

Energy Strategy for Northern Ireland Consultation on Policy Options

Comments by

Northern Ireland Environment Link

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Northern Ireland Environment Link (NIEL) is the networking and forum body for non-statutory organisations concerned with the natural and built environment of Northern Ireland. Its 63 Full Members represent 190,000 individuals, 262 subsidiary groups, have an annual turnover of £70 million and manage over 314,000 acres of land. Members are involved in environmental issues of all types and at all levels from the local community to the global environment. NIEL brings together a wide range of knowledge, experience and expertise which can be used to help develop policy, practice and implementation across a wide range of environmental fields.

These comments are made on behalf of Members, but some members may be providing independent comments as well. If you would like to discuss these comments further, we would be happy to do so. If you do have any further questions please contact:

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Background

NIEL welcomes the publication of the Energy Strategy consultation document and the many positive proposals it contains. NIEL would like to compliment the Department for the Economy on the extensive and thorough work that has gone in to producing this very well written consultation document. There are however some errors in the strategy that NIEL would like to draw attention to.

The Energy Strategy says on page 5 that

“The body responsible for advising the UK and devolved governments on climate change – the Climate Change Committee (CCC) – has advised that Northern Ireland’s contribution is an 82% reduction in all greenhouse gas emissions by 2050.”

The Energy Strategy also say on page 5 that

“The CCC has advised that an 82% reduction in total greenhouse gas emissions is consistent with net zero carbon in Northern Ireland”.

There are inaccuracies in both of those statements. The CCC said in its Sixth Carbon Budget¹ report that NI must have **at least** an 82% reduction in GHGs, so that a potential 82% cut in NI’s greenhouse gas (GHG) emissions is a minimum i.e. a floor and not a ceiling. The CCC outlined five scenarios in its Sixth Carbon Budget, only one of which, the Balanced Pathway, involved a reduction in GHG emissions of **at least** 82% by 2050. The tailwinds scenario involves the UK reaching net zero by 2042 and a GHG reduction of 94% in NI by 2050. Also, the wording of the first statement above does not accurately reflect the tone of the statements made by the CCC. The CCC said in the Sixth Carbon Budget² that the scenarios it came up with in the Sixth Carbon Budget are not prescriptive but illustrative. The CCC Sixth Carbon Budget says:

“While our Balanced Pathway is the basis for our recommended budget it is not intended to be *prescriptive*. Rather it is *illustrative* of what a broadly sensible path based on moderate assumptions would look like.”

Also, NIEL understands the reduction by at least 82% in GHGs in NI was evaluated as part of a scenario in which the UK would reach net zero GHGs by 2050 rather than an evaluation of how and by when Northern Ireland could reach net zero GHG emissions. In any case, it would appear unlikely that NI could reach net zero GHG emissions if NI GHG emissions are only reduced GHGs by approximately 82%, without extremely high levels of GHG reduction technologies which are not available at present.

Questions in the consultation document

Q1: Do you agree with the overall goal of achieving net zero carbon energy no later than 2050?

Yes. NIEL agrees with and welcomes the overall goal of the energy strategy to achieve net zero carbon no later than 2050, as decarbonising energy is an essential component of the move to net zero greenhouse gases. However, NIEL believes that the energy sector needs to be decarbonised earlier than 2050 and would encourage the department, along with all other relevant departments, to decarbonise the energy sector as soon as possible. NIEL also agrees that the Energy Strategy should be a 'live document', remaining flexible, able to adapt and regularly reviewed.

According to the Department for the Economy³, for the 12 month period January 2020 to December 2020, 49.2% of total electricity consumption in NI was generated from renewable sources located in NI. This is very positive but much remains to be done, given that, as outlined in the consultation document, electricity is responsible for 16% of total energy consumption in Northern Ireland and the whole of NI's energy system - electricity, heat and transport - needs to be decarbonised as soon as possible. One of the first steps to decarbonising our energy system is to eliminate the use of fossil fuels and only generate energy from renewable energy sources. As such the reference, on page 90 of the consultation, to the need to decarbonise power (electricity), heat and transport and remove residual emissions is very welcome and NIEL supports these objectives. As regards removing residual emissions, NIEL believes it is essential that the role of nature based solutions (NbS) to remove and sequester carbon are prioritised and used as much as possible rather than relying on unproven technological options which could also be more expensive. Furthermore, it is important to note that renewable energy sources should be subject to detailed ecological impact assessments to ensure that the right technology is deployed in the right place, in harmony with nature, so as to avoid negative impacts such as those resulting from hydropower installations for example, which have been known to cause problems for migratory fish species like Atlantic salmon by inhibiting fish passage upriver beyond such installations thus preventing spawning.

While aiming for 100% renewable energy may seem extremely ambitious, it can be done. In a 2009 article in Scientific American⁴, Mark Z. Jacobson from Stanford University and Mark A Delucchi⁵ from the University of California, concluded that a world completely (i.e. 100%) powered by renewable energy sources for all purposes by as early as 2030 is possible, though the timescale depends on the policy decisions made as with extremely aggressive policies, all existing fossil-fuel capacity could theoretically be retired and replaced in 20 to 30 years. Separately, Mark Jacobson has stated⁶ that there are no technological or economic barriers to converting the entire world to clean, renewable energy sources but

"It is a question of whether we have the societal and political will."

The UK CCC report on Net Zero⁷ also concluded that electricity can be decarbonised, finding that

“emissions from the UK's electricity system can be reduced to almost zero whilst meeting increased electricity demands from the transport and heat sectors, potentially doubling the size of today's electricity system”

According to the SONI 2020-25 strategy⁸ the grid can accommodate up to 65% renewable energy at present and that this figure must increase to 95% by 2030. In this strategy, SONI says it is

“committed to leading the decarbonisation of Northern Ireland for the good of everyone who lives and works here”.

There is also support for decarbonising energy from the business community as illustrated by the CBI description of the recovery from the COVID-19 pandemic as a real opportunity to build back better and pivot towards the low-carbon, sustainable, and net-zero aligned economy that we know we need⁹. Amongst other things the CBI called for government action to:

“Accelerate the deployment of low-carbon electricity generation and investment in grid system flexibility”

“Deliver jobs and energy savings by retrofitting homes and buildings to be more energy efficient and switch to low-carbon heating.”

NIEL notes that there was no reference in the strategy to another primary driver of the need to decarbonise energy in NI, and globally, and possibly the most important one, namely the issue of peak oil and the declining availability of oil. For example, according to the BP Statistical Review of World Energy 2020¹⁰ in 2019, there was less than 50 years supply left of oil (49.9 years) and gas (49.8 years). In this context of diminishing reserves of oil and gas it is imperative that we wean ourselves, as a society, off fossil fuels as quickly as possible. In May 2021, " Fatih Birol, the International Energy Agency (IEA) executive director said¹¹

"The pathway to net zero is narrow but still achievable. If we want to reach net zero by 2050 we do not need any more investments in new oil, gas and coal projects,"

The need to move away from fossil fuels to renewable energy sources has been clear for a long time. In the World Energy Outlook 2008¹² the IEA said

“The world’s energy system is at a crossroads. Current global trends in energy supply and consumption are patently unsustainable — environmentally, economically, socially. But that can — and must — be altered; there’s still time to change the road we’re on. It is not an exaggeration to claim that the future of human prosperity depends on how successfully we tackle the two central energy challenges facing us today: securing the supply of reliable and affordable energy; and effecting a rapid transformation to a low-carbon, efficient and environmentally benign system of energy supply. What is needed is nothing short of an energy revolution.”

While that energy revolution has started, it needs to accelerate significantly and that is down to the decisions we make. NIEL would like to see a clear strategy from the Department for the Economy that ultimately will decarbonise our energy system no later than 2050 and preferably before then in order to achieve net zero GHGs by 2050 at the latest.

Related to that goal of achieving net zero GHG emissions, NIEL would recommend that the energy industry must strive to eliminate the use of all greenhouse gases in energy production and transmission and distribution, in particular, sulphur hexafluoride (SF₆). 80% of all SF₆ is used in the electricity industry in circuit breakers and switchgear^{13, 14}. SF₆ has a Global Warming Potential (GWP) of around 22,800 over a 100-year time horizon, which means that it is approximately 22,800 times as effective as Carbon Dioxide (CO₂) in warming the planet. This makes it the most potent greenhouse gas regulated under the Kyoto Protocol¹⁵ and it has been identified as the most potent and persistent greenhouse gas in existence¹⁶. As there are no sinks or disposal methods for SF₆, it continues to accumulate in earth’s atmosphere. However, there are alternatives to SF₆ and the use of those alternatives and the need to recycle SF₆¹⁷ must be implemented by the energy sector to prevent as far as practicable any further leakage of SF₆ in to the atmosphere.

Q2. Do you agree with the proposed outcome of “net zero carbon and affordable energy” for the Energy Strategy?

Yes. There needs to be a transition to net zero carbon energy and ultimately net zero GHGs no later than 2050 and this will require investment in renewable energy sources (RES) and clear strong legislation and policies that support the expansion of RES in order to reassure potential investors. It is important to consider the affordability of energy because according to the Department for Communities¹⁸ and the NI Housing Executive (NIHE), in 2016, 160,000 households¹⁹ in NI and 22% of the NI population were living in fuel poverty. However, NIEL believes it is important to consider the time scales within which these outcomes are meant to be achieved because additional investment will be required to completely replace fossil fuels, in particular in the heating and transport sectors and this is likely to especially be the case in the early stages of this transition. In other words, the necessary investment will be needed up front. As such, the outcome of affordable energy must be a long term outcome so as to allow for any front loading of investment that is necessary.

