport decarbonisation and active travel. Carbon emissions are difficult for the general public to understand, the emissions are invisible, there is limited immediate impact.

Q32.

- Investment in railways; both to decarbonise and improve service to encourage use. Railways are already lower carbon than road transport and this can be improved further through boosting passenger numbers and introduction of zero

emission technologies such as hydrogen fuel cells.

- The Glider is a successful example of an initiative leading to reduced emissions; however, passenger numbers for the Titanic Quarter route are low and users of this area remain reliant on personal cars. Research is required to develop an understanding of this behaviour and how this can be mitigated.
- A clean air zone (like in London) for Belfast City Centre should be considered in order to encourage use of public transport and/or transition to zero emission vehicles.

Q34.

- Electric vehicles are not the only option for transport. Hydrogen fuel cells are also an option, along with synthetic liquid fuels made from biogenic sources such as biodiesel, dimethyl ether and biobutanol. The problem with internal combustion engines is not necessarily the engines themselves, but the type of fuels which they burn.

Q35.

- CASE has funded research on the possibility of operating heavy transport (specifically haulage lorries) on biomethane as opposed to diesel, quantifying the economic, environmental and health benefits of doing so [8], and in the development of novel catalytic converters suitable for use with biogas/biomethane powered internal combustion engines[9].

[8] CASE Dual Fuels Project: https://www.case-research.net/projects/case-funded-projects/dual-fuel-vehicle-modelling/

[9] CASE Photocatalysis Project: https://www.case-research.net/projects/case-funded-projects/photocatalysis/

9. Other Issues:

a. Security of Supply

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

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

Q36 & 37.

- **Security of supply:** A number of issues need to be considered with respect to security of supply. These include grid capacity as we move towards further electrification of transport and heat; a reliance on imported fuels as we roll out the new natural gas network (an expected transitionary step as we move along the pathway of decarbonisation); the need for storage and other DS3 services; and the requirement to unblock the existing problems with interconnection. Security of supply in a holistic energy system therefore relies on a large range of stakeholders including SONI, NIE Networks, the Regulator, utilities providers; transport companies and so on. These organisations need to work collaboratively and need to be properly resourced (both in personnel and capital budgets) so can that they explore more challenging solutions such as the B9 led project concept Power-to-X.[10]

- **Grid Capacity:** Northern Ireland has achieved a high level of connection of renewable energy to the electricity grid, mostly through (intermittent) onshore wind developments and grid curtailment is an issue. Curtailment and constraint levels are currently around 11% in Northern Ireland and this will only increase as we seek to connect further intermittent renewables. Balancing intermittency with renewable energy that is more predictable eg. tidal energy and co-location with energy storage will support the grid in reaching more challenging connection targets. This will require and investment in infrastructure, which should be considered against the cost of constraint and curtailment measures.

- **Imported fuels – availability of low carbon gas:** The installation of the NI gas grid provides an alternative to electricity for heat and transport particularly and could act to reduce the required capacity for the electrical grid. Whilst natural gas is a cleaner fuel than coal and oil, it will not meet the decarbonisation agenda without injection of biomethane or hydrogen (from renewable generation). In 2018/19 a total of 17,046 GWh of natural gas was imported on to the gas grid in NI. The two gas powered electrical generations at Ballylumford and Coolkeeragh consumed 10,627 GWh of natural gas and the three gas distribution companies in NI, Phoenix

[10] https://smartcitiesireland.org/wp-content/uploads/2019/11/10.-DSurplus-Belfast-Power-to-X-Project-AISCFPres19.pdf

Natural Gas, Firmus and SGN supplied 6,421 GWh of natural gas to their customers. A significant proportion of this imported natural gas could be displaced by zero carbon renewable gas generated from animal manure in NI through biogas, biomethanisation and gasification/pyrolysis. There is already a significant installed asset base of biogas plants and the technologies of Biomethanisation and gasification/pyrolysis are commercially available and can be integrated with existing biogas plants. There is c. 4.5 Mt of animal manure produced from the 1.6M cattle, 600k pigs and 26M chickens in NI every year. From this feedstock the zero carbon renewable fuel potential is 5,540 GWh per year equivalent to 86% of the natural gas that the gas distribution companies supply to their customers or 52% of the natural gas consumed by the two gas fired power stations in NI. Utilisation of this indigenous resource would significantly decarbonise the NI heat sector and the base load generation of electricity in NI.

