



Rialtas na hÉireann
Government of Ireland

Draft National Energy & Climate Plan (NECP) 2021-2030

December 2018

GENERAL FRAMEWORK FOR INTEGRATED NATIONAL ENERGY AND CLIMATE PLANS

Part 1

General framework

SECTION A: NATIONAL PLAN

1. OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

1.1. Executive summary

i. Political, economic, environmental, and social context of the plan

The current Government is a minority coalition of *Fine Gael* (member of the European People's Party (EPP)) and Independents, and has been in office since May 2016. Ireland's current Programme for Government is entitled *Programme for a Partnership Government*.¹

The Department of Communications, Climate Action, and Environment (DCCAE) (the Irish energy and climate ministry) is responsible for the development of Ireland's energy and climate policies. The Department's Statement of Strategy 2016-2019² provides an overview of the current policy strategy.

Ireland's long-term energy policy framework is set out in the 2015 Energy White Paper, *Ireland's Transition to a Low Carbon Energy Future 2015-2030*.³ This sets out a framework to guide Irish energy policy in the period up to 2030 and sets out a vision for a profound transformation of Ireland's energy systems; moving to lower emissions fuels and ultimately towards a lower reliance on fossil fuels; significantly increasing renewable generation; achieving a step change in energy efficiency performance; implementing smart and interconnected energy systems; strong regulatory structures and markets to underpin these changes; and repositioning energy consumers to have a more active role within the energy sector.

Ireland's long-term climate policy framework is set out in the 2017 *National Mitigation Plan*⁴. This is a whole-of-Government plan, which reflects on the central roles of electricity generation, the built environment, transport, and agriculture. The measures to be implemented through the National Mitigation Plan will lay the foundations for transitioning Ireland to a low carbon, climate resilient, and environmentally sustainable economy by 2050. The National Mitigation Plan does not provide a complete roadmap to achieve the 2050 objective, but begins the process of development of

¹ [https://merriionstreet.ie/MerrionStreet/en/ImageLibrary/Programme for Partnership Government.pdf](https://merriionstreet.ie/MerrionStreet/en/ImageLibrary/Programme%20for%20Partnership%20Government.pdf)

² <https://www.dccae.gov.ie/en-ie/news-and-media/publications/Documents/20/Statement%20of%20Strategy%202016-2019.pdf>

³ <https://www.dccae.gov.ie/documents/Energy%20White%20Paper%20-%20Dec%202015.pdf>

⁴ <https://www.dccae.gov.ie/documents/National%20Mitigation%20Plan%202017.pdf>

medium- to long-term mitigation choices for the next and future generations. This ongoing process will involve the preparation of successive National Mitigation Plans at least every five years.

Ireland's long-term national vision for environmental policy is underpinned by a broader sustainable development policy framework, "*Our Sustainable Future*"⁵. The focus of the ministry includes promoting good air quality, maintaining public confidence in relation to nuclear safety and radiation protection, ensuring a sustainable waste policy, promoting access to information on the environment, and supporting the Environmental Protection Agency (EPA) in the performance of its legislative mandate to protect and improve the environment.

The Department of Transport, Tourism and Sport is the ministry responsible for Ireland's Transport policy. The National Policy Framework on Alternative Fuels Infrastructure for Transport in Ireland: 2017 to 2030⁶ represents a first step in communicating a longer term vision for the Irish transport sector. It sets an ambitious target that by 2030 all new cars and vans sold in Ireland will be zero emissions (or zero emissions capable) with the use of fossil fuel vehicles rapidly receding. The Framework outlines the main fuel options that could provide alternatives to oil in transport, namely: electricity, hydrogen, biofuels, and natural gas, in the forms of compressed natural gas (CNG), liquefied natural gas (LNG), and liquefied petroleum gas (LPG). It is likely that electricity will fuel the majority of passenger cars, commuter rail and taxis, while natural gas and biofuels will play an increasingly important role for larger vehicles such as heavy goods vehicles and buses. Hydrogen use is also anticipated to increase its penetration across the entire fleet spectrum in the coming decades but not in the short-term.

In recent years, the Irish economy has made a strong return to growth since the sharp economic downturn that began in 2008. This has contributed to the restoration of stability in the public finances. The official macro-economic outlook forecasts growth of an average of over 3% between 2017 and 2021. The monthly economic bulletin produced by the Department of Finance⁷ sets out the latest position.

Earlier in 2018 the Government published the National Planning Framework to 2040 as well as a National Development Plan 2018-2027, which provides a framework for infrastructure investment plans for the upcoming decade. Ireland's planning framework for 2040 is entitled *2040 – National*

⁵ <https://www.dccae.gov.ie/documents/Our%20Sustainable%20Future%20-%202012.pdf>

⁶ <http://www.dttas.ie/sites/default/files/publications/public-transport/english/alternative-fuels-framework/6186npfalternative-fuels300517.pdf>

⁷ <https://www.finance.gov.ie/what-we-do/economic/monthly-economic-bulletin/>

*Planning Framework*⁸, while the ten year investment plan is called the *National Development Plan 2018-2027*.⁹

Ireland has a population of 4.75 million (Census, 2016), of which slightly more than 1.3 million reside in Dublin city and county. Outside Dublin, the major centres are Cork on the southern coast, and Limerick and Galway on the western coast. Total land area is just under 70,000 km². Northern Ireland (population 1.8 million, major city Belfast) is part of the United Kingdom.

The 2016 Census of Ireland identified 1,697,665 dwellings¹⁰ occupied by persons usually resident in the Irish State, otherwise termed as ‘permanent occupied dwellings’ or ‘households’ in census reports. The 2016 Census identified 442,669 one-off houses (i.e. one quarter of occupied dwellings) (for census reports, one-off houses are defined as ‘occupied detached houses with individual sewerage systems’ of which 425,840 (96%) were outside the 873 towns or settlements identified in the Census. This type of population dispersal is unusual in Europe. It can immediately be seen that a quarter of the population are unlikely to be directly connected to any heating network now or in the near term. This population dispersal also results in particular challenges in terms of transportation options.

Climate: The climate in Ireland is temperate maritime, strongly influenced by the North Atlantic Current. It consists of mild winters and cool summers with a relatively high degree of humidity throughout the year.

ii. **Strategy relating to the five dimensions of the Energy Union**

Dimension: Decarbonisation

In line with our commitment under the Paris Agreement, Ireland has put in place a comprehensive new framework of policies and targets to guide climate policy to 2030, and to advance the long-term vision of becoming a low-carbon economy by 2050, as set out in the 2014 National Policy Position on Climate Action and Low Carbon Development.

The legislative framework is set by the “Climate Action and Low Carbon Development Act, 2015” and builds on the 2014 “National Policy Position on Climate Action and Low Carbon Development”. The National Policy Position towards 2050 aims for an aggregate reduction in carbon dioxide (CO₂) emissions of at least 80% (compared to 1990 levels) across electricity generation, built environment

⁸ <http://npf.ie/>

⁹ <http://www.per.gov.ie/en/national-development-plan-2018-2027/>

¹⁰ See <https://www.cso.ie/en/releasesandpublications/ep/p-cp1hii/cp1hii/od/>

and transport, and to become carbon neutral in the agricultural and land use sectors, including forestry, by 2050.

	Climate Policy Framework	Target/objective
2014	National Policy Position on Climate Action and Low Carbon Development	Minus at least 80% by 2050 (compared to 1990 level) in energy-related emissions and carbon neutrality in agriculture and land use sectors.
2015	Climate Action and Low Carbon Development Act 2015	Provides the statutory basis for the national transition objective laid out in the National Policy Position.
	Ireland's Transition to a Low Carbon Energy Future, 2015-2030 (The White Paper)	Includes a complete energy policy update, which sets out a framework to guide policy until 2030.
2017	National Mitigation Plan (NMP)	Closes the gap to 2020 target and prepares for the 2030 target.
	Annual Transition Statements	Contains an overview of climate change policies and 'annual sectoral mitigation transition statement'
2018	National Adaptation Framework	Provides sectoral adaptation plans to reduce the vulnerability of the negative effects of climate change.
	Project Ireland 2040: including National Planning Framework & National Development Plan	Seeks to achieve the ten strategic outcomes of the National Planning Framework
	Developing National Energy and Climate Plan 2021-2030	Set out contributions, targets and objectives in emissions and energy to 2030 and the planned policies and measures to achieve these.
2020	EU Effort Sharing Decision	20% emission reduction in non-ETS sector compared to 2005
2030	EU Effort Sharing Regulation	30% emission reduction in non-ETS sector compared to 2005

Table 1: Climate Policy Framework

The 2015 Climate Act contains a number of legal obligations including the preparation of National Mitigation Plans (NMP), a National Adaptation Framework (NAF) and Annual Transition Statements (ATS) to allow regular monitoring of the progress made and to take corrective steps, if required. The first NMP was adopted in 2017 and aims to close the gap to Ireland's 2020 target and to prepare for the 2030 target. The NMP, as published, contains 70 specific mitigation measures and 106 individual actions across Government ministries. The NMP is cognisant of the challenges facing Ireland in trying to meet the 2020 and 2030 targets.