The CCC has been clear on the significant long term economic benefits that can be created by achieving net zero GHG emissions. For example, the CCC found²⁰ that

“the net costs of the transition to net zero by 2050 (including upfront investment, ongoing running costs and costs of financing) will be less than 1% of GDP over the entirety of 2020-2050, lower than we concluded in our 2019 Net Zero report.”

Modelling commissioned for the CCC Sixth Carbon Budget report²¹ suggests achieving net zero in the UK will give a boost to UK GDP growing to around 2% of GDP by 2030, with an accompanying boost to employment of around 1%. According to this analysis the GDP boost will continue growing after 2030 before levelling off at around a 3% boost by 2050. The CCC goes on to say²² that considering the various economic models and evaluations, the investment programme for achieving net zero set out in section 2 of the Sixth Carbon Budget report

“can provide a significant economic boost in the coming years and support the UK’s economic recovery.”

Wholesale economic analysis has not yet been carried out as to the potential economic benefits of a net zero Northern Ireland but it is clear that moving to a net zero carbon economy also offers massive potential economic benefits.

Investing in a green economy and zero carbon options can also save money in the long term. The CCC said in its Sixth Carbon Budget report (page 261) that

“Around half of the measures to reduce emissions are expected to be cost saving by 2050, primarily decarbonising electricity and surface transport.”

We also know that there will be costs if we do not act, and those costs are projected to be much higher than the costs of investing in a green, low/zero carbon economy. DAERA summed up the implications arising from any delay in cutting GHG emissions when it said in the Discussion Document on a NI Climate Change Bill²³

“the rate at which we reduce our GHG emissions is at least as important as emissions levels at specific points in time. Consequently, the later cuts are made, the greater they must be to achieve the same long-term goal, and so they will be more expensive to implement;”

Q3. Do the five principles identified provide clear direction around the approach that we want to take with the Energy Strategy?

Yes

Q4. Are there any key delivery priorities for the Energy Strategy not captured? If so, please outline what you believe should be included.

NIEL agrees with all the priorities mentioned but believes that the top priority should be decarbonising the energy system and as quickly as possible as the next nine years will be key.

The need for urgent action to tackle climate change by 2030 was made clear by the UN Intergovernmental Panel on Climate Change²⁴ (IPCC) 2018 Special Report on global warming of 1.5°C²⁵ which found that in model pathways with no or limited overshoot^a of 1.5°C, which is the target of the Paris Agreement, global net anthropogenic CO₂ emissions decline by about 45% from 2010 levels by 2030 (40–60% interquartile range), reaching net zero around 2050 (2045–2055 interquartile range), (para C.1 page 12). This is the basis for the global move to setting targets for achieving net zero GHGs by 2050 or earlier.

However, given the global average temperature rise of 1.2°C observed by the World Meteorological Organisation (WMO)²⁶ and the UK Met Office²⁷ which found that the average global temperature in 2020 was about 1.2°C above the pre-industrial (1850-1900) level, it seems clear that we must act as urgently as we can, in line with or even beyond the upper estimates of previous recommendations. As the UN Secretary General Antonio Guterres said in the UN 'State of the Global Climate 2020' report²⁸

“The data in this report show that the global mean temperature for 2020 was around 1.2 °C warmer than pre-industrial times, meaning that time is fast running out to meet the goals of the Paris Agreement. We need to do more, and faster, now.”

There needs to be greater and preferably full integration with other strategies, in particular the Economic Development Strategy, Regional Development Strategy and next Programme for Government (PfG). Also there is the issue of how the proposed changes will be funded. An implementation/delivery plan will be needed with SMART targets and allocation of responsibilities.

^a According to the IPCC Special Report on 1.5°C, '1.5°C limited-overshoot' means those emissions pathways limiting warming to below 1.6°C and returning to 1.5°C by 2100.

There is also an argument for a dedicated energy and climate change department in the short-medium term which is empowered to encourage behaviour change and penalise behaviours that are not working towards the priorities.

As well as helping to mitigate climate change NIEL believes that the planning of NI's renewable and fossil fuel free energy system needs to adapt to climate change so that the system is designed to be able to withstand the greater risks from extremes in weather²⁹ that are predicted for example, by the third Climate Change Risk Assessment which highlighted

“Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures.”

“Risks to business locations and infrastructure from coastal change from erosion, flooding and extreme weather events.”

These risks need to be accounted for in the upgrading of existing systems and the design of any new systems.

Q5. Do our proposed indicators adequately allow us to measure success at achieving the proposed Energy Strategy outcome? If not, please advise on what alternative metrics should be used. a) Carbon emissions from energy-related sectors b) Jobs and turnover in the low carbon and renewable energy economy c) Domestic energy costs relative to household income d) Business energy purchases relative to business turnover e) Households in fuel poverty f) Relative electricity & gas prices

NIEL would support the use of these five indicators although it is not initially clear how emissions from fuels used by aviation and shipping are to be measured and accounted for in NI's energy footprint. These fuels should be included in the measurement of NI's energy footprint and some means of accounting for the embedded emissions in our consumption of products should also be a measured and accounted for.

Also, if the overall objective is decarbonisation, the indicators in their current form appear to be too focussed on costs. The distinction between domestic energy costs relative to household income and households in fuel poverty is unclear, given that

“A household is in fuel poverty if in order to maintain an acceptable level of temperature throughout the home, the occupants would have to spend more than 10% of their income on all household fuel use.”

As regards fuel poverty, for a long time NI had the highest levels of fuel poverty in the UK. In 2011 the fuel poverty rate in NI was 42%, though by 2016 this had dropped to 22%³⁰ though

this drop is interpreted as being mainly down to the reduction in fuel prices during that time, as well as increased income levels and a reduction in energy use. While this is good in terms of fuel poverty this does not necessarily reflect any improvement in the insulation levels or efficiency of buildings or the reduction in energy consumption. As such this indicator may not reflect any decarbonisation of energy, which NIEL believes should be the priority and so on balance, there is probably no need for both these draft indicators. The carbon footprint or GHG footprint of buildings or of certain sectors might be a better metric.

Overall, there is evidence that tackling climate change can also help reduce fuel poverty. A HSBC evaluation³¹ of the various economic stimuli packages from around the world highlighted the benefits of tackling climate change and although the benefits were not taken into account in the formal scoring the authors acknowledged that energy efficiency measures,

“also enhance energy security and help the less well off with their fuel bills”

Q6. Do you think there are significantly different illustrative scenarios which should be developed? If so, please provide further information

NIEL believes that there is likely to be a high level of electrification in transport and heating options but that the most likely is Scenario 4. Current building regulations would need to be significantly improved to ensure that all new builds are capable of being Net Zero carbon and that heat pumps would operate at optimal efficiency.

NIEL notes the increasing role for biofuels, as outlined in figure 10 on page 37. However, there are a number of issues with growing demand for biofuels, above all that the increasing demand for biofuels has led to rainforest in Indonesia and Malaysia for example being burned (which adds to global warming by releasing massive amounts of carbon dioxide, especially when that rainforest is on peatland, as is the case in much of Indonesia) or clear felled to make way for monocultures of palm oil plantations which have little or no biodiversity value. This has had a particularly detrimental effect on the orangutan in Borneo and Sumatra for example. According to the Orangutan Foundation International, it is estimated that between 1,000 and 5,000 orangutans are killed every year because of palm oil development³². In the last decade, orangutan populations have probably decreased by 50% in the wild, primarily due to deforestation resulting from intense legal logging, illegal logging, conversion of forest to palm oil plantations and timber estates, mining, clearing forest for settlements, and road construction³³. Therefore, if biofuels are to play a part in decarbonising energy in NI, the supply of biofuel should be regulated to ensure it meets sustainability criteria and does not result in damage to important high value nature habitats or species and aligns with Principle 4 requiring fossil fuels to be replaced with ‘indigenous renewables’.

Q7: Do you agree with the four consumer population groups we have identified? Please advise on key considerations within each. a) Domestic vulnerable consumers b) Other domestic consumers c) Small businesses d) Larger businesses

Yes.

Q8: Do you agree with the five measures identified to “enable and protect” consumers? If not, please outline what else should be included? a) Making available information and advice b) Offering proactive “wrap-around” support c) Providing financial support measures d) Driving change e) Reviewing statutory protections

Yes. There is the potential for the addition of a sixth measure, namely the removal of barriers to development and the empowering of active consumers through decentralisation.

Q9: Do you agree with the proposed scope of the “one stop shop”? Please advise on any different activities you think should be included. Energy Strategy for Northern Ireland Consultation on Policy Options 12

Yes. The designated body could also be responsible for delivery and enforcement of the policy.

Q10: Which approach do you think should be taken to create this organisation? Please outline your rationale.

No comment.

Q11: Do you believe that additional financial assistance to protect certain groups of consumers should be introduced? If so, please identify what consumers should be targeted and what support would be needed.

Yes. Those in fuel poverty, the least efficient buildings and those with larger energy demands should potentially be prioritised for financial assistance. Assistance for small businesses could also be considered: e.g. 50% grant to install low carbon measures. The remit of NISEP may need to be reviewed as part of any expansion of the provision of financial assistance.

Q12: Do you agree with the four identified priority clean energy sectors: a) Energy efficiency b) Renewable energy c) Hydrogen economy d) Circular economy Please advise on any additional areas that you believe should be prioritised and your reasons for this.