- **Storage & DS3 services:** As we move away from petroleum derived liquid fuels, there is a need for new transport fuel storage facilities and storage mechanisms.· The largest storage asset currently available is the gas grid – and this should be utilised for the storage of excess electrical energy via Power-to-X technologies (for example direct hydrogen injection and or via biomethanation). Large scale batteries should be deployed in strategically important locations. Consideration should be given to novel technologies such as flow batteries (especially those less reliant on rare metals) alongside traditional cell batteries. Two CASE funded projects have explored this issue; one looking at alternative electrolytes for solid state batteries (non-lithium based chemistry) and one investigating cost reductions in the production of flow batteries to make them more affordable for a domestic consumer.

- **Interconnection:** The problems with interconnection between Northern Ireland and the Republic of Ireland and with the reduced capacity on the Moyle interconnector MUST be resolved in order for decarbonisation targets to be met.

b. The Role of Data

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

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

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

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

Q38.

- The current situation is that there is a limited level of granular data available for energy usage. For example, NIE Networks currently read meters across 880,000 customers in Northern Ireland however the vast majority is not accessible online and don't provide the required data granularity for the energy transition. A benchmarking exercise is required. We cannot set targets for improvement without fully understanding / quantifying the current situation and where the opportunities are.

  The following bullet points are suggestions with relation to data:
  - New and innovative data analysis techniques should be developed to identify opportunities for improvement.
  - Smart metering for total energy consumption at sites – real time data if possible.

Q39.

- Digitalisation and encryption of data is required.
- Concerns will relate to the time dependent granular level of detail needed at an individual and traceable level. Similarities do exist between this and internet providers who will log traffic on a more regular basis than energy.

Q40.

- No specific comment

Q41.

- Engineers and scientists based at Queen's University's ECIT have world leading expertise in data science and cyber security. Their expertise should be utilised.

c. Carbon Capture and Storage

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

Q42.

- The focus should be on capture of biogenic carbon (e.g. carbon dioxide in biogas), tree planting and agricultural crops.
- Large scale CCUS is not a sustainable option.

d. Energy and the Economy

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

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

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

Q43.

- By moving towards localised energy production there is investment in the local economy (spread out across all six counties of Northern Ireland) and development of associated jobs.
- Money stays in the economy instead of leaving to pay for imported fossil energy

Q44.

- Skills development required by the FE/HE sector – upskilling existing technicians, training new apprentices, development of new MEng/MSc degrees and training of graduates to PhD level.
- Fundamental research required (like that carried out by CASE) to bridge the gap between academia and industry on which to develop new businesses. These new businesses add value to the economy and retain the new doctoral level graduates in the local economy.

Q45.

- Any future economic development is likely to be coupled with a growth in energy demand – this has been the experience of the late 20th and early 21st centuries, as evidenced by the drop in electrical demand experienced following the 2007/8 financial crisis.
- Revision of building regulations and provision of suitable incentive schemes are required to ensure zero carbon aspirations do not become a barrier to growth
- Coordination with the agri-food and other industry sectors can be enhanced to reduce carbon emissions e.g. coupling of wastes to energy generation.

e. Delivery Framework for an Energy Strategy

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

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

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

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

Q48.

- No specific comment.

Q46, Q47 & Q49.

- CASE is in favour of a proposed new single body responsible for all actions related to decarbonisation. This independent body should be accountable to the Executive and not to one government department. The Personnel appointed to work within this new organisation are key to its success. It is important that there is an appropriate level of technical expertise that will help to support the ongoing delivery of the Department's plans and also link to other key stakeholders in the sector operating in Northern Ireland.

- Among the range of stakeholders that this body should work with, it is important that there should be recognition of the relevance of potential community / regional energy policies and the planning policies and local government plans should be considered and perhaps further enhanced. Suggestions would include that local plans take into account unique scenarios relevant to the region, for example the plan for Belfast would focus on emissions and/or air quality; for Newry, Mourne and Down District the focus would be on the development of Kilkeel as a hub for off shore wind operations (Kilkeel Harbour Works collaborative network).

- Proposals under the City Deal should be enhanced to include decarbonisation and this independent body may support aspirations in this regard. Good examples of similar type bodies include the Sustainable Energy Authority Ireland (SEAI), who work with all energy consumers – homeowners, communities, business and government on decarbonising the

energy system in Ireland. https://www.seai.ie/

- A suggestion might be to pool some existing resources, already delivering on a range of support mechanisms in Northern Ireland and second individuals to a new body with a range of different expertise and skills, all located in one place. These organisations may include / not be limited to Invest NI (and its' sustainable energy competence centre, CASE), NIRIG, Action Renewables…etc. This secondment activity may be in place until a formal body can be established.