The 2017 Statement contains separate sectoral mitigation transition statements for the four sectors covered under the NMP and projections of future emissions. In January 2018, the Government published the first statutory National Adaptation Framework (NAF) that builds on the principle of subsidiarity and sets the context for action by local authorities. To support implementation of the NAF, sectoral adaptation plans are being prepared, including for the electricity and gas networks. The sectoral adaptation plans and the local adaptation strategies will be prepared for approval in the second half of 2019.

Ireland has developed a strategic outlook for the future development of the country under the 'Project Ireland 2040'. The National Development Plan (NDP) 2018-2027 sets out investment priorities of €21.8 billion for climate action for the 10 year period of which €7.6 billion is to come from the Exchequer. The remaining investment is to be made by Ireland's semi-state companies and by the private sector. In addition, some €8.6 billion funding has been made available for sustainable mobility projects, mostly in public transport. This substantial funding increase will facilitate upscaling of investments and implementation of actions needed to move the country towards the 2030 climate targets. The funding will support the implementation of energy efficiency and renewable measures in the electricity, transport and built environment, especially for heating and cooling. In addition, the NDP contains a commitment to establish a new €500m Climate Action Fund to leverage investment by public and private bodies to contribute to the achievement of Ireland's energy and climate targets.

Dimension: A fully-integrated internal energy market

Ireland currently has gas and electricity interconnection with the UK only. In view of the UK's planned exit from the EU, it is very important to ensure secure stable energy trades between the two countries, particularly on the matters of cross-border gas and electricity flows.

Electricity

A new chapter in the Irish electricity sector was opened when a new market design was applied to the all-island wholesale electricity market, the Single Electricity Market (SEM). The new market rules came into operation on 1 October 2018 introducing the EU target model and complying with Commission Regulation (EU) 2015/1222 (CACM regulations).

The establishment of day-ahead, intraday and balancing markets, the possibility for producers, suppliers and large consumers to participate, the determination of an ex-ante clearing price and the obligation on participants to take responsibility for their own imbalances are all important changes compared to the previous ex-post gross mandatory pool market.

Single Electricity Market – island of Ireland

The Single Electricity Market (SEM) has been operating since 2007 as the all-island wholesale electricity market covering two jurisdictions, Ireland and Northern Ireland (United Kingdom). The SEM is governed by the SEM Committee, its regulatory decision-making body, comprising the CRU, the Utility Regulator for Northern Ireland and the independent member(s).

The SEM operated as an ex-poste gross mandatory pool until the end of September 2018. All electricity generated (above 10 MW) or imported had to be sold into and purchased out of the SEM. Bids for generation were made once daily for the day ahead and matched with demand to arrive at the single island-wide System Marginal Price (SMP). The market schedule was optimised by the System Operator to ensure a feasible dispatch with supply and demand in balance, and constraints accounted for. In addition, generators also received a capacity payment if they were available to generate, and they received constraints payments if delivered and scheduled generation differed due to technical operating constraints of the SEM.

The SEM lacked flexibility as it effectively allowed trading in only one market and was not designed to best accommodate the sharply increasing production from variable renewables as renewables could not trade close to real time. As part of Ireland's obligations to integrate the SEM with European electricity markets through market coupling as set out in EU energy legislation, the I-SEM project has been pursued under the general supervision of the SEM Committee, overseen by the Department for Communications, Climate Action and Environment (DCCAE) and the Department for the Economy Northern Ireland (DfE), to revise the operating rules of the market model.

New market rules – the I-SEM Project

Following the go-live of the new market design on 1 October 2018, SEM is now coupled with other EU Member States via Great Britain, using Single Day Ahead market coupling. This has facilitated Ireland's effective and compliant participation in the EU Internal Energy Market. The market rules now consist of five markets: (i) forward, (ii) day ahead, (iii) intra-day, (iv) balancing and (v) capacity.

The forward market is operated as a financial market only where no physical trade can take place. The SEM Committee commissioned several consultation papers to assess the benefits and challenges of a physical forward market and eventually concluded that the small size and relative isolation of the Irish market made its introduction challenging. Instead, to ensure the maximum transparency of the markets, physical trading should be concentrated on the day ahead and intraday market.

The day-ahead market offers simple bids of hourly contracts as well as complex orders. Furthermore, three intraday auctions have been set up. Two of them are coupled with Great Britain and one remains local within SEM. The market also offers a local continuous trading platform for electricity.

The market is delivering a range of benefits to the Irish consumers and the energy system as a whole. More competitive trading arrangements will allow better use of existing infrastructure assets in the electricity system and will ensure that the interconnectors operate in the most efficient way. The SEM will also facilitate the continued growth of renewable generation through the ability to trade closer to real time, which is expected to reduce wholesale prices and which is critical for the long-term decarbonisation of the Irish energy system.

The new capacity remuneration mechanism (CRM) is a competitive auction that determines the value of capacity in the market. It introduces penalties for generators that receive reliability option payments after a successful bid but are then not available to produce when required at times of system stress. In systems with high variable electricity production, as in Ireland, energy-only markets can make it difficult for capacity providers to recover their long-term investment as they are called upon less frequently and last in the merit order and therefore earn less revenues. This is of particular concern for isolated island markets, like the Irish one. Yet, the electricity system still needs dispatchable capacity in periods of high demand and low renewable output.

The capacity auction for the period 2018/2019 yielded a saving of approximately €200 million compared to the final year (2017/2018) of administratively-determined payments under the old capacity payment system. Future auctions will yield different outcomes but the outcomes will always be determined competitively. In the CRM, only those capacity providers with successful bids in the capacity auction will receive payment. The cost of purchasing capacity is paid by all suppliers. The capacity market also allows the aggregation of small or intermittent generators.

Competition in the electricity retail market continues to increase. In 2017, 12 suppliers were active, compared to eight suppliers in 2011. Not all are serving both the domestic and business market segments. Currently seven suppliers offer non-domestic electricity, namely Electric Ireland, Bord Gáis Energy, Energia, SSE Airtricity, Flogas, Vayu and GoPower. Two new suppliers entered the domestic electricity market in 2017 bringing the total to ten. Seven suppliers are so-called dual suppliers, offering electricity and gas. 64% of customers have switched supplier for electricity and 62% have switched for gas according to a survey by the energy regulator.

DS3 System Services – EirGrid – Ireland's Transmission System Operator (TSO)

The strand of work focussing on enhanced ancillary services is called the DS3 System Services. Ancillary services typically include frequency control, and spinning and operating reserves to ensure that there is enough electricity flow to meet demand continually. Traditionally generators provided those services by using a limited set of proven technologies and receiving compensation through regulated prices. The value of the ancillary services provided in the all-island market was estimated at approximately €60 million annually up to 2015. However, with the rapid increase of intermittent generation, a different set of equipment and technologies is needed and the mode and mechanism for remunerating ancillary services needs to be adapted. The DS3 System Services is being rolled-out in phases.

Smart Grid

At distribution system level, ESB Networks (ESBN) is also working on smart grid technologies. In April 2018 it launched a major pilot on the Dingle peninsula in which ESBN will deploy a range of technologies to understand how evolving technologies will interact with the electricity network of the future. A key component of the Dingle pilot project is the engagement with the local community in discovering what opportunities the future of energy can unlock for end-customers. Under the pilot project smart devices on the network will help to monitor and predict the network events better in order to ensure less outages and more resilience on the distribution network. Exploring the potential for enhanced energy efficiency measures among the local business community as part of the smart-solution will also be pursued

Interconnectors

The National Policy Statement on Electricity Interconnection published in July 2018 reflects the increasing importance of interconnection to national and EU policy. The policy statement emerged following a public consultation that took place in early 2018. This policy statement lays out the official position on electricity interconnection. It outlines the many drivers and benefits of interconnection, as well as the potential impacts electricity interconnection may have on the wider energy market. It will help to guide potential developers in better understanding the range of national policy drivers and the CRU (Ireland's energy regulator) in determining its regulatory approach to electricity interconnection, by drawing attention to key policy parameters for consideration in its evaluation of interconnection applications from project promoters.