No on the basis that transport should be a sector. Also, in terms of the hydrogen economy, this should be labelled as the renewable or green gas economy, which includes hydrogen and biogas but only as a transition fuel.

Q13: Do you agree with the economic growth opportunities identified within energy efficiency? What supporting policies do you believe are needed to take advantage of these?

Yes.

NIEL is pleased to see the Energy Strategy recognise that “Energy efficiency is therefore a win-win for decarbonisation and economic growth.”

It is important that the economic growth opportunities offered by reducing energy consumption are fully accounted for and taken and a long term plan to do that should be part of the 2050 Energy Strategy.

More people have been working from home as a result of the coronavirus pandemic and it is widely expected this may continue in the future. As a result there are potential opportunities in the technological/digital sectors to reduce or eliminate the need to travel and Invest NI may have a role in supporting innovation in those sectors.

Q14: Do you agree with the economic growth opportunities identified within renewable energy? What supporting policies do you believe are needed to take advantage of these?

The potential for job creation in renewable energy and low carbon choices is enormous and must be maximised. This was illustrated by research for The Institute for Public Policy and Research³⁴ which concluded that greater investment in a green recovery and clean, low-carbon jobs could create 1.6 million new jobs over the next decade in the UK, of which over 40,000 could be in Northern Ireland. This is more than three times the 11,700 FTE jobs in the low carbon and renewable energy (LCRE) economy in NI which generated £2 billion in 2017³⁵. Of those 1.6 million jobs, half a million (560,000) could be created by improving the energy efficiency of homes, which would also help reduce fuel poverty and help the health and economic prospects of thousands. Action is required across government but it is important to recognise that many of the green economy policy options can generate benefits

across society, in line with the aims of the draft NI Programme for Government (PfG) 2016-21. For example, the benefits from investing in better insulation in buildings could create jobs for people and firms (relevant to the Department for the Economy), reduce carbon emissions (relevant to DAERA) and reduce fuel poverty (relevant to the Department for Communities) by saving energy and making buildings warmer. This would have very positive impacts on the physical and mental health of those who would be taken out of fuel poverty and live in warmer properties (relevant to the Department of Health) and all of this could be delivered by improving building regulations, which is the responsibility of the Department of Finance.

In order to make the most of the economic opportunities offered by energy efficiency, NI needs to make different investment choices. As the CCC³⁶ said, a priority for the Cabinet Office and No.10 is to

“Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK’s climate objectives”

Related to that is the need to end support for fossil fuel generation e.g. for any upgrading of fossil fuel power stations.

NIEL believes that the NI administration should lead by example and ensure that by 2030 it is powered only by renewable sources. The purchasing power of the government and all the statutory bodies in NI is massive and provides a huge opportunity to drive the development of a green economy. Procurement expenditure accounts for some £3bn annually, representing a quarter of the NI Executive’s budget³⁷. If the Department of Finance and the Executive ensured this expenditure was as green as possible it could make a huge difference to reducing Northern Ireland’s ecological footprint and should help support green, low carbon industries, many of which could be local. As the NI Finance Minister³⁸ said in relation to a reported £31 million in savings achieved under a new contract which will see 100% renewable energy supplied to government buildings

“procurement can be a key lever in the transition to a Green Economy.”

NI could learn from Scotland’s sustainable procurement duty, outlined in the Procurement Reform (Scotland) Act 2014³⁹ which aligns with the Scottish government’s purpose to create a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth.

The CCC provided further detail on the financial implications of net zero in a letter to the AERA Minister dated 1st April⁴⁰ when it said the following:

“Business models that are not compatible with a Net Zero future are increasingly risky.”

“A slower path to decarbonisation in Northern Ireland would bring large-scale risks that would be difficult to manage”

“In addition to green recovery opportunities and the investment requirements and operational savings, there is overwhelming evidence that reducing greenhouse gas emissions will be beneficial to public health in Northern Ireland.”

“Our scenarios require that almost all new purchases and investments in Northern Ireland are in zero-carbon solutions by 2030 or soon after, and virtually all technology in Northern Ireland is zero-carbon by 2050.”

This makes a clear case for NI to make investment and divestment choices that will ensure the achievement of net zero GHGs in NI is a priority above all other options, and to stop investment in high carbon options completely. The case for developing a green economy was made in the House of Commons Environmental Audit Committee in its “A Green Economy”⁴¹ report which said

“The whole economy needs to be green and traditional sectors of the economy will need to be transformed”

This would for example, raise questions about the need for a gas storage facility at Islandmagee on the basis that NI should not be investing in fossil fuels.

NIEL believes NI needs to fully assess the potential for all forms of low and zero carbon renewable energy sources on land and in the sea.

Q15: Do you agree with the economic growth opportunities identified for hydrogen production, demand and manufacturing within the hydrogen economy? What supporting policies do you believe are needed to take advantage of these?

It seems there are opportunities from a hydrogen based economy but on the basis that generating hydrogen from fossil fuels is not a long term option then the only option is to generate hydrogen using electricity from renewable sources. This however raises the question of how that hydrogen would be used. There may be a good opportunity to decarbonise heating using hydrogen as opposed to using hydrogen for transportation as that would, in effect, be using renewably produced electricity, which itself is a fuel source for EVs and other transportation options as well as a heating source, to generate another form of transportation fuel. As such, the merits of hydrogen are dependent upon the proposed use of hydrogen as well as the source of the hydrogen.

Q16: Do you agree with underpinning principles identified within the circular economy? What supporting policies do you believe are needed to take advantage of the potential economic opportunities?

Yes, this is very welcome. The development of a circular economy would however require the buy in of the NI Executive and all departments. As the University of Ulster⁴² said in its draft budget consultation 2021

“Creating a zero-carbon economy will require a ‘Whole of Government’ response and can help support economic growth”

The University went on to say⁴³ that

“As well as delivering environmental benefits, there is also the potential to deliver significant economic benefits and create jobs.”

As such a cross departmental Executive wide, long term, green recovery plan for NI is needed which is based upon the Sustainable Development Goals⁴⁴ and will contribute to their achievement.

Q17: Do you agree that we should develop a green innovation challenge fund? If so, what scale and type of innovative projects should this support?

Yes, investment in zero carbon options is needed now and in the longer term so the proposal to develop a green innovation challenge fund is very welcome. However, on the basis that it is clear the NI’s energy sector needs to be decarbonised by 2050, the funding for green innovation must be long term and not short term. Obviously if funding is to be provided for any particular project that is likely to be, by nature, shorter term, but long term funding needs to be made available for the development and refinement of green and zero carbon technologies.

Q18: Do you believe that we should work with the Utility Regulator to review how energy regulation can facilitate a green recovery and green innovation? If so, how can this be done in a way which protects consumers from the higher risks associated with innovation projects?

Yes. The Utility regulator could play an important role in ensuring that NI’s energy is renewable and sustainable.

Q19: Do you agree with a focus on research mapping, research funding, business linkages and UK opportunity scanning to maximise the impact of the local research base with clean energy specialisms? Please identify specific opportunities in the local research base that could be progressed.

This will be important but most of this should already be known. Anything that will help improve the efficiency of sustainable renewable energy production in NI will be welcome. NIEL would refer the department to groups like Action Renewables who would be better placed to advise on mapping such opportunities.

Q20: Do you believe that utilising and tailoring existing education and training routes can meet the short-term skills needs of the clean energy sector? How can activities within these routes be shaped to meet the needs of the sector?

NIEL believes that having more tailored and relevant training opportunities that will equip people with the skills necessary to implement the transition to a net zero carbon energy sector is essential. However, NIEL is not best placed to advise on existing education and training routes but recognises that training may not be able to meet the short term/immediate needs of the clean energy sector depending on how quickly that sector expands due to the length of time such training takes. NIEL understands that Invest NI previously invested a lot of time and effort in working with third level education establishments (universities and FE colleges) on creating training opportunities, apprenticeships and academic courses in relation to renewable energy. This was very welcome. However, a change in UK government support and policy meant that these foundations were not properly built upon. This is why setting the right long term policy is so important. NI's energy system will have to be carbon free and hopefully GHG free in the long term and for the long term. As such the provision of appropriate training is a key component of the just transition that is needed to prepare NI for the anticipated changes ahead of us. This fits with the recommendation of the CCC⁴⁵ to the Cabinet Office and No.10 to

“Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives”

Q21: Do you agree with the proposal to establish an Energy Skills Forum to shape the future skills needs of clean energy sector? If so, what do you believe the role, remit and membership of such a group should be?

Yes. NIEL would recommend that the department should engage with relevant stakeholders to help develop any such forum.

Q22: Do you believe that there is a need for specific measures aimed at ensuring a just transition in Northern Ireland? If so, please advise on what the focus of these should be in addition to the education and training routes already proposed for a low carbon workforce.

Yes. As outlined in response to Q20, ensuring a just transition is a key component of reaching net zero as it is essential that the move to a net zero carbon economy managed in a way that respects worker rights and is achieved with the help and input of employers and employees to ensure the positive economic opportunities are maximised. In relation to a just transition, the CCC said in 2019⁴⁶,

“The transition, including for workers and energy bill payers, must be fair, and perceived to be fair. Government should develop the necessary frameworks to ensure this. An early priority must be to review the plan for funding and the distribution of costs for businesses, households and the Exchequer.”