- An independent energy body should work with the new Environment Protection Agency mooted under the New Decade New Approach (Stormont deal) in January 2020.

10. Additional information

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

Information on CASE

The Centre for Advanced Sustainable Energy (CASE) is funded through Invest NI's Competence Centre programme and aims to transform the sustainable energy sector through business research. CASE was established in 2013 following recommendations from the MATRIX (government science advisory) panel to bridge the gap between academic research outputs and industry research needs. Since then £5m of research funding has been devoted to supporting the development of marine renewable energies, bio-energy and energy systems. Hosted by Queen's University Belfast, CASE supports industry led collaborative research projects with academics from all three Northern Ireland research institutions, including QUB, Ulster University and the Agri-Food & Biosciences Institute. To date, CASE has funded 25 projects in the sustainable energy field, working with 60 companies. With a remit to bring benefit back to the Northern Ireland economy, the focus in phase 1 was on development of new models, markets and technology to support the growing renewable energy sector locally. A small sample of our projects can be found below. For more information go to www.case-research.net.

- **Tandem Tidal Turbine Testing** - CASE research in the tidal energy field was a world first at scale in different testing environments and the outputs have fed into the development of large scale marine renewable energy devices. Outputs from this suite of research projects will support the development of the 200MW of tidal energy site identified off the north coast of Northern Ireland.
- **Dual Fuel vehicles** – assessment of the impact of the transition of diesel vehicles to compressed natural gas (CNG) and further the integration of bio-gas into the gas system. By using data from literature and from the anaerobic digestion plant on the site of AgriAD, the potential of biomethane as a transport fuel was analysed. In Northern Ireland in 2012 freight used 383 million litres of imported diesel, at a total cost of £383-550 million, all of which exited the Northern Ireland economy. For every one hectare of grassland, anaerobic digestion can produce 2400 m3 of biomethane, equivalent to 4500 litres of diesel. Therefore, 50% diesel displacement could be achieved using only around 5% of the total grassland in Northern Ireland. There are 500,000 tonnes of food waste generated annually in Northern Ireland, which is enough biomethane to displace 10% of diesel.
- **Coleraine Microgrid** – This project examined the feasibility of developing a hybrid 'power to heat' energy system for industrial heat consumers in Coleraine based on a large-scale water source heat pump (WSHP) and electrode boilers. More specifically the project sought to quantify the capability of large-scale advanced water source heat pumps, combined with megawatt-scale electrode boilers, to provide grid services (frequency regulation, reserve, load on demand) in a system with a high penetration of variable renewable energy (VRE).
- **Senergy** – Senergy Innovations had developed a technology concept which utilises carbon nanotubes to modify the optical, thermal and structural properties of polymers used in a low cost extrusion process to produce solar absorbers. Senergy have embodied their polymer nanocomposite absorber concept into a new design of all plastic covered solar water heater which features a minimal number of components to maximise robustness and minimize manufacturing costs. This project demonstrated the Senergy collector design and the nanocomposite absorber technology and advanced the technology towards commercialisation.

Our projects supported 31 fte researchers over a 1 – 5 year contract period, the development of 2 patents and resulted in 17 academic publications to date. Other impacts include capability and capacity building at the research centres and in companies; new business networks; more agile business to business and business to academia collaborations; internationalisation and companies entering new markets. CASE was also responsible for leveraging funding of £8.1m to the Northern Ireland economy between 2013 and 2019 and has successfully secured an additional £3.7m to continue research and development activity along a decarbonisation pathway to 2023. CASE is now recognised as a 'go to' centre for research and development in sustainable energy.

CASE's sister centre is the the €9.7m INTERREG VA **Bryden Centre**, the successful funding bid for which was led by CASE. The Bryden Centre is a virtual centre, supporting cross-border research into biomass and marine-based renewable energy. CASE Partners Queen's University Belfast, Ulster University, the Agri-Food and Bioscience Institute are joined by Letterkenny Institute of Technology, Donegal County Council, the University of the Highlands and Islands and Dumfries and Galloway Council in the Bryden Centre. The consortium employs a 30 strong team of PhD students and post-doc researchers carrying out industry led research at TRL 3/4.