Ireland's geographical location brings challenges in terms of interconnection with neighbouring countries. Ireland is exclusively connected to the United Kingdom through two electricity

interconnectors: The 300 MW North-South interconnector, linking the electricity systems of Ireland and Northern Ireland, and the 500 MW East-West Interconnector connecting Ireland and Wales (United Kingdom). EirGrid owns and operates both interconnectors. Ireland is currently not meeting the indicative EU electricity interconnection target of at least 10% of installed capacity by 2020; its current level of interconnection is 7.4%. When the UK leaves the EU, Ireland will have no direct electrical interconnection with the rest of the EU. Table 2 below shows proposed new interconnection.

Proposed infrastructure	Capacity (MW)	Countries	Project promoter	Expected start date
Second North-South interconnector	1500	Connecting Ireland and the UK (Northern Ireland)	EirGrid	2023 (planning permission received)
Greenlink interconnector;	500	Connecting Ireland and the UK (Wales)	Greenlink	2023
Celtic interconnector	700	Connecting Ireland and France	EirGrid	2025

Table 2: Proposed interconnectors

Smart Meters

The National Smart Metering Programme (NSMP) is a multi-year investment project including the roll out of new digital electricity (and gas) meters, a communications network to support them, and investment in new IT systems. The Commission for Regulation of Utilities (CRU) is responsible for the overall coordination of the NSMP in the electricity (and gas) sectors. In phase one (2019-2020) 250,000 smart meters will be installed. Smart services such as time-of-use tariffs and smart bills will become available at the end of 2020, so that consumers can benefit from the additional services provided even before the entire NSMP has been delivered. Approximately 500,000 meters will be installed in each of the four subsequent years.

Gas

Ireland currently obtains a significant proportion of gas required for domestic consumption from the Corrib gas field. The remaining gas supply is imported from the United Kingdom through two interconnectors via the Moffat entry point in Scotland.

The Irish wholesale market is governed by the EU gas network codes. In February 2005, the CRU approved the implementation of a new Code of Operations which governs the rules for both the transmission and the distribution networks. The latest code (Version 5.02) was published in April 2018. The Irish gas market has undergone a number of changes in recent years. In 2016, in accordance with the 2009 Gas Directive, Gas Networks Ireland was certified as a fully ownership unbundled (FOU) entity.

According to the CRU's Gas Retail Markets Report (2018), in the first quarter of 2018, there were six large companies operating in Ireland's gas retail market. Bord Gáis Energy was the dominant retail player and had the largest market share of 46% in terms of both the customer numbers and volume of sales (GWh). Bord Gáis Energy is a private limited company under Centrica Group, a British multinational energy and services company. Electric Ireland held the second-largest number of customers with a 21% market share, followed by Airtricity (14%), Energia (8%), Flogas and PrePayPower (PPP) with 5% each respectively, and small players such as Vayu taking the rest of the shares.

Project	Project promoter	Aim	Status
Twinning of South West Scotland Onshore System (SWSOS)	GNI UK Ltd	Twinning of unparalleled section of pipeline. Moffat capacity increase to 375 GWh/d.	To be completed in 2018. Funding provided by Connecting Europe Facility (30%) and regulatory capital allowance.
Physical reverse flow at Moffat	GNI UK Ltd	Making Moffat entry point bi-directional.	Feasibility study ongoing. Funding provided by Connecting Europe Facility (50%).

Table 3: Infrastructure developments

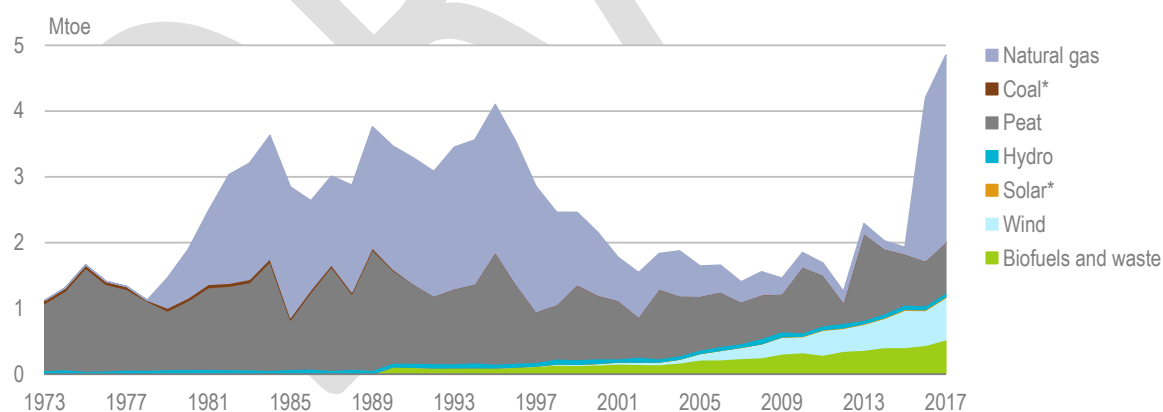
In addition to the twinning of the SWSOS between Cluden and Brighthouse, work is ongoing to build independent compressor systems for Ireland's two existing gas interconnectors with the UK. The project is due for completion in 2020.

Dimension: Security, Solidarity & Trust

In 2017, Ireland's total domestic energy production reached a new peak at 4.9 Mtoe, nearly tripling over the past decade. However Ireland still imports most of its energy needs, as energy production only covers 35% of Total Primary Energy Supply (TPES). The largest indigenous energy source is natural gas, representing more than half (58.7%) of total domestic production in 2017. The remainder was comprised of peat (15.8%), wind (13.2%), biofuels and waste (10.7%), hydro (1.2%), and solar (0.3%).

Ireland has had a low total energy production during the last two decades due to a sharp fall in natural gas production. However, it rapidly picked up in 2016 thanks to the opening of the Corrib gas field in December 2015 (Figure 1 below). Consequently, Ireland's overall energy import dependency fell from 95% in 2015 to 73% in 2017 contributing to improved energy security.

Peat production has been broadly consistent since 2013. Ireland has no domestic oil production, and relies completely on imports, currently mainly crude oil from Norway and oil products from the UK. Furthermore since the early 1990s, Ireland's total annual coal supply of around 1.3 Mtoe is imported, mostly from Colombia.



*Negligible. Total energy production has increased in the last decade, due to growth in renewable energy production and a steep rise of natural gas in 2016.

Figure 1: Energy production by source, 1973-2017 Source: IEA (2018)

The Irish energy system is undergoing a significant transformation. Reliance on fossil fuels in Total Primary Energy Supply (TPES) has dropped by five percentage points since 2010 but remains high at

90%. Renewable energy has steadily increased, accounting for just over 10% of TPES in 2017, up from 4.6% in 2010.

However, the most visible change has taken place in the electricity sector where the share of renewable electricity generation more than doubled to 30% of total generation in 2017, up from 13% in 2010. Wind generation accounted for one quarter of total generation.

In the oil sector, energy policy is to promote market flexibility and competition as a means to ensure security of supply. Ireland's downstream industry is fully open and competitive. There is no direct regulation of oil product prices but the government sets basic policy frameworks to ensure price competition and consumer protection, enforced by the Competition and Consumer Protection Commission (CCPC). Ireland's domestic oil product prices are determined by various factors including market fundamentals, exchange rate (EUR/USD) and refining capacity - the levies and taxes applied on petroleum products make up about 60% of the retail price.

Ireland is entirely dependent on shipping for all oil imports. The existing oil import facilities on the island of Ireland, taken as a whole (Ireland and Northern Ireland), offer a robust infrastructure that would provide viable alternatives in the event of a serious disruption at any of the six principal oil ports. With no oil pipeline infrastructure in place, Ireland's inland distribution is dependent on road transport, which has improved significantly with the development of the motorway network between 2000 and 2010.