NIEL believes that NI could and should adopt an approach similar to that taken in Scotland. The Scottish Government established the Scottish Just Transition Commission⁴⁷ in 2019 to advise on a net-zero economy that is fair for all. The Scottish principles for a just transition state that action to reduce net greenhouse gas emissions should: support environmentally and socially sustainable jobs; support low-carbon investment and infrastructure; create decent, fair and high-value work in a way which does not negatively affect the current workforce and overall economy and contribute to resource efficient and sustainable economic approaches which help to address inequality and poverty. The Scottish Government also committed funding to a just transition with £100m pledged towards a Green Job Fund, £60m to help industrial and manufacturing sectors decarbonise, £70m for improved refuse collection infrastructure and £150m to deliver a 50% increase in woodland. Similar funds in Northern Ireland should be established to help create opportunities for blue and green infrastructure, sustainable tourism, nature restoration, to mitigate against climate change and help progress other key Executive priorities. NIEL welcomes the Department for Infrastructure’s commitment to £20m for Green and Blue infrastructure in June 2021 and the £2.8m funding for greenways announced on 16th September 2020. These are steps in the right direction, however, more action and longer term planning and funding will be required.

Q23: Do you agree that an energy savings target should be set for Northern Ireland?

Yes. Reducing the demand for energy also has to be a major part of the drive to decarbonise energy.

As far back as 2002, the potential for saving energy was highlighted by the Cabinet Office’s Performance and Innovation Unit (PIU) 2002 report on energy efficiency which found that there is the potential to save approximately 30% of final energy demand across all sectors amounting to reduced costs to customers of £12,300,000,000 (£12.3 billion) annually.

According to the National Infrastructure Committee⁴⁸ smart power – principally built around three innovations, Interconnection, Storage, and Demand Flexibility – could save consumers up to £8 billion a year by 2030, help the UK meet its 2050 carbon targets, and secure the UK's energy supply for generations. According to The Carbon Trust⁴⁹,

“Energy storage could save £2.4 billion a year system wide by 2030; if regulatory hurdles are overcome this could rise to £7 billion a year.”

Q24: Do you agree that Minimum Energy Efficiency Standards should be set to drive improvements in energy efficiency? If so, what buildings should be the early priorities for introducing minimum standards?

Yes. The most inefficient buildings should be targeted first. New build properties should be addressed through improved Building Control standards. The 390,000 domestic dwellings currently below EPC band C should be the early priority, with further consideration given to improving to band B, once a cost benefit analysis has been carried out.

Q25: Do you agree with the general scale and proposed pace of change outlined in DoF's five phase plan for building regulations? If not, please outline what achievable timescale or programme should be implemented and your rationale for this.

NIEL is not best placed to advise on building regulations but would be generally supportive of the timetable proposed but that there should be a higher level of ambition with a greater role for decentralised carbon neutral gas provision.

Q26: Do you think that we should seek to explore how the rates system can be used to encourage energy efficiency? If so, please outline key issues that would need to be considered.

Yes. NIEL understands that, for example, WWF NI previously proposed a scheme whereby rates rebate would be offered to homeowners for installing energy efficiency measures^{50,51}.

Q27: Do you agree that we should introduce a pilot domestic retrofit scheme by spring 2022, followed by a substantive scheme as part of a “one stop shop” approach? If so, what changes are needed to the wider energy efficiency support landscape to ensure a joined-up approach?

No. It is absolutely clear that the energy performance of the vast majority of buildings in NI needs to be improved, in many cases radically improved. The consultation document says on page 75

“We recognise that the current standards for new buildings in Northern Ireland need to be uplifted”

NI has for many years had higher levels of fuel poverty than any other region of the UK or Ireland. While the levels of fuel poverty fluctuate, the need for improvement in NI’s buildings is absolutely clear. As such, a pilot project is not what is needed, but a strategic, thorough, long term plan to improve the efficiency rating of NI buildings, starting with the least efficient.

The CBI⁵² has recognised the benefits of insulating properties and called for government action to

“Deliver jobs and energy savings by retrofitting homes and buildings to be more energy efficient and switch to low-carbon heating.”

The PSO should be reviewed and alternative models explored including private funding models, to provide green mortgages to low interest loans for those who are not covered by NISEPs replacement.

Q28: Do you agree that we should ring-fence the PSO funding for vulnerable consumers including the fuel poor? Please advise on changes you believe should be made to the level and scope of the PSO for energy efficiency.

Yes.

Q29: Do you believe that green private finance solutions have a role to play in supporting domestic consumers to invest in energy efficiency? If so, what specific green finance solutions should be explored?

Potentially, though government should take the lead in terms of policy and funding for such measures. Please refer to the use of rate rebates as an incentive for installing energy efficiency measures, as outlined in NIEL’s response to Q26.

Q30: Do you agree that Invest NI should deliver a pilot energy efficiency support scheme for businesses, to be followed by a substantive scheme delivered through the proposed “one stop shop” organisation. If so, what type of support do you believe is most appropriate for different groups of business consumers?

There are many schemes of this nature and as such a pilot scheme would not be necessary. There are a number of organisations who have prior experience in this area including for example, the Energy Savings Trust, Carbon Trust, Invest NI and Action Renewables.

Q31: Do you believe that green private finance solutions have a role to play in supporting non-domestic consumers to invest in energy efficiency? If so, what specific green finance solutions should be explored?

Potentially, yes, for example through grants and low interest loans to enable the installation of energy efficiency measures.

Q32: Do you agree that we should seek to develop skills and capability, enhance quality assurance and standards, and use an accreditation body to provide guarantees on work undertaken by the energy services for retrofit sector? If so, how can we help to prepare the sector for these changes?

Yes. The Microgeneration Certification Scheme (MCS) under the NI Renewables Obligation (NIRO) is generally viewed as a success and this could be expanded.

If an accreditation body is to be established, then a long term approach will be necessary to ensure that training in the necessary skills and quality management is available. This means that a decision on this would need to be taken soon.

Q33: Do you agree that information, awareness and behavioural change should be a key strand of future energy efficiency support? If so, what are the key behaviours that should be targeted?

Yes. However, simply relying on consumer choices is unlikely to bring about the levels of change needed. NIEL believes building regulations need to be change so that it is compulsory to have much more energy efficient buildings and financial incentives must be provided such as that referred to in response to Q26.

**Q34: What measures do you think can have the most impact to support people to reduce the miles they travel in private vehicles? Please explain your rationale.
Replace Fossil Fuels With Indigenous Renewables**

The Energy Strategy states on page 86 that

“Significant investments have been made in walking, cycling and public transport infrastructure in Northern Ireland to try to reduce the amount of miles that people travel in private vehicles.”

However, as the Energy Strategy also points out

“There has been little to no shift towards active or sustainable transport since the Travel Survey for Northern Ireland was first carried out twenty years ago”

It therefore seems that the investments made in active travel and public transport have resulted in minimal or no change in the uptake of those options.

According to Sustrans, the claim that significant investments have been made in walking, cycling and public transport infrastructure is debatable. According to Sustrans, in recent years the per capita spend on walking and cycling in Northern Ireland was £2. By comparison, the equivalent spend per capita in England is £7, in Wales £10 and in Scotland £25. In 2020, the Republic of Ireland committed to investing 20% of its entire transport budget on active travel and the equivalent active travel spending figure is £66 per head of population⁵³.

Rather than thinking about how to move cars through cities and around NI, the Executive needs to think about how to move people through cities and around NI. In this context, NIEL welcomes the statement in the Energy Strategy on page 86 that

“We need to take steps to help consumers to reduce travel and move towards active travel and public transport.”

NIEL believes that the NI Executive, in particular the Department for Infrastructure should do more than encourage a shift away from private car use to active transport and public transport, and should actually provide the infrastructure and services that will ensure higher levels of active travel and public transport. For example, according to the Department of Infrastructure, there were 3.7 million passenger journeys on Glider services since they were introduced on 3 September 2018 up to 31 March 2019⁵⁴ and the use of the Comber Greenway has risen by 75% between April and November 2020⁵⁵.

Greater levels of investment in broadband should also help encourage a shift away from private car use for commuting if there is more home based working. As Edmund King from the AA said in 2020⁵⁶

“in future, we should invest more in broadband because what this current crisis has shown is that the majority of companies can continue working from home, and it can be more efficient.”⁵⁷

There are other legislative and policy measures that could be adopted to encourage greater use of active travel and use of public transport including the introduction of an Active Travel Bill and an increase in investment in active travel and public transport. The private car continues to dominate day-to-day travel in Northern Ireland, with 70% of our journeys made by car and this is also reflected in the very high levels of spending on roads versus public transport in Northern Ireland, as compared to England, Scotland and Wales. According to the National Audit Office⁵⁸, in 2017-18, 59% of the NI transport budget was spent on roads with 18% spent on railways, 11% on local public transport and 12% on other transport. By comparison in England 31% of the transport budget was spent on roads, 59% on railways and 8% on local public transport. In Scotland 42% of the transport budget was spent on roads and 47% on public transport (39% on railways and 8% on local public transport). In Wales 45% of the transport budget was spent on roads and 51% on public transport (46% on railways and 5% on local public transport). NIEL would like to see a significant shift in spending so that so that the overall transport spend has at least a 50/50 split between roads and public transport, similar to the spending pattern in other UK administrations. The promotion of public transport and active travel is also crucial to delivering sustainable, low carbon solutions for connected infrastructure across Northern Ireland and can create significant economic, social and environmental benefits, and should receive greater support from the NI Executive.

The importance of having the appropriate infrastructure in place to enable an expansion in active travel was illustrated in the 2015 cycling strategy for NI ‘Changing Gear’⁵⁹, which has a three pillar approach to getting more people to cycle and these were ‘Build’, ‘Promote’ and ‘Support’. The most recent Travel Survey for Northern Ireland shows that for the period 2017-19, cycling accounts for 1% of all journeys⁶⁰.