CASE supports the work of The **Centre for Sustainable Technologies** (CST), Ulster University's energy research centre. Energy research and education has been proactive in Ulster University since 1972 and has grown to a multi-million pound centre that provides world leading research and education. The overall strategy of CST has been the integration and assessment of decarbonisation approaches using combinations of future energy scenario developments evaluated through blends of building performance analysis, techno-economic modelling, life-cycle assessment, energy market modelling, electric network modelling and Locational Net Benefit Analysis underpinned by real dynamic data derived from our extensive laboratories and Terrace Street – our family occupied living laboratory recreation of 1900's homes. Terrace Street accommodates live heat pump, thermal storage, battery storage, Photovoltaic panels and electric vehicle integration. Specific laboratories deliver advanced technologies in solar energy, heat pumps, thermal energy storage, building materials and advanced glazing and biomass combustion and gasification and analysis. With 12 academics leading 31 post-doctoral researchers and PhD scholars and supported by commercial exploitation and the Northern Ireland Contact Point for Energy, technicians and administration, CST is a leading authority in advising on energy policy based on models underpinned by practical facts.

Addendum - Marine Renewable Energy

1. The UK Wide opportunity

The UK industry currently boasts 22 tidal stream technology developers and 23 wave developers with an estimated investment to date of around £508m of private capital in developing marine energy technologies and £70m in direct public support. Tidal stream and wave technologies have progressed at different rates leading to them being viewed as two distinct sectors but with a strong crossover between many elements of the supply chain.

By taking positive action now the UK can secure a realistic majority share of a growing global market, the tidal stream industry could generate a net cumulative benefit to the UK by 2030 of £1.4bn, including considerable exports and creation of 4,000 jobs. Wave energy, which is a newer technology sits behind tidal stream by perhaps 10 years, will also add a net positive contribution to the UK economy, worth a new cumulative benefit to the UK by 2040 of £4.0bn and support 8,100 jobs.

2. What makes Northern Ireland special?

Whilst Northern Ireland does not host any OEMs or technology developers, there is a strong history of marine renewable energy in the region.

a) R&D history

Queen's University Belfast has a 40+ year history of marine renewable energy research starting with the invention of the Well's Turbine in 1976, moving to the sea trial and wave powered sea navigation buoy and then to on-shore wave devices such as the LIMPET on Islay. The Aquamarine Oyster device was invented in Belfast with the Aquamarine research team based in the QUB laboratory for several years. In more recent years, the expertise has extended to tidal energy research through £1m of CASE[11] funding tandem tidal device testing, including a number of campaigns in Strangford Lough. The QUB Marine Group has also been undertaking research projects in offshore wind and floating solar. The expertise extends to:

- Innovative site survey and characterisation methods
- The use of composites and new or hybrid materials
- Resource modelling and site assessment, and
- Blade, gear box and generator innovations
- Foundations and moorings
- Prototype deployment in a range of test environments

Ulster University has a research background in environmental sciences and marine archaeology. The Agri-Food and Biosciences Institution has expertise in seabed analysis, marine mammals, benthic surveying and owns a research vessel, the Corystes.

[11] The Centre for Advanced Sustainable Energy (CASE), The Centre for Advanced Sustainable Energy (CASE) is funded through Invest NI's Competence Centre Programme and aims to transform the sustainable energy sector through business research. Industry led collaborative research is delivered by QUB, Ulster and AFBI and includes three key themes:

- Energy Systems
- Energy from biomass, and
- Marine Renewable Energy.

b) Supply chain and 'first mover' advantages

Northern Ireland was home to the world's first ever grid connected tidal turbine, the 1.2MW Seagen device. Seagen was deployed in 2008, as a scientific experiment, in Strangford Lough, which is one of the most designated waterways, from a conservation perspective, in Europe. Lessons learned through characterisation of the site, environmental and mammal monitoring and deployment methodologies have been observed around the world. Northern Ireland Environment Agency was the first licencing team to deliver a marine scientific licence anywhere in the world. Seagen was also the first tidal turbine to be decommissioned in global waters.