NORA was established as a non-commercial state body under the National Oil Reserves Agency Act (NORA) 2007. It has responsibility for the management of Ireland's stockholding obligation i.e. to hold 90 days of net imports as a contingency against an oil supply disruption. NORA activities are funded by a levy imposed on oil products. Marine bunker oils and aviation fuels are exempt from the levy, as required under international obligations. The levy is currently set at €0.02 per litre of oil products. As of October 2018, Ireland holds 91 days of net imports in public stocks. 57% of Ireland's stockholding is held in Ireland, 21% in the UK (9% in Northern Ireland and 12% in Scotland) and 22% in other EU Member states (Denmark, Spain and Sweden). Ireland has bilateral agreements with those Member States where the emergency stocks are held.

There are no public stocks of natural gas in Ireland and since 2017, there is no storage site in operation. In the event of a gas supply emergency, Ireland relies on supply side measures (import flexibility via pipeline and increased domestic production) and demand side measures (interruptible contracts; fuel switching and load shedding).

Ireland's gas interconnectors (IC1 and IC2) provide a level of line pack security and, in the event of loss of supply at the Moffat gas entry point, the line pack in IC1 and IC2 could potentially supply Irish gas demand on a 1-in-50 winter for five days. However, this provision of five days is based on the assumption that all gas-fired power stations could switch fuel from gas to diesel, within five hours, and that no line pack is diverted to Northern Ireland through the South North Pipeline via IC2.

Indigenous gas supplies are mostly at maximum production, which infers that no additional indigenous supply is available in an emergency. Biomethane production and injection into the natural gas network in Ireland is at a very early stage of deployment and will not contribute to security of supply in the near term.

In case of a gas supply emergency, Ireland is likely to call for solidarity from its EU neighbouring countries, under the EU gas security of supply regulation 2017/1938. The EU gas infrastructure standard N-1 evaluates a Member State's ability to satisfy total gas demand in case of a disruption of its single largest gas infrastructure on the day of exceptionally high gas demand, which has a statistical probability of once in 20 years. The EU infrastructure standard is met when the N-1 value is greater or equal to 100 %. Ireland and the United Kingdom apply a more severe criterion to ensure that their markets are able to meet at least once in 50 years peak demand. In Ireland, the Irish energy regulator places an obligation on shippers and suppliers to book capacity for a 1-in-50 peak day at the network exit point, as set out in Ireland's network code of operations. The Irish TSO has oversight of the gas activity and ensures the capacity is booked.

Ireland has two gas interconnectors with the UK. The 2016 National Risk Assessment identified the Moffat entry point (with the two subsea interconnectors IC1 and IC2) as the single largest piece of infrastructure. The risk assessment reconfirmed that if a failure happens in Moffat, Ireland is unable to meet the N-1 infrastructure standard, set out in Regulation 2017/1938; based on a median supply and demand scenario. The result of the N-1 calculation is 35% (28% without market based measures). The Irish, Northern Ireland and UK energy regulators agreed a regional approach and a joint risk assessment and preventive plan. With a joint risk assessment between the United Kingdom and Ireland, the combined N-1 calculation is equal to 134%.

Following completion of a project to implement independent compressor systems for the two gas interconnectors at Brighthouse Bay in 2020, it will result in a revision of the largest piece of gas infrastructure for Ireland, as defined in the EU gas security of supply regulation 2017/1938. The N-1 failure thereafter would constitute a partial disruption, as opposed to a complete disruption.

Ireland has no LNG terminal, but there is a commercial proposal to construct the country's first LNG regasification terminal in the Shannon Estuary, on the Southwest coast. In July 2017, a US LNG export company signed a memorandum of understanding with the Port of Cork to study the possible development of a floating storage and regasification unit (FSRU) and the associated LNG import terminal infrastructure in Cork, in the South of Ireland. The development of a LNG import terminal, either an onshore facility or a FSRU would improve energy security by providing direct access to the global LNG market.

Upstream Oil & Gas

The Irish government encourages investment in exploration and production through measures such as deepening knowledge of Ireland's oil and gas potential, in particular through data acquisition and supporting key research projects; making sure that the regulatory regime is fit for purpose; and offering licensing opportunities.

Dimension: Energy Efficiency First

Ireland's energy efficiency target for 2020 is 20%. The target is calculated based on the average final energy used over the period 2001-05 and is equivalent to 31 925 GWh of primary energy savings by 2020. The Government has set a separate target for the public sector to reach 33% energy savings by 2020 to contribute to the national effort towards the 20% target.

In line with the European Union (EU) Energy Efficiency Directive Ireland produces a National Energy Efficiency Action Plan (NEEAP) every three years – the most recent in 2017. The 2017 report will be the last as energy efficiency reporting will be subsumed into the National Energy & Climate Plan 2021-2030 from 2021. The NEEAP has been Ireland's central energy efficiency policy document and provides a comprehensive overview on the strategies and policies in place across all sectors and monitors developments. The energy efficiency policies implemented under NEEAP 3 that ran from 2013 to 2016 and its two predecessors have resulted in substantial progress towards meeting the 2020 target.

By end-2016, Ireland had achieved 12% energy savings, corresponding to 18 654 GWh, which reduced CO₂ emissions by approximately 4.4 million tonnes. The savings represent over €1 billion of reduced energy bills nationally. Ireland expects to reach energy savings of c.16.23%, equivalent to 25 904GWh by 2020, based on the policy measures in place up to end-2016 (see Figure 2 under). This leaves a shortfall of c.3.77% that would require additional measures.

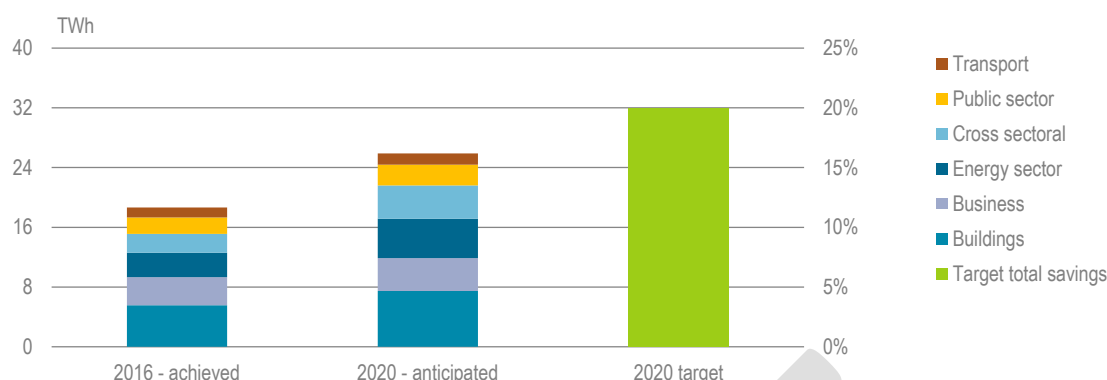


Figure 2: Primary energy savings by sector, compared to 2020 target

The expected shortfall against the 20% target could still potentially be reduced through the full and timely implementation of additional measures. Those are set out in the *National Energy Efficiency Action Plan for Ireland #4 2017–2020 (NEAAP 4)*¹¹ that became effective in 2017 and covers the period up to end-2020. Additional policy and strategy documents including the *Public Sector Energy Efficiency Strategy* of 2017, the first *National Mitigation Plan* of 2017, the *Long Term Renovation Strategy (2017-2020)* and the *National Development Plan 2018* complement the NEEAP 4.

Beyond 2021, the Government has identified a technical potential to save up to a further 16 000 GWh in the period towards 2030. However, this will require deeper and more expensive measures, especially in the building sector and to decarbonise heat, as most shallower measures will have already been implemented. Scaling-up energy efficiency will also require increasing policy efforts and sufficient level of funding.

Energy Efficiency funding and advisory services

After a sharp reduction in public funding for energy efficiency as a consequence of the economic crises, funding has increased markedly since 2016. The budget allocation made available to SEAI for 2018 was €107 million. This compares to a total funding of €452 million for the period 2011-2017 of which €100.2 million was for the year 2017 and €72.7 million for 2016. The projects funded from the 2018 budget are expected to result in savings of 4.83 GWh for 2018 and savings of 120 000 tons of CO₂.