Any active travel infrastructure must be safe and the safety of cycling infrastructure is a key issue. As outlined in Sustrans 2019 report ‘Bike Life’, concerns about safety was the top reason why people do not cycle or cycle less often. Furthermore, 80% of those surveyed said that more traffic free cycle routes away from roads would be useful to help them cycle more and 77% of those surveyed said more cycle tracks along roads physically separated from traffic and pedestrians would be useful to help them cycle more⁶¹. The provision of safe, active travel infrastructure, i.e. separate from roads, which is much more extensive should also be integrated with public transport networks e.g. greenways to bus and train stations, and the provision of bike racks at public transport stations to further encourage this shift to active travel. Also, increasing mileage allowances for travel to work by bicycle should also be applied.

Active travel also offers opportunities for increasing mental and physical wellbeing, reductions in pollution, improving air quality and economic benefits. For example, according to Cycling UK⁶², the average economic benefit-to-cost ratio of investing in cycling and walking schemes (active travel) is 13:1 while research for the UK Department of Transport found that cycling schemes can have benefit-to-cost ratios in the range of 5:1 to 19:1, with some returns as high as 35.5:1. This research also found that a typical “cycling city” could be worth £377 million to the NHS in healthcare cost savings, in 2011 prices⁶³. By comparison, according to UK Department for Transport Road Investment Strategy: Economic analysis of the investment plan⁶⁴ the benefit-to-cost ratio for bypasses and link roads is 2:1. So clearly, investing in active travel offers a very positive return on investment, generally much better than road building and on top of that, greenways can also offer opportunities for enhancing biodiversity.

According to ‘The Value of the Cycling Sector to the British Economy: A Scoping Study’ (2018)⁶⁵, cycling’s economic contribution to the UK is £5.4 billion with the larger share of this, £4.1 billion, coming from wider impacts, particularly reductions in loss of life, and reduced pollution and congestion. Products associated with the cycling industry contribute £729 million while tourism attributable to cycling contributes, at least, a further £520 million. The researchers described these as minimum estimates of the scale of the cycling economy and argued that if benefits associated with avoidance of climate change damage, reduced morbidity, improved mental health as a result of physical activity, and improved children’s health were included, there would be an additional contribution of £3.0 billion. The research also found that cycling generates around 64,000 FTE jobs in the UK including jobs in tourism, sales and repair, cycle delivery, manufacturing, and cycle infrastructure. The report compared cycling to the steel industry which in 2016 had an economic output of £1.6 billion and supported 32,000 jobs.

According to Cycling UK⁶⁶, the average economic benefit-to-cost ratio of investing in cycling and walking schemes (active travel) is 13:1. Cycling UK also state that if cycle use in the UK were to increase from less than 2% of all journeys (2016 levels) to 10% by 2025 and 25% by 2050, the cumulative benefits would be worth £248bn between 2015 and 2050 for England - yielding annual benefits in 2050 worth £42bn in today’s money⁶⁷. Also according to Cycling UK, cycle commuting employees take one less sick day each year than non-cyclists and save the UK economy almost £83m.

Denmark is one of the leading cycling countries in Europe and academics who studied the cost benefit analysis for cycling in the UK referred to Copenhagen⁶⁸. A 2016 study⁶⁹ in the Capital Region of Denmark found that in terms of value for money per mile of infrastructure, cycling delivered a socioeconomic return of 19%. According to the Danish Ministry of Transport⁷⁰, in order for a project to be socio-economically profitable its internal rate of return should be compared to an internal rate of return of 4%. The internal rate of return on the cycle superhighways in the Danish Capital Region was 11%, compared to a 4% return on the Harbour Tunnel new eastern ring road in Copenhagen⁷¹. A cost-benefit analysis of cycling in Denmark found that when all factors are calculated, society gains DKK 4.79^b per

^b Based on the exchange rates on 2nd July 2021 DKK 4.79 DKK equates to £0.55 pounds sterling or €0.64 and DKK 5.29 equates to £0.61 pounds sterling or €0.71

kilometre cycled, primarily due to the large health benefit, whereas it costs society DKK 5.29 for every kilometre driven by car⁷². Research by the Confederation of Danish Industry found that if 10% more kilometres are cycled there will be an annual socio-economic gain in Denmark of DKK 1.1 billion (€150 million)⁷³. Research for the City of Copenhagen in 2018 found that the societal level health benefits derived from walking make it the most profitable transport mode from a cost-benefit point of view, with a societal gain of DKK 7.4 per kilometre walked (€1)⁷⁴.

In summary, it seems that accounting for the social, recreational, health and economic benefits it generates, there should be much greater investment in cycling, and active travel and public transport.

Q35: Do you agree with setting a 70% renewable electricity target by 2030, whilst retaining the flexibility to increase this to 80%?

Yes. In fact, there should be flexibility for having even more than 80% of RE by 2030 if the transmission and distribution network is able to deal with those levels of RE.

Q36: Do you agree with the criteria identified that would allow in order to consider any future increases in the renewable electricity target? a) Projects can be delivered in a cost-effective manner. b) Offshore wind can be delivered by 2030. c) Storage technologies can minimise system curtailment of renewables. d) Greater clarity on electricity demand for heating and transport. e) Consumers' bills are not disproportionately impacted. If not, what alternative criteria might be used?

Yes.

However, one important consideration that has not been mentioned is need for an appropriate assessment of the overall environmental impact of proposed developments. NIEL supports the development of renewable energy as a means of tackling climate change but we face both a climate crisis and a biodiversity crisis as illustrated by the declaration of both a climate crisis and a biodiversity crisis by the Northern Ireland Assembly on 3rd February 2020⁷⁵. Therefore, the Department for the Economy, in conjunction with DAERA and other relevant departments, must ensure that renewable energy developments designed to tackle the climate crisis should not have a negative impact on biodiversity.

The State of Nature Report (2019)⁷⁶ clearly demonstrates that Northern Ireland's terrestrial, air, water, and marine environments are suffering. According to the State of Nature report, of the 2,450 species found in Northern Ireland that have been assessed using the IUCN Regional Red List criteria, and for which sufficient data were available, 272 (11%) are currently threatened with extinction from Ireland as a whole. According to the DAERA

^c Based on the exchange rates on 2nd July 2021 DKK 7.4 equates to £0.86 pounds sterling or €1.00

Environmental Statistics Report 2020,⁷⁷ 35% of the features in NI's Areas of Special Scientific Interest (ASSIs) are in unfavourable condition and according to the statistics on freshwater quality standards released in August 2020⁷⁸, 95% of NI's lakes are now failing Water Framework Directive quality standards with only one lake out of twenty one in Good condition in 2019.

It is therefore important to note that when developing renewable energy sources, on land or in the seas, they should be subject to detailed ecological impact assessments to ensure that the right technology is deployed in the right place, in harmony with nature, so as to avoid negative impacts such as those resulting from hydropower installations which have been known to cause problems for migratory fish species like Atlantic salmon. There have also been issues with wind farms on peatlands and the impacts of wind turbines on bats which can die from barotrauma (tissue damage to air-containing structures caused by rapid or excessive pressure change) or blade strike⁷⁹.

NIEL therefore supports the recommendation by Ulster Wildlife that the Department for the Economy considers the approach proposed by Natural England relating to offshore wind developments, namely that each project builds in plans to actively enhance nature and mitigate any negative impacts on the marine environment⁸⁰.

As the Natural England Technical Note states⁸¹

“For nature to thrive, offshore wind should aim not only to avoid and limit environmental impact but to contribute to nature recovery and enhancement. We want all developments to provide benefits for nature over and above those required for avoidance, mitigation and compensation, contributing to tackling both climate and biodiversity emergencies.”

According to Natural England, nature enhancement mechanisms include Net Gain, which it defines as “an approach to development that aims to leave the natural environment in a measurably better state than beforehand” and which Natural England describes as an emerging area in marine sustainable development which offers great opportunities. Natural England makes the point that

“To be most effective, a toolkit should set out where and how Net Gain can be delivered at national scale, so these considerations are built into early strategic planning.”

There is potential for offshore wind farms to enhance biodiversity as for example, the wind turbines can act as an artificial reef⁸², but it is important that any such development is appropriately planned and assessed to ensure that new projects demonstrate net environmental gain.

Q37: Do you agree that we should explore with BEIS the possibility of extending the Contracts for Difference scheme to Northern Ireland? If so, what terms would be needed to ensure generation in the region whilst protecting consumers?

Yes, on the basis that CfD can protect customers and providers alike by offering security and stability of price for electricity. However, the limits for CfDs should be reviewed with a view to setting the lower limit of CfDs at 500kW.

Q38: Do you believe it is possible that an offshore wind project in Northern Ireland could be operational before 2030? If so, please outline what targeted actions could be taken to deliver this.

Yes, although NIEL is not best placed to say how long an offshore wind farm will take to install and be operational. NIEL supports the stated intention of the department to develop a targeted action plan to bring forward offshore wind and marine renewables in Northern Ireland. This strategic forward planning is essential, as NIEL is aware of previous applications for offshore wind farms that have failed to materialise. As previously stated, particularly in NIEL's response to Q36, it is important that renewable energy sources should be subject to detailed ecological impact assessments to ensure that the right technology is deployed in the right place, in harmony with nature, so as to avoid negative environmental impacts and to benefit nature. This applies in the marine environment as much as the terrestrial environment. There will also be a need for greater investment in the grid infrastructure to accommodate off-shore electricity being transmitted to the grid.