First mover advantages from this installation included a boost of £4m to the local economy from supply chain contracts and expenditure on accommodation, travel etc. Capacity and capability enhancements were seen in the form of up-skilling and diversification of a range of different sectors including (but not limited to):

- local marine vessel operators - eg. Cuan Boats went on to service several other tidal device installations in Strangford Lough,
- construction companies - eg. McLaughlin & Harvey were subsequently contracted to deploy the OpenHydro turbine into the Bay of Fundy in Nova Scotia),
- environmental consultancies - eg. Marenco supporting further marine energy licencing environmental impact assessment / marine mammal observations and
- resource assessment consultancies - eg. ARR was contracted to undertake resource evaluation work for the Fair Head Tidal lease application.
- Fabrication / manufacturing – Harland & Wolff fabricated the ScotRenewables SR2000 device at their premises in Belfast Harbour before it was taken to the European Marine Energy Centre (EMEC) in Orkney. Cimpina (also Belfast Harbour) worked on the QED Naval sub-hub before it was towed to Strangford for testing.

There is 200MW of site with a Crown Estate Agreement for Lease off the north coast of Northern Ireland; 100MW at Fair Head and 100MW at Torr Head. Work has been ongoing by the site developers granted the Agreements for Lease, under a consenting and licencing process since 2013.

3. The challenge

There are a number of challenges facing the sector in Northern Ireland. These are summarised below:

- There are no mechanisms to incentivise renewable energy development in Northern Ireland since the removal of the NI Renewable Obligation Certificates (NIROCs) and Renewable Heat Incentive (RHI). There is therefore no market incentive to develop the tidal energy sites at Fair Head and Torr Head.
- Grid connection at the north coast sites will be costly with a constrained grid in the area and,
- There is limited grant support for tidal energy technology in Northern Ireland Technology is at a lower Technology Readiness level than other renewable energy devices and continues to need support on the pathway to more cost efficient commercialisation. At present the main sources of grant funding for marine renewable energy technology is

through CASE (TRL 4 – 7) and the Bryden Centre (early stage r&d at PhD level) in Northern Ireland and through collaboration on projects such as the Ocean Power Innovation Network with Scottish Enterprise and the Sustainable Energy Authority Ireland (SEAI).

- Given timescales between issuing of Agreements for Lease (2013) and licencing (still ongoing), there is a possibility that the option to develop the sites on the north coast will be lost (as happened with the 600MW first flight wind site of the coast of County Down).
- With all of the challenges noted above, companies in the sector are falling into administration – capacity, capability and know-how which is potentially unique to Northern Ireland is being lost.

4. Recommendations

- Should incentives be returned under the new NI Assembly, then consideration should be given to support for technology that is innovative and lower down the Technology Readiness Level (TRL) and further away from commercialisation, ie. for tidal energy. Mechanisms similar to the Innovation Contracts for Difference (iCfDs) being discussed between the UK Marine Energy Council and Westminster MPs should be considered. Please refer to Call for Evidence information submitted by the Marine Energy Council following a meeting with DfE on Monday March 2nd 2020.
- There is evidence of a requirement for continued grant support to move marine renewable energy technology along the commercialisation pathway and reduce the levelised cost of energy to become more competitive with other technologies (eg. offshore wind). See Offshore Renewable Energy Catapult Cost Reduction Report https://s3-eu-west-1.amazonaws.com/media.newore.catapult/app/uploads/2018/11/19142426/Tidal-Stream-and-Wave-Energy-Cost-Reduction-and-Industrial-Benefit.pdf
- There is a need for test facilities for medium scale marine renewable energy devices in the UK. Some testing work has been carried out by CASE to date in Strangford Lough and Minesto are currently testing their underwater kite in the lough. A report was commissioned by Invest NI in 2013 on the need for a test site in Northern Ireland (report prepared by Puremarine gen). More recently CASE appointed BVG consultants to assess the potential of Strangford Lough as a commercial testing facility. The opportunity was deemed to be favourable however not feasible without some significant investment. More work should be done to realise the potential of the lough as a test site, especially now that the Seagen device has been decommissioned. The supply chain opportunities are very significant (£4m of supply chain advantage was delivered at the time of the deployment of the Seagen device) and this could open channels for foreign direct investment (ie. Minesto is a Swedish company that has opened an office in Portaferry and Schottel (a German turbine manufacturer) has tested their devices in the lough)).
- DfE should consider updating the Offshore Renewable Energy Strategic Action Plan in light of the Crown Estates sites with Agreements for Lease and developments in technology. There should also be some consideration for the creation of a specific post at the Department with responsibility solely for marine energy.
- Northern Ireland should ensure continued input into UK wide marine renewable energy strategy and participate fully in inter-regional activity in support of the sector.