Financial incentives and support schemes are made available through a number of measures and they target specific sectors. An accelerated capital allowance scheme has been in operation since 2008. It encourages the use of the most energy efficient technologies and the list of the most the

¹¹ www.dccae.gov.ie/documents/NEEAP%204.pdf.

relevant efficient eligible technologies is updated on an ongoing basis. Its purpose is to encourage businesses to purchase highly energy efficient equipment and machinery by enabling companies to write down the capital cost in the year of purchase instead of over the standard eight-year period for the most energy efficient equipment which is listed in SEAI's Triple E (Energy Efficient Equipment) Register.

The Better Energy Financing (BEF) programme supports applied research for developing innovative financing solutions for deeper level of building upgrades and investigates how to incentivise greater uptake of home retrofit programmes in the residential sector.

Offering access to advisory services is another enabler to enhance energy efficiency, as financing options alone are seldom sufficient to initiate decision makers to act. The Government has therefore broadened the remit of SEAI and increased its resources accordingly.

In 2017, SEAI created a new research unit for behavioural economics to raise the awareness among business and household sectors and to better understand their motivations in the uptake of sustainable energy solutions. A technical bureau was also set up in 2017 to complement the range of programmes delivered by DCCA and SEAI. SEAI also produces annual energy forecasts to inform the debate on future energy trends and to assist the government in taking corrective measures.

A key aspect of SEAI's activities is promotion of awareness of energy efficiency among suppliers and customers. SEAI is also offering energy management training for SMEs and free information and best practice guidelines on energy management.

Dimension: Research Innovation & Competitiveness

Ireland's Energy White Paper for the period 2015 to 2030 (Department of Communications, Climate Action & Environment, 2015) aims to position Ireland as a leading European energy innovation hub to ensure that Irish-based firms benefit from increasing investment in sustainable energy innovation. The paper states that energy research plays an integral part in Ireland's energy policy. A successful research environment will help to develop the tools required for the transition to a sustainable, low carbon environment and to ensure that Ireland is a world leader during the energy transition.

The Energy White Paper recognises that Ireland's energy transition will present further opportunities for job creation and economic growth. For example, it has been estimated that measures required to meet our 2020 renewable energy targets could deliver between 2,500 and 5,550 jobs in the bioenergy sector and up to 4,000 in onshore wind deployment. In addition, analysis carried out by

SEAI, IDA Ireland and Enterprise Ireland (EI), along with DCCAE and DBEI, found that sustainable energy is already worth €1.5 billion a year to Ireland, and currently employs 18,000 people.

The Energy Research Strategy (2016) published by the Department of Communications, Climate Action & Environment (DCCAE) states that in order to fully realise the potential of new and emerging technologies, and to develop and demonstrate clean and sustainable energy solutions, further investment into energy research and innovation in Ireland is needed. It recognises that this has major implications for economic development and high quality job growth

The Energy Research Strategy published by DCCAE recognises Ireland's reputation as a world class location for research across a number of sectors, including Life Sciences and ICT, with many global companies actively engaged in research activities in Ireland. The strategy states that the energy research sector has the potential to achieve similar success - this is recognised in the ambition to establish Ireland as an 'Energy Innovation Hub'. The strategy states that the Irish energy research system should:

- 1) Develop new technologies for the harnessing and integration of indigenous renewable resources (e.g. wind energy, ocean energy and bioenergy).
- 2) Identify and develop products and services that will radically transform the efficient utilisation of energy across all sectors of the economy, with consequent benefits for economic growth, development of new Irish businesses and job creation.
- 3) Undertake basic research in such areas as material sciences and bio-sciences, to expand the knowledge base on which breakthrough innovations in energy supply and utilisation can be made.
- 4) Take innovative ideas and concepts developed elsewhere, and examine how they might usefully be adapted, further developed, demonstrated and deployed by Irish companies both in Ireland and abroad.
- 5) Help Irish companies in the energy sector to develop and grow at national and international level.
- 6) Seek to collaborate and attract investment from indigenous and foreign businesses in order to enhance the benefits of energy research.
- 7) Contribute to effective policy making, through the development and maintenance of an energy system modelling capability.
- 8) Investigate and address the various technological and behavioural barriers to the uptake of new energy efficient and low carbon technologies.

The Energy Research Strategy published by DCCAE calls in particular for continued incentivising of effective collaboration between industry and academia in energy research. It states that particular attention should be paid to international research collaboration as this offers opportunities under Horizon 2020 as well as further enhancing Ireland's reputation for global research excellence in energy. It also calls for Ireland to continue to build upon IEA international collaborative research activities through the eight Technology Collaboration Programmes that Ireland is a member of and to ensure Ireland's research is to the forefront of international best practice.

In respect of areas which should be prioritised for investment, the strategy recognises that Ireland's Energy Research Strategy needs to remain open to a broader range of possible energy futures, and to look to a longer range time horizon, so as to effectively inform energy policy through successive cycles. It also calls for more research into the social and behavioural aspects of the energy transition, and in particular to identify the key enablers and strategies to achieving the necessary behaviour changes. Finally, the strategy refers to the importance of sustained funding in order to ensure that companies and research performing organisations invest time and resources in the performance of energy RD&D and such that skilled and experienced researchers in the energy domain are developed and retained in Ireland.

The *SEAI Statement of Strategy 2017 to 2021* (Sustainable Energy Authority of Ireland, 2017) outlines how SEAI will support the realisation of its vision for Ireland's energy to be sustainable, secure, affordable and clean through measures and activities focused on the transition to a smarter and more sustainable energy future. The strategy recognises that Ireland must develop new approaches to its sustainable energy transition from technological, economic and social perspectives. It acknowledges SEAI's mandate to support research, innovation and enterprise, while developing evidence-based responses that engage all stakeholders.

Recognising its importance to the goals of the Energy Union and to Ireland's low carbon transition, Research & Innovation is a core strategic priority of SEAI's 2017 Statement of Strategy. SEAI will enhance its role as national coordinator of energy RD&D investments and activities in Ireland over the coming years. It is intended to significantly increase investment levels in energy / low-carbon technology research, development and demonstration through the national energy RD&D Funding Programme in order to enable Ireland's low carbon transition and to ensure Ireland is well-positioned to take advantage of the associated energy/low-carbon technology sector enterprise and job opportunities.

Written in the context of International, European and National policy drivers, and at a time of significant economic and socio-political change, the SEAI Strategy outlines the requirement to address the following key high-level priorities relating to SEAI Research & Innovation activities:

- (i) Increase funding of R&D projects and test sites with national and international impact;
- (ii) Enhance Irish engagement with Horizon 2020;
- (iii) Increase delivery of demonstration and innovation projects contributing to enterprise development; and
- (iv) Increase mapping and co-ordination of Irish energy research, leading to higher impact.

Ireland's National Mitigation Plan (2017) recognises that research, development and innovation will play a key role in achieving Ireland's transition to a low carbon economy and society. It states that the development and adoption of new and existing green technologies will be vital in areas ranging from energy efficiency, to electricity generation, to transport and agriculture. Innovations in business models and services provision, along with research aimed at modelling future scenarios and monitoring progress, will also be important.

Innovation 2020 is Ireland's five-year strategy on research and development of science and technology. Innovation 2020 sets out the roadmap for continuing progress towards the goal of making Ireland a Global Innovation Leader, driving a strong sustainable economy and a better society. Innovation 2020 recognises energy as one of six enterprise themes which are of particular importance to Ireland and calls for greater use of RDI funding to find solutions to pressing societal challenges in areas such as energy. Innovation 2020 indicates that a productive (energy) research environment will help to develop the tools for transitioning to a sustainable low-carbon environment and to make Ireland a world leader in the energy transition. It can also help to create economic opportunities and to provide long-term societal and environmental benefits. It refers to the six priorities set out in the energy green paper in respect of innovation in energy: empowering energy citizens; markets and regulation; planning and implementing essential energy infrastructure; ensuring a balanced and secure energy mix; putting the energy system on a sustainable pathway; and driving economic opportunity.

Research Priority Areas align the majority of competitively awarded public research funding with areas that deliver economic and societal impact. Public research funding is prioritised in research priority areas. In March 2018 the Department of Business, Enterprise & Innovation published the

revised Research Priority Areas 2018-2023 report¹². Based on developments since 2012, including the increased urgency to address climate change and sustainability challenges, alongside the increased opportunities for enterprise within this wider context, the former Energy research priority theme has evolved to reflect these drivers and is renamed Energy, Climate Action and Sustainability, and the priority areas have been updated to Decarbonising the Energy System and Sustainable Living.