Q39: Do you believe that a fixed platform offshore wind project should be targeted to be part of the renewable generation mix? If so, how would you propose some of the challenges associated could be overcome?

Q40: Do you believe that floating platform offshore wind offers the best long-term opportunities for offshore wind in Northern Ireland's waters? If so, what additional steps could be taken to encourage these projects?

This is a response to Q39 and Q40.

NIEL is not best placed to evaluate the relative benefits of fixed and floating offshore wind turbines but would generally be of the view that there is huge potential for offshore wind, be that in fixed or floating platforms, that should be developed to a greater extent than has been thus far, but that any such installations must be undertaken where appropriate and in a sensitive manner to ensure there is no environmental damage to sensitive, high value habitats or species, wherever they are located, be they fixed or mobile. As well as being less expensive, fixed wind farms also have the advantage of acting as artificial reefs which is beneficial for marine biodiversity. Any proposals to develop marine based renewable energy

projects will require a thorough and appropriate assessment of the environmental impacts and this will in turn mean that the Northern Ireland Marine Plan will need to be updated and that a marine spatial planning framework is adopted.

Q41: Do you believe that other marine renewables can play a key role in our renewable generation mix? If so, please identify what technologies offer the greatest potential and what steps can be taken to support these.

Yes. In fact the potential for marine based renewable energy sources has not been fully developed. The Marine Current Turbine that was tested in Strangford Lough illustrated some of the potential for marine based renewable energy in NI and NIEL is aware of proposals for marine based renewable projects off the coast of North Antrim. Obviously there will need to be extensive negotiations with stakeholders, particularly landowners in the development of any such project but there is potential for marine based renewables to expand and make a much greater contribution to renewable electricity in NI. According to Foras na Mara/the Marine Institute⁸³ and SEAI⁸⁴, Ireland possesses one of the richest wave and tidal energy climates in the world with the wave energy resources potentially available to Ireland of 21TW of accessible electricity, able to meet 75% of the Republic's electricity requirement⁸⁵. According to the Marine Renewables Industry Association in Ireland,⁸⁶ Ireland has about one-third of all of the current European Union's total renewable energy resource based on all sources of energy.

According to the SEAI report "Assessment of the Irish Ports & Shipping Requirements for the Marine Renewable Energy Industry" June 2011⁸⁷, a study carried out by the Irish Department of Public Enterprise and the Northern Irish Department of Enterprise, Trade and Investment in 2000 – Assessment of offshore wind energy resources in the Republic of Ireland and Northern Ireland – states that the total wind resource within 12 nautical miles (22.2km) of the Republic's territorial waters is estimated at approximately 1,018 TWh/year, from 3.0 MW turbines at grid spacing of 500m. The Assessment of offshore wind energy resources in the Republic of Ireland and Northern Ireland from 2000 states that the total wind resource within 12 nautical miles (22.2km) of Northern Irish territorial waters is approximately 187 TWh/year from 3.0 MW turbines at grid spacing of 500m. More recently the Offshore Renewable Energy Development Plan published in 2014 identified a total development potential of 31,100MW of wave energy in Ireland that could be extracted without having likely significant adverse effects on the environment⁸⁸.

It would be important for the potential for marine based renewable energy sources in NI waters to be fully and properly evaluated in a strategic spatial plan.

Q42: Do you agree that a strategic approach to planning the location of renewable projects should be taken? If so, please outline practical steps that could be taken to deliver this.

Yes, in fact this is essential. While the potential for all renewables in NI is likely to be lower than that in the Republic of Ireland, the baseline potential must be quantified and mapped to ensure development of renewables is situated in the most appropriate places. Taking a strategic approach to planning the location of renewable projects should provide greater clarity in the decision making process and as a result facilitate more rapid decisions and delivery of appropriate projects.

Q43: Do you believe that there should be a requirement for renewable developers to share some of the financial benefits of developments with local communities? If so, what share do you think would be reasonable? If not, please provide your rationale. Energy Strategy for Northern Ireland Consultation on Policy Options 15

Yes.

There is also the option for community ownership of renewable energy developments. This approach has been established in Scotland for over twelve years. In NI for example, Drumlin Wind Energy Co-op⁸⁹ owns and operates a number of community owned wind turbines. Northern Ireland Community Energy (NICE) is a local community energy co-operative⁹⁰ in Northern Ireland which offers the opportunity for communities to invest in renewable energy projects.

In Germany citizen owned power generation has played an important role in the development of renewables for more than twenty years. In Germany, various legal forms of ownership have allowed citizens to own solar parks and wind turbines. The most common forms are energy co-operatives (Energiegenossenschaften) and the hybrid "GmbH & Co.KG"⁹¹ (limited liability company & limited partnership). In 2018, Germany's total installed renewable energy capacity (without pumped storage) was 100.3 gigawatts (GW), of which 31.5% was owned by private individuals and another 10.5% by farmers, bringing citizens energy ownership in the narrower sense to 42%, down from 46% in 2012⁹². The possibility of a centrally-delivered "community fund" that could be sourced from a generation levy on fossil-fuel electricity generation is another option that is worth exploring.

Q44: Do you agree with taking separate approaches to on-gas grid and off-gas grid consumers? If not, what approach should be taken?

NIEL is unclear why the Energy Strategy states on page 99 that "Our overall objective has to be to remove all, or almost all, fossil fuel heating sources in Northern Ireland by 2050." Surely for NI's energy to be decarbonised all fossil fuels must be eliminated by 2050 if not

before and qualifying the stated objective by saying “almost all” fossil fuel heating sources are to be eliminated is incongruous.

The strategy document also said that “there is likely to be parallel on-gas grid and off-gas grid approaches.” This appears to be a reasonable suggestion, but this is not the same as separate approaches being taken to on gas and off gas grid customers. NIEL understands that the potential options available to customers on the gas grid may differ to those options available to those off the gas grid and would wish to see co-ordination of approach and consistency of approach which is based on decarbonisation of energy when helping customers move away from a fossil fuel based heating system while accounting for the differing circumstances of connection to the gas grid.

Q45: Do you agree that we should not rule out potential low and zero carbon heat solutions at this stage? If not, please outline your rationale.

NIEL would suggest that as a rule NI should move to zero carbon heat solutions as quickly as possible. If low carbon heating solutions are allowed as an interim measure then depending on the nature/carbon intensity of that option, it is highly likely that those low carbon heating options will need to be upgraded or replaced by zero carbon options. As such, if existing heating options are to be replaced it would be more efficient and less expensive to make one change to that heating system rather than two changes.

NIEL agrees with the statement in the Energy Strategy that heat pumps will play a role in the decarbonisation of heat, and we do not see any viable pathway to reach net zero carbon which does not use this technology, but the cost of heat pumps presents a potential obstacle. The Energy Saving Trust estimates that a typical air source heat pump installation will cost you around £6000 – £8000, and a ground source heat pump installation can cost £10,000 – £18,000 depending on the amount of heat required⁹³so the levels of support/incentives available to homeowners to install such renewable heating options will be key.

Q46: What low and zero carbon heat solutions do you believe we should prioritise for trials? Please identify where such trials should be focused and what key issues should be tested within each.

Potentially the following low and zero carbon options could be prioritised: biogas and hydrogen injection into the gas grid; large scale (over 1MW) biomass or geothermal heat in industrial settings; heat pump performance on retrofit dwellings and medium and deep geothermal district heating

Q47: Do you believe that the role of heat pumps will be different depending on whether consumers are on or off the gas grid? Please outline what you think the specific roles should be.

No comment

Q48: Do you agree that Northern Ireland should develop a pilot grant scheme to support low carbon heat technologies for domestic and small non-domestic consumers? If so, please identify key issues that need to be considered in designing and delivering such a scheme.

Potentially, yes.

Q49: Do you agree that legislative and regulatory steps should be taken to facilitate biomethane injection into the gas network?

Yes. NIEL believes that there is potential for decarbonisation of the gas grid, through the inclusion/injection of hydrogen and/or biogas into the existing gas network, but other organisations, such as B9 energy and Action renewables would be better placed to quantify the potential for this.

Q50: Do you believe that support should be provided to encourage biomethane production for injection into the gas network? If not, please outline what alternative approach should be taken to decarbonising the gas network.

Yes. There is potential for the use of biomethane in the existing gas network NI. As regards the Republic of Ireland, according to the SEAI "Assessment of Cost and Benefits of Biogas and Biomethane in Ireland" biogas production could be 1,044 ktoe (43.7 PJ) of primary energy equivalent which was roughly 28% of Ireland's natural gas supply in 2015 and could create over 5,000 jobs in the construction of the AD plants and up to 3,000 permanent jobs in the operation of those plants. NIEL is not clear on the potential of biomethane in NI but this is one of the aspects of bioenergy that should be clearly evaluated. NIEL understands that NI could learn from the Green Gas Support Scheme currently being developed by Ofgem in relation to the potential use of biomethane for injection into the gas network.

Q51: Do you agree that the local Gas Network Operators should develop and publish a plan to decarbonise gas out to 2050? If so, what key issues must be considered within it?

Yes, although this should be with the ultimate aim of eliminating all fossil fuel base gas use no later than 2050.

Q52: Do you agree that the sale and installation of new oil boilers should not be allowed for consumers on the gas grid? Please outline your rationale and, if you agree, what a viable timeline for introducing this might be?

Yes, on the basis that we need to eliminate the use of fossil fuels.

Q53: Do you believe that off-gas grid consumers should have the option to retain oil boilers for use with biofuels? If not, what is a viable timeline for introducing a ban on the use of all oil boilers?

That depends on the potential for and suitability of heating homes with biofuels as there is an issue in relation to how sustainable some biofuels are. For example, palm oil which has been produced from palm oil plantation that have been cultivated on what was formerly rainforest as has been widespread in Indonesia for example, is not sustainable. As such the issue may well be the volume of biofuels that will be required and the ecological footprint of those fuels.

Q54: Do you agree that the local Oil Industry should develop and publish a plan on how biofuels could play a role in decarbonising heat out to 2050? If so, what key issues must be considered within it?

No. While NIEL would support the local oil industry helping to plan out the transition away from fossil oil to renewable fuels that needs to have been completed long before 2050. Furthermore, as the Energy Strategy refers to, heat pumps are likely to replace fossil fuel oil boilers and as such prolonging the life of such boilers may well hinder the progress of alternative non fossil fuel based heating systems.

Q55: Do you believe that support should be introduced to promote the uptake of biomass for off-grid consumers? If so, please advise on what support is needed and where it should be focused.

Potentially yes, but it would require careful management in terms of the life cycle analysis of its ecological footprint. There is potential for much more energy, heat and electricity, especially in Combined Heat and Power (CHP) plants, to be produced from biomass in NI.

However, as was outlined in response to Q53 above, the potential for and suitability of using biomass for all customers depends on how sustainable the biomass is. For example as the Ecologist⁹⁴ and Channel 4's Dispatches reported, huge areas of hardwood forest in the state of Virginia and in southern parts of the US are being cut down, sometimes clear felled, to create biomass energy which is used in Britain in Drax power station for example. Clear felling of any long established native forest is unlikely to be truly sustainable. According to The Ecologist, because biomass is viewed as 'carbon neutral' under European rules, this means power stations like Drax are not obliged to officially report the carbon emissions coming out of its chimney stack and that C4's Dispatches calculated that if Drax were to report on the full extent of its emissions it would show that in 2017 that amounted to 11.7 million tonnes of CO₂.

Advice as to the sustainability criteria that are to be applied to biomass is available from a number of NGOs. For example WWF⁹⁵ has argued for legally binding sustainability criteria for biomass for electricity, heating and cooling in order to ensure that:

- There is full accounting of carbon emissions from biomass to allow prioritisation of biomass based on their real GHG mitigation potential, as well as the efficient use of biomass.
- There is zero use of valuable land in order to protect biodiversity and the ecosystem services of forests or restricted use in line with the management criteria for these areas.
- There is implementation of sustainability principles for forest management.
- Internationally proclaimed human rights are respected, including customary and statutory tenure and use rights, and the right to give free and prior informed consent.
- These principles are implemented in a credible way.

Q56: Do you agree that the sale of coal and wet wood should be banned in Northern Ireland? If so, do you believe this should be extended to include other solid fuels with the exception of kiln dried wood?

Yes. On the basis that NI, like the rest of the UK, will need to achieve net zero carbon by no later than 2050, based upon the 2019 legislation (The Climate Change Act 2008 (2050 Target Amendment) Order 2019)⁹⁶, though this target date may be brought forward, then NIEL would support a ban on the sale and importation of all forms of coal in to Northern Ireland, so that coal is completely phased out as a fuel source. The sale of wet wood should also be banned, although that may not completely eliminate the burning of unseasoned wood as anyone could burn unseasoned wood that has not been purchased.

Q57: Do you agree that we should develop a Northern Ireland specific strategy that sets an overarching, long-term plan for cleaner, greener transport and shows how we will meet net zero emissions within the transport sector? If so, what Northern Ireland specific issues need to be factored into this in order to accelerate the uptake of Zero Emissions Vehicles?

Yes

As previously referred to in NIEL's response to question 13, the CCC has made clear the importance of integrating net zero decisions in to all policy making and procurement strategies and that ⁹⁷:

“Business models that are not compatible with a Net Zero future are increasingly risky.”

Therefore a green investment strategy would be important if not essential as part of the long term strategic plan the needs to be developed to ensure that as a minimum the NI energy sector reaches net zero carbon. Though in all likelihood this will need to be part of a broader long term strategic plan for how NI can achieve net zero GHGs by 2050 or earlier.

Q58: Do you agree that an EV communication campaign should be run in Northern Ireland? If so, what key messages would be most impactful for consumers as part of this?

Yes but addressing the issues with the charging network should come first. There must be a reliable network for EV charging available before widespread promotion of EVs, otherwise there is a risk that consumers may buy EVs only to find that the recharging network falls short as that would generate

negative attitudes and publicity which a communication campaign could find hard to counter.

Q59: Do you agree that the private sector and local government have a key role to play in developing EV infrastructure? If so, what barriers can government address to ensure that such projects are commercially viable?

There may be a role for the private sector and local government in developing EV infrastructure but this should be explored further, along with other stakeholders including the energy companies who could advise on planning, pricing and grid connection issues. However, given the UK target to phase out diesel and petrol cars there is a need for a clear plan for the expansion of the EV charging infrastructure to be developed as a matter of urgency so the development of the infrastructure always runs ahead of demand based on the rates of EV ownership rather than lagging behind it.

Q60: Do you agree that we should develop an EV Charging Infrastructure Plan in collaboration with public and private partners? If so, what should the key priorities of the plan be?

NIEL is not best placed to comment on the economic structures of the EV infrastructure but believes that the department should be developing an EV charging infrastructure plan in the very near future as outline in NIEL's response to Q59 and the department should be open to working public and private partners if it will produce better outcomes.

Q61: Do you agree that public sector contracts can be a key driver for developing technologies and markets for alternative fuel vehicles? If so, what specific opportunities are there that could be progressed?

Yes, as referred to in our response to Q14 procurement expenditure accounts for some £3bn annually, representing a quarter of the NI Executive's budget⁹⁸ so the NI Executive could play a very significant role in driving the market for alternative technologies and fuels. NIEL believes that the NI Executive should lead by example and so public sector contracts should seek to support and promote zero carbon technologies and markets. One option is for public procurement policy to require that public sector fleets be electric vehicles or alternatively fuelled, and investment is made in a support infrastructure for refuelling within government estates.

Local authorities should set targets for their own operations to be zero net carbon by 2050. There are a number of bodies that could advise local councils on how to reduce their environmental, including on how to decarbonise their operations. Including Sustainable NI, who can advise councils how to make their operations more sustainable and Climate NI who can advise on how a council can adapt to climate change. Fermanagh and Omagh District Council has for example, bought electric vehicles for council staff to use. Reducing energy demand and/or using renewable energy as well as reducing miles travelled for council business through the use of video conferencing are other simple options for reducing the ecological footprint of a council's operations. Taking actions to reduce the energy consumed by a council would be in line with the statutory duty in the Northern Ireland (Miscellaneous Provisions) Act 2006 Section 25⁹⁹, that

"a public authority must, in exercising its functions, act in a way it considers best calculated to contribute to the achievement of sustainable development in Northern Ireland ..."

Q62: Do you agree that collaborative research will be important to demonstrate alternative fuels? If so, what are the best routes to identify and progress potential projects?

Yes, although this is an area that has been quite well researched but any such research should reflect the ambitions of the Energy Strategy.

Q63: Do you believe that Compressed Natural Gas/Liquid Natural Gas and/or synthetic fuels can play a role as an interim measure to decarbonising transport? If so, how can government help to encourage the private sector to trial and use these fuels?

NIEL agrees with the sentiment expressed in the Energy Strategy on page 113 that we cannot wait ten to fifteen years to decarbonise transport and so more immediate solutions are needed. However, as Compressed Natural Gas (CNG) and Liquid Natural Gas (LNG) are carbon based fossil fuels, NIEL believes that these fuels should be phased out as soon as possible.

Q64: Do you believe that CCUS can play a role in Northern Ireland? If so, what potential applications could be the initial focus for demonstration projects?

NIEL does not have a position on CCUS but the potential role for CCUS, particularly in relation to the availability of suitable sites, the efficacy, particularly at a large scale, and the economic viability of such options is unclear at this moment. Overall, CCUS is an unproven technology. As the consultation document says on page 116, the CCC believes that Northern Ireland is not an ideal place to locate these CCUS technologies and so the Department does not intend to develop a policy regime to store carbon at sites onshore in NI. As such NIEL believes the potential role for CCUS in NI is likely to be very limited.

Related to this, NIEL believes that the priority must be on reducing carbon and GHG emissions through the elimination of fossil fuels. Any carbon that needs to be removed should first of all be removed by nature based solutions (NbS) including through habitat restoration and creation, for example, appropriate tree planting, wetland restoration, especially peatlands, the protection and creation of blue carbon habitats (the carbon stored in coastal and marine ecosystems¹⁰⁰) and careful soil management. Unfortunately, many of our ecosystems are in poor condition. These NbS have already been proven, are necessary because, NI is the only UK region where the land use change sector acts as a net emitter of GHGs rather than a sink.¹⁰¹ Using nature based solutions would also reflect the recommendations of the CCC in its Sixth Carbon Budget report¹⁰² which outlined some of the main policies for reducing emissions from land use and agriculture including afforestation, restoring and protecting peatlands and growing energy crops. Nature based solutions can help biodiversity while creating jobs and so should be the priority for carbon sequestration. In their 2020 report, the RSPB, WWF and the Nature Based Solutions Initiative¹⁰³ outlined how nature based solutions can deliver multiple benefits for climate

change adaptation, mitigation, biodiversity, health and the economy supporting affair and resilient economic recovery from the Covid-19 crisis with significant potential for creating green jobs.