The Department of Business, Enterprise and Innovation is spearheading the Government's new €500 million Disruptive Technologies Innovation Fund. This is one of four funds under the National Development Plan 2018-2027. Applications under this fund must align with the aforementioned research priority areas, which include the Energy, Climate Action and Sustainability theme, and "Decarbonising the Energy System" research priority area. This Fund is about doing something additional on top of existing innovation programmes and exploiting collaborative research to deliver new technologies and new solutions.

Environmental Protection Agency Climate Research Strategy

The Irish Environmental Protection Agency (EPA) provides funding for climate science research in Ireland, recognising the need for research to inform a practical response to, and strategic engagement on, climate change. The EPA has a statutory role in coordinating environmental research in Ireland. EPA Research has a strong focus on policy and is driven by national regulations and European Directives.

The EPA's 2014-2020 programme is framed by the vision of Ireland's transition to a carbon-neutral, low emission and climate-resilient society and economy by 2050, and being a source of climate change information and solutions. It builds on the success of the previous programme and responds to developments and emerging issues. It is shaped around two concepts; "Towards 2050" and "Laboratory Ireland".

"Towards 2050" encapsulates research that informs the transition to a carbon neutral, low emission climate resilient Ireland by 2050. "Laboratory Ireland" promotes an experimental approach to analysis of solutions and technologies and promotes Ireland as a key location for innovation. Together these aim to leverage action and support sustainable economic growth.

The programme has four themes:

¹² <https://dbe.gov.ie/en/Publications/Publication-files/Research-Priority-Areas-2018-to-2023.pdf>

- Theme 1: Carbon Stocks, GHG Emissions, Sinks and Management Options
- Theme 2: Ireland's Future Climate, its Impacts, and Adaptation Options
- Theme 3: Climate Solutions, Transition Management and Opportunities
- Theme 4: Air Science

The goal for the 2014-2020 period is to enable an effective research programme that is practical, solutions-focused and strategic.

iii. Overview table with key objectives, policies and measures of the plan

See Spreadsheet on Policies and Measures (attached).

Note that Ireland's draft NECP 2021-2030 is based on 4 scenarios – 2 baseline (with existing measures) scenarios and 2 advance (with additional measures) scenarios as follows:

NECP 1 - With existing measures (WEM) – high oil prices (EU *Energy Reference Scenario* (2016) Prices (constant 2013 values))

NECP 2 - With additional measures (WAM) - high oil prices (EU *Energy Reference Scenario* (2016) Prices (constant 2013 values))

NECP 3 - With existing measures (WEM) - low oil prices (Department of Business Energy and Industrial Strategy (UK) (BEIS) 2017 low fossil fuel prices))

NECP 4 - With additional measures (WAM) - low oil prices (BEIS 2017 low fossil fuel prices))

In the case of 'With Existing Measures' scenarios (i.e. NECP 1 and NECP 3), the measures included are those that were adopted and implemented by the end of 2017.

	NECP ₁ With Existing Measures (WEM) (High oil price)	NECP ₂ With Additional Measures (WAM) (High oil price)	NECP ₃ With Existing Measures (WEM) (Low oil price)	NECP ₄ With Additional Measures (WAM) (Low oil price)
	2030	2030	2030	2030
*Energy Efficiency %	18.7	24.7	18.9	25.1
RES-E %	41.2	53.8	39.6	55.0
RES-H %	19.2	26.3	12.9	18.3
RES-T % (regulation)	4.0 (10.4)	9.3 (25.4)	4.0 (9.7)	9.3 (24.4)
Overall RES %	19.2	27.7	15.8	23.7
Total GHG Emissions Mt CO ₂ eq	64.6	55.2	66.8	59.7
ETS	20.6	14.1	18.4	14.4
Non-ETS	44.0	41.1	48.4	45.3
Prices	EU Energy Reference Scenario (2016) Prices.(constant 2013 values)	EU Energy Reference Scenario (2016) Prices.(constant 2013 values)	BEIS 2017 low fossil fuel prices.	BEIS 2017 low fossil fuel prices.
Policies and measures (PAMs)	Includes policies in place prior to the end of 2017.	Includes anticipated impact of all NDP announced and active or additional PAMs.	Includes policies in place prior to the end of 2017.	Includes anticipated impact of all NDP announced and active or additional PAMs.
Biofuel blend assumptions	Statutory target remains at current level of 8.696% (commonly referred to as 8% by volume: 8%/92% = 8.696%) until 2030. Advanced biofuel target and food-based constraint assumed to be met.	Statutory target at 11.111% from 1 January 2019 and 12.360% from 1 January 2020. Blending levels to reach E10 and B12 by 2030 with statutory blend increasing incrementally. The increases shall be in line with the overall RES trajectory set out in the Governance Regulation. The starting level for the purposes of calculating the trajectory is assumed to be the level achieved in 2020 under the 'WEM' scenario and the 2030 level is assumed based on achieving E10 and B12.	Statutory target remains at current level of 8.696% (commonly referred to as 8% by volume – 8%/92% = 8.696%) until 2030. Advanced biofuel target and food-based constraint assumed to be met.	Statutory target at 11.111% from 1 January 2019 and 12.360% from 1 January 2020. Blending levels to reach E10 and B12 by 2030 with statutory blend increasing in incrementally. The increases shall be in line with the overall RES trajectory set out in the Governance Regulation. The starting level for the purposes of calculating the trajectory is assumed to be the level achieved in 2020 under the 'WEM' scenario and the 2030 level is assumed based on achieving E10 and B12.
Low carbon heating	SSRH based on 1-year funding.	SSRH based on 5-years of funding to achieve 1.6TWh RES-H;	SSRH based on 1-year funding.	SSRH based on 5-years of funding to achieve 1.6TWh RES-H;

assumptions	Heat pumps in new domestic and commercial buildings driven by building regulations	<p>Biomethane injection of 1.6TWh by 2030 achieved by incentive and/or obligation; Additional district heating of 0.12TWh growing linearly from 2023 to 2028</p> <p>Heat pumps in new domestic and commercial buildings driven by building regulations 170,000 heat pumps in existing residential buildings.</p>	Heat pumps in new domestic and commercial buildings driven by building regulations	<p>Biomethane injection of 1.6TWh by 2030 achieved by incentive and/or obligation; Additional district heating of 0.12TWh growing linearly from 2023 to 2028</p> <p>Heat pumps in new domestic and commercial buildings driven by building regulations 170,000 heat pumps in existing residential buildings.</p>
Electricity generation	<ul style="list-style-type: none"> • Lough Ree and West Offaly stations to co-fire with biomass after the PSO for those stations expires at the end of 2019. • Moneypoint to close at the end of 2030. • Wind increases at 140MW per annum. • Offshore wind is introduced from 2028. • Solar PV growth similar to EirGrid GCS. • SNSP at 65% throughout. • 40% RES-E achieved in 2030 and maintained 	<ul style="list-style-type: none"> • Lough Ree and West Offaly stations to co-fire with biomass after the PSO for those stations expires at the end of 2019, at a higher rate than for the Baseline. • Moneypoint to close at the end of 2025. • Wind grows on a linear trajectory • Offshore wind is introduced from 2023. • Solar PV grows to 1.5GW installed capacity by 2030. • SNSP increases from 65% to 75% in from 2026. • 5MW ocean energy demonstration projects from 2023. • Additional interconnection added in 2025 and 2026. • ~55% RES-E achieved in 2030 and maintained 	<ul style="list-style-type: none"> • Lough Ree and West Offaly stations to co-fire with biomass after the PSO for those stations expires at the end of 2019. • Moneypoint to close at the end of 2030. • Wind increases at 140MW per annum • Offshore wind is introduced from 2028. • Solar PV growth similar to EirGrid GCS. • SNSP at 65% throughout. • 40% RES-E achieved in 2030 and maintained 	<ul style="list-style-type: none"> • Lough Ree and West Offaly stations to co-fire with biomass after the PSO for those stations expires at the end of 2019, at a higher rate than for the Baseline. • Moneypoint to close at the end of 2025. • Wind grows on a linear trajectory. • Offshore wind is introduced from 2023. • Solar PV grows to 1.5GW installed capacity by 2030. • SNSP increases from 65% to 75% in from 2026. • 5MW ocean energy demonstration projects from 2023. • Additional interconnection added in 2025 and 2026. • ~55% RES-E achieved in 2030 and maintained
EVs	~250,000 EVs on the road by 2030 (¾ BEV, ¼ PHEV).	<p>~500,000 EVs on the road by 2030 (¾ BEV, ¼ PHEV).</p> <p>No new non-zero emissions vehicles sold post-2030.</p>	~250,000 EVs on the road by 2030 (¾ BEV, ¼ PHEV).	~500,000 EVs on the road by 2030 (¾ BEV, ¼ PHEV).
Energy Efficiency *(NB: Includes demand-side savings only. Supply side savings accounted for separately.)	Most national energy efficiency programmes assumed to continue delivering their 2017 achieved level of savings until the end of 2021. No further activity under	<p>Most national energy efficiency programmes assumed to continue delivering their 2017 achieved level of savings across the entire forecast horizon.</p> <p>Achieved 2017 savings under EEOS are assumed to be</p>	Most national energy efficiency programmes assumed to continue delivering their 2017 achieved level of savings until the end of 2021. No further activity under these schemes assumed from 2022 onwards.	<p>Most national energy efficiency programmes assumed to continue delivering their 2017 achieved level of savings across the entire forecast horizon.</p> <p>Achieved 2017 savings under EEOS are assumed to be</p>

	these schemes assumed from 2022 onwards.	maintained until 2030. No further savings after that.	Achieved 2017 savings under EEOS are assumed to be maintained until 2030. No further savings after that.	maintained until 2030. No further savings after that.
	Achieved 2017 savings under EEOS are assumed to be maintained until 2030. No further savings after that.	Impact of the 2019 domestic building regulations and 2018 non-domestic building regulations included over entire forecast horizon	Impact of the 2019 domestic building regulations and 2018 non-domestic building regulations included over entire forecast horizon	Impact of the 2019 domestic building regulations and 2018 non-domestic building regulations included over entire forecast horizon
	Impact of the 2019 domestic building regulations and 2018 non-domestic building regulations included over entire forecast horizon			

Table 4: Overview of modelling results and assumptions

1.2 Overview of current policy situation

i. National and Union energy system and policy context of the national plan

European Union energy policy is currently defined by a framework called the “Energy Union”. The European Commission’s strategy as set out in the Energy Union package is about achieving an energy resilient union with a forward looking climate policy. The strategy seeks to ensure secure, affordable, and climate-friendly energy for citizens and businesses and to allow a free flow of energy across borders with a secure supply in every EU state.

The Energy Union has five *mutually-reinforcing and closely interrelated* dimensions:

- (i) Energy security based on solidarity and trust;
- (ii) A fully integrated European energy market;
- (iii) Energy efficiency contributing to moderation of energy demand;
- (iv) Decarbonising the economy; and
- (v) Research, Innovation and Competitiveness.

Essentially, Energy Union is about the EU importing less and reducing our dependence on external energy suppliers; upgrading and modernising our infrastructure for a lower carbon energy system; completing the internal energy market with hardware (infrastructure), software (network codes, digitally smart grids), and optimal regulations; and providing secure, sustainable, competitively priced energy to homes and businesses.

Ireland is firmly committed to the concept of the Energy Union and its ultimate goal of achieving an energy-resilient union with a forward looking climate policy. As a peripheral, less-well-connected country, Ireland believes that the Energy Union has the potential to greatly enable Ireland’s transition to a low carbon future, just as the Single Market led to an economic transition for many Member States.

What are Ireland's Energy Union priorities?

Ireland's Transition to a Low Carbon Energy Future (Energy White Paper 2015), aligns fully with the principles set out in the Energy Union strategy, and provides the framework to transform Ireland into a low carbon society and economy by 2050.

In line with the need for citizen engagement and empowerment, it is important that Energy Union puts “citizens at its core”, as does our White Paper. The Energy Union embraces peripheral regions. Regional cooperation will assist us in achieving EU-wide market integration and will further contribute to unlocking the full potential of renewables in the energy systems. Enhanced regional co-operation will also be critical in ensuring uninterrupted energy supplies and affordable prices for consumers.

The construction of interconnectors to link relatively poorly connected peripheral Member States - such as Ireland - to the European system will also require funding from EU financing facilities such as the Connecting Europe Facility (CEF). There are three proposed interconnector projects for Ireland. The first is another North-South Interconnector (between Ireland and Northern Ireland.) There are two proposed sub-sea interconnectors - Greenlink (between Ireland and Britain) and Celtic (between Ireland and France.) All three projects have been recognised as EU Projects of Common Interest.

In September 2018, EirGrid lodged an investment request with the Commission for Regulation of Utilities (CRU) for the proposed Celtic Interconnector, between Ireland and France. The Celtic Interconnector project has previously received funding from the CEF and it is hoped that a further application for EU funding will take place in Q2 2019. Innovative funding mechanisms for non-commercial but important projects for the medium- and long-term, such as the CEF and the European Fund for Strategic Investment are essential.

Greenlink is a project for a 500MW interconnector between Ireland and Wales. The project promoter is Element Power, a private investor. In October 2018, CRU reached an initial determination that the project was in the public interest and signalled its intention to devise a regulatory framework for the project. Following the submission of sufficiently detailed financial and technical information from the Greenlink developers, the CRU expects to undertake a further consultation in 2019 on the proposed regulatory regime to support the project.

The completion of the Internal Energy Market is also a priority. As early as 2007 Ireland commenced regional energy market integration through implementation of a single electricity market on the island of Ireland. Ireland also particularly wishes to see Energy Union as a driver to encourage the pursuit of new technology solutions and investment opportunities both within and beyond the EU and is committed to research and development.

Clean Energy for All Europeans Package Background

On 30 November 2016 the European Commission, as part of the Energy Union strategy, published the ‘Clean Energy for All Europeans’ Package, consisting of eight legislative proposals. The eight legislative proposals can be placed in four groupings:

Energy Efficiency:

- The *Energy Efficiency Directive*; and
- The *Energy Performance in Buildings Directive*

Internal Energy Market Reform:

- The *Internal Electricity Market Design Regulation*;
- The *Internal Electricity Market Design Directive*;
- The *Agency for the Cooperation of Energy Regulators (ACER) Regulation*; and
- The *Risk Preparedness in the Electricity Sector Regulation*.

Renewable Energy:

- The *Renewable Energy Directive*; and

Governance

- The *Governance of the Energy Union and Climate Action Regulation*.

Following negotiation, the Energy Performance of Buildings Directive was published in June 2018 and entered into force on 09 July 2018. Following successful negotiations, the Governance of the Energy Union and Climate Action Regulation, the Energy Efficiency Directive, and the Renewable Energy Directive are expected to be published and to enter into force on 24 December 2018. Agreement has been reached between the Council and the European Parliament on the Risk Preparedness in the Electricity Sector Regulation. The remaining three files (the Internal Electricity Market Directive, the Internal Electricity Market Directive and the ACER Regulation) are still under negotiation and are progressing well.

Emissions

On 20 July 2016, the European Commission presented two legislative proposals for the non-ETS sector;

- the Effort Sharing Regulation (ESR), which set out the binding emissions reductions for energy, industrial processes and product use, transport, agriculture and waste, and;
- The land use, land use change and forestry (LULUCF) proposal, which set out the accounting rules for emissions and removals from the categories of afforested land, deforested land, managed cropland, managed grassland, managed forest land and managed wetland.

Effort Sharing Regulation (ESR)

The ESR sets out binding annual greenhouse gas emission targets for Member States for the period 2021–2030. These targets cover sectors of the economy that fall outside the scope of the EU Emissions Trading System (EU ETS). These sectors, including transport, buildings, agriculture and waste management, account for almost 60% of total EU emissions. This proposal is the follow-up to the Effort Sharing Decision, which established national emissions targets for Member States in the non-ETS sectors between 2013 and 2020. There are no individual targets for each sector in the Effort Sharing Regulation. The 30% reduction target that is set for Ireland will cover all non-ETS sectors, including transport, buildings, agriculture and waste management.

Emissions Trading Scheme

The EU Emissions Trading Scheme (ETS) includes some 11,000 stationary installations (101 currently in operation in Ireland of which approximately 70 are industrial installations) with an installed power-generation capacity of more than 20 MW. Irish-based ETS plants are mainly in power-generation and large-scale industrial production. Since the start of 2012, emissions from all flights from, to and within the European Economic Area (EEA) are included in the EU ETS. The legislation, adopted in 2008, applies to EU and non-EU airlines alike, and all Irish-based carriers above the ETS threshold must participate fully in the Scheme.

The EU ETS, now in its third phase, covers about 45% of total EU emissions, but just 29% of total emissions in Ireland, based on the latest (2016) inventories published by the Irish Environmental Protection Agency in November 2017. The relatively small share of total greenhouse gas emissions which the ETS sector in Ireland accounts for is owing to the relatively light industrial base in Ireland and the disproportionately large agricultural sector for which emissions are captured in the non-ETS inventory. Emissions from the ETS sector have been rising in recent years in Ireland. This is most likely attributable to the recession and decreased output from industry during 2009-2013 and the subsequent pent-up demand that industry is now attempting to satisfy. As the carbon price in ETS rises, the decarbonisation signal for ETS participants will become stronger, incentivising additional efficiency improvements in capital stock. Phase IV of EU ETS will commence in 2021.

National Policy

The Irish Government's [Energy White Paper](https://www.dcae.gov.ie/en-ie/energy/publications/Documents/2/Energy%20White%20Paper%20-%20Dec%202015.pdf) (2015) ¹³ presents a long-term strategic vision that is intended to guide the direction of Irish energy policy from now until 2030. This ambitious vision for Ireland's energy system envisages a reduction in greenhouse gas emissions from that sector by 80-95% relative to 1990 levels by 2050. The White Paper identifies the long-term strategic importance of diversifying Ireland's energy generation portfolio and largely decarbonising the energy sector by 2050.

The *National Mitigation Plan*¹⁴ published in July 2017, represents an initial step to set Ireland on a pathway to achieve the deep decarbonisation required by mid-century in line with Government policy objectives. It includes a series of mitigation measures and actions to decarbonise the electricity generation sector and to prepare for the EU renewable energy targets that Ireland will take on for 2030, in addition to measures and actions aimed at achieving carbon neutrality in the agriculture sector.

The National Policy Framework on Alternative Fuels Infrastructure for Transport in Ireland: 2017 to 2030 represents a first step in communicating a longer term vision for the Irish transport sector. The *Low Emissions Vehicle (LEV) Taskforce* was established to accelerate the deployment of low carbon transport technologies.

In February 2018, the Government published a National Development Plan (NDP) called *Project Ireland 2040*.¹⁵ The transition to a Low Carbon and Climate Resilient Society is one of ten strategic outcomes identified in the plan.

Project Ireland 2040¹⁶ is informed by the Programme for a Partnership Government which commits to reducing our import dependency while reducing energy-related emissions as well as by the *National Planning Framework to 2040* and the *National Development Plan 2018 – 2027*.¹⁷ Climate and energy transition related provisions contained in the National Development Plan 2018-2027 can be found in Table 5 below.

¹³ (<https://www.dcae.gov.ie/en-ie/energy/publications/Documents/2/Energy%20White%20Paper%20-%20Dec%202015.pdf>)

¹⁴ (<https://www.dcae.gov.ie/en-ie/climate-action/publications/Pages/National-Mitigation-Plan.aspx>)

¹⁵ <http://www.gov.ie/en/project-ireland-2040/>

¹⁶ (<http://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf>)

¹⁷ <https://www.per.gov.ie/en/national-development-plan-2018-2027/>

Contribution to 2021-2030 Non-ETS targets	Contribution to long-term decarbonisation
Investment in energy efficiency, with upgrades to homes increasing from 30,000 to 45,000 per annum from 2021 to achieve a minimum BER Rating 'B'	New Renewable Electricity Support Scheme to support up to 4,500 megawatts of additional renewable electricity by 2030
Investments in energy efficiency of existing commercial and public building stock with a target of all public buildings and at least one-third of total commercial premises upgraded to BER Rating 'B'	Energy research funding to accelerate diversification away from fossil fuels to green energy, including wind, wave, solar, biomass, biofuels, biogas and hydrogen
Supports for changing out oil-fired boilers to heat pumps, along with the provision of roof solar, in at least 170,000 homes	Ongoing reinforcement of existing power grid and Enhanced electricity interconnection, including the Celtic Interconnector to France and further interconnection to the UK
Full roll-out of the new Support Scheme for Renewable Heat	Conversion of Moneypoint to end the burning of coal by 2025 and Conversion of peat power plants to more sustainable low-carbon technologies by 2030
At least 500,000 electric vehicles on the road by 2030 with additional charging infrastructure to cater for planned growth	Roll-out of the National Smart Energy Metering programme to commence in 2019
Expand the refuelling network for alternately fuelled vehicles to address freight emissions	Development of gas infrastructure projects to support regional and rural development and the low-carbon transition
Major investments in public transport, including replacement of public transport bus fleet , Cycling and Walking Network	Piloting of 'climate-smart countryside' projects to establish the feasibility of the home and farm becoming net exporters of electricity
Town-scale pilots of food and agricultural waste to gas in agricultural catchments for local gas networks supply and biogas production	

Table 5: Climate and Energy Transition provisions in the National Development Plan 2018-2027

ii. Current energy and climate policies and measures relating to the five dimensions of the Energy Union

Dimension Decarbonisation	
National Dialogue on Climate Action	To increase awareness of the challenges presented by climate change
National Mitigation Plan	Achievement of Ireland's binding annual GHG emission targets 2021-2030
Regional climate action offices	Regional climate action offices to enable local level decarbonisation and adaptation
National Adaptation Framework	Strategy for national climate change adaptation planning
Climate Action Fund	Support achievement of climate and energy targets. The Fund is one of four such funds established under the National Development Plan 2018-2027 as part of Project Ireland 2040
Carbon tax	Tax reform targetting GHG reduction on polluter pays principle
Emissions Trading Scheme (ETS)	To reduce industrial GHG emissions in a cost-effective manner
Carbon Credits	To purchase carbon credits to assist in meeting emission targets
Origin Green	Sustainable food production
Carbon Navigator	Reduction in participating farms' carbon footprint
Woodland Environmental Fund	Providing additional incentives to encourage landowners to plant new native woodlands
Beef Environmental Efficiency Pilot	To lower the intensity of GHG emissions by improving the quality and efficiency of the national beef herd
Rural Development Programme	Sustainable development of rural economies

Cross Compliance and Green Direct Payment	Cross compliance as per EU regulations to include food safety, animal health and welfare and plant health
Smart Farming Programme	To support the measurement, monitoring and improvement of environmental performance of individual farms
Public Transport Investment	To increase use of public transport system
Low Emission Vehicles Taskforce	To increase the uptake of low emission vehicles
CORSIA	Carbon Offsetting Scheme for International Aviation
International Transport Forum's (ITF) Decarbonising Transport Worldwide research and modelling project	Research into reduced emissions from transport
Investment in cycling and walking infrastructure	To provide viable alternative transport infrastructure
Greenways Strategy	To invest in Greenways
Development refuelling network for alternative fuelling	Development of alternative fuel infrastructure aimed at increasing use and availability of alternative fuels particularly for fleet transport
Biofuels Obligation Scheme	To increase the use of renewable energy in the transport sector
Behavioural Economic Unit	To provide analysis on consumer behaviour
REFIT 1	To support wind, hydro and biomass/landfill gas projects

REFIT 2	To support wind, hydro and biomass/landfill gas projects
REFIT 3	To support additional biomass technologies
Ocean energy prototype development fund	To assist development of ocean energy projects
Pilot Micro Generation Support Scheme	To develop micro generation in Ireland
Political Declaration on Energy Cooperation between the North Seas countries	To enhance energy cooperation in the greater Northern Seas area
Establishment of Bord na Móna BioEnergy	To increase provision of biomass
Forest Programme	To encourage tree planting, biomass production
Home Renovation Incentive (HRI)	Tax relief scheme for home improvements including energy improving measures
Business, Environment and Technology through Training Extension and Research BETTER Farms Programme	Research targeted at promoting resource efficiency
Green Public Procurement	To encourage procurement of goods for the public service with a reduced environmental impact.
Vehicle Registration Tax and Annual Motor