Q65: Do you believe that our approach to petroleum licensing should change in line with our commitment to decarbonise energy?

Yes. In fact, it would be inconsistent and illogical not to do so.

NIEL is opposed in principle to fossil fuel exploration (both onshore and offshore) in Northern Ireland, including the pursuit of unconventional gas sources through fracking. Notwithstanding the potential environmental consequences, the long-term economic fortunes and well-being of society would be better served through investment in renewable energy infrastructure (job creation, security of supply, cleaner air, water and land). NI's approach to petroleum licencing needs to be changed so that is accurately reflects NI's commitment to decarbonise energy.

The CCC outlined the many benefits of achieving net zero in a letter to the AERA Minister dated 1st April¹⁰⁴ when it said

“A slower path to decarbonisation in Northern Ireland would bring large-scale risks that would be difficult to manage”

“In addition to green recovery opportunities and the investment requirements and operational savings, there is overwhelming evidence that reducing greenhouse gas emissions will be beneficial to public health in Northern Ireland.”

The CCC also said in this report that

“Business models that are not compatible with a Net Zero future are increasingly risky.”

This makes a strong case for shifting investment from high carbon fossil fuel based energy sources to renewable energy sources as quickly as possible.

Q66: Do you agree that the Electricity Network and System Operators should produce a pathway to creating a flexible and integrated energy system? If so, please provide evidence to demonstrate what the initial priorities of such a plan be?

Yes. NIEL would suggest that a more flexible and integrated system will be needed to incorporate more renewable energy sources, especially when those sources are intermittent, to allow for a broader range of renewable sources to contribute to the energy mix. However, NIEL believes there is also a role for much more decentralised renewable energy. Also the development of a Smart grid should help with the timing and cost of charging and EV and the opportunities that exist for EV's to act as short term storage for electricity that could be pumped back in to the grid at times of need.

Q67: Do you agree that conventional power generation can play an important role in the pathway to decarbonised energy? If so, what opportunities and barriers exist for such plants?

On balance no, but this is based upon the current interpretation of what is meant by the term 'conventional power generation' because the nature of power generation will have to change, most notably through the elimination of fossil fuels. Certainly the current role for what are referred to as 'conventional' fossil fuelled power stations must end. It is possible that some existing power stations could be repurposed to run on renewable sources, including biomass, though some of the sustainability issues with biomass have already been outlined in response to Q55 but it seems likely that the nature and sources of energy for power stations will have to change.

There is a potentially important role for greater storage which can help to accommodate variable renewables onto the system. Northern Ireland has recently begun to see a number of battery storage projects, with an estimated 184MW of storage potential in the pipeline.

Q68: Do you believe that further interconnection will be needed in the future? If so, is a new revenue mechanism needed to bring forward this investment?

On balance, yes. NIEL believes the completion of the second North-South Interconnector is an essential step in facilitating the expansion of the provision of renewable electricity (from wind power in particular). According to Eirgrid¹⁰⁵ the N-S Interconnector

“will help to improve the efficiency of the electricity system, reducing costs and ultimately saving money for the end user, the electricity customer.”

Eirgrid also say that the N-S interconnector will also help in facilitating the connection of more renewable electricity generation to the grid and the import and export of any surplus

renewable electricity. This would also help address the issue of the lack of a route to market for low cost intermittent renewables, which was one of the CCC's policy priorities. According to a 2017 report by Grant Thornton for IBEC and CBI Northern Ireland¹⁰⁶, the Economic and Social Research Institute (ESRI) estimated in 2014 that the interconnector will facilitate a 2.6% reduction in carbon emissions.

Q69: Do you agree that our power system should be based around flexible solutions to align demand and supply? If so, please advise on what key decisions are needed to achieve this.

Yes. This should help 'future proof' the system by amongst other things, accommodating small and medium scale generators including community scale generators, while enabling them to respond collectively to variations in demand. The Utility Regulator for Northern Ireland (UREGNI), promotes the principles of democratisation, digitalisation, decentralisation and decarbonisation.

Q70: Do you believe that the SEM and DS3 offer sufficient market routes to support the deployment of flexible technologies for generators of all sizes? If not, please provide evidence to demonstrate what additional market routes may be needed.

Potentially, though NIEL is not best placed to comment on these mechanisms.

Q71: Do you agree that a policy framework should be put in place to enhance access to and use of consumer data? If so, please outline key considerations that need to be factored into this framework.

Yes, on the basis that this will assist the planning and delivery of energy generation and supply.

Q72: Do you believe that we should take forward the Energy Data Taskforce recommendations in Northern Ireland? If so, please advise on key differences with Great Britain that need to be factored in.

No comment.

Q73: Do you agree that a Cost Benefit Analysis of smart meters should take into account the broader benefits they can bring to consumers as an enabler of energy data and a smart system? If the CBA for smart meters is not positive, what alternative approaches can be taken to deliver these benefits for consumers?

Yes.

Q74: Do you believe that financial support should be provided for micro-generation to increase the number of active consumers in Northern Ireland? If so, what should this support look like? If not, what are the alternatives?

NIEL is not best placed to advise on the specific details of a potential future support scheme but is generally supportive of support schemes to increase microgeneration of renewable energy such as Feed in Tariffs (FiTs).

Q75: Do you agree that network charging in a decentralised energy system will need to change? If so, what are the principles that should be adopted in distributing future network costs across consumers?

NIEL is not best placed to answer this but would be supportive of greater decentralisation of energy production.

Q76: Do you believe that a new regulatory framework is needed to protect consumers who engage in decentralised arrangements? If so, what consumer protection measures should be part of this?

NIEL is not best placed to comment on this issue but would be supportive of greater decentralisation of energy production.

Q77: Do you believe that energy communities have a role to play as part of the energy transition? If so, what support is needed to progress these? If not, what are the alternatives?

Yes. There is also the option for community ownership of renewable energy developments. This approach has been established in Scotland for over twelve years. In NI for example, Drumlin Wind Energy Co-op¹⁰⁷ owns and operates a number of community owned wind turbines. Northern Ireland Community Energy (NICE) is a local community energy co-operative¹⁰⁸ in Northern Ireland which offers the opportunity for communities to invest in renewable energy projects. In the Republic of Ireland, the Sustainable Energy Authority of Ireland (SEAI) has developed a model for Sustainable Energy Communities (SECs).

NI could also learn from the approach taken in Germany, where citizen owned power generation has played an important role in the development of renewables for more than twenty years. In Germany, various legal forms of ownership have allowed citizens to own solar parks and wind turbines. The most common forms are energy co-operatives

(Energiegenossenschaften) and the hybrid “GmbH & Co.KG”¹⁰⁹ (limited liability company & limited partnership). In 2018, Germany’s total installed renewable energy capacity (without pumped storage) was 100.3 gigawatts (GW), of which 31.5% was owned by private individuals and another 10.5% by farmers, bringing citizens energy ownership in the narrower sense to 42%, down from 46% in 2012¹¹⁰.

Q78: Do you agree that the potential of geothermal energy should be further explored, supported by a legislative and regulatory framework? If so, what applications do you believe there are for geothermal energy in Northern Ireland?

Yes and NIEL would recommend the Department consult stakeholders, in particular the Geological Survey of Northern Ireland (GSNI) in relation to the potential for geothermal heating in NI.

NIEL understands that an assessment of the potential for geothermal heating in NI has been done¹¹¹. This research concluded that there is widespread potential for geothermal heating in Northern Ireland with the Lower Permian Sandstones in the Larne-Antrim area having the highest potential. It has been estimated that 81 thermal MW of geothermal energy could have been developed in NI by 2020 and that would equate to approximately 31.5% of the renewable heat target of 1,300 thermal GW by 2020¹¹². NIEL understands that the Lyric Theatre in Belfast is in part powered by geothermal energy, so it is currently an option for NI. In an Assembly debate on 6th October 2014, a motion was passed¹¹³ which called on the (then DETI) Minister

“to ensure that appropriate legislation and incentives are in place to support the development of this industry”.

Q79: Do you agree that further trials of heat networks should be carried out? If so, what key issues do you think should be tested through these?

Yes. In particular the potential for CHP power stations and the potential for using excess or unwanted heat.

-ENDS-

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<https://www.grantthornton.ie/globalassets/1.-member-firms/ireland/insights/publications/grant-thornton---north-south-interconnector.pdf>
- ¹⁰⁷ Drumlin owns and operates 6 x 250kW turbines after raising £3.7 million in 2 successful share offers. In 2012 the co-operative raised £2.7m to build 4 turbines across Northern Ireland and in 2014 raised a further £1.2m to construct two more community owned and managed turbines
- ¹⁰⁸ <http://www.nicomunityenergy.org/>
- ¹⁰⁹ <https://www.gtai.de/gtai-en/invest/investment-guide/establishing-a-company/company-forms/gmbh-and-co-kg>
- ¹¹⁰ <https://www.cleanenergywire.org/factsheets/citizens-participation-energiewende>

¹¹¹ The Geothermal Potential of Northern Ireland Pasquali, R., O'Neill N., Reay D and Waugh T. Proceedings World Geothermal Congress 2010 Bali, Indonesia, 25-29 April 2010 <https://www.geothermal-energy.org/pdf/IGAstandard/WGC/2010/1625.pdf>

¹¹² <https://www.theyworkforyou.com/ni/?id=2014-10-06.7.13>

¹¹³ <https://www.theyworkforyou.com/ni/?id=2014-10-06.7.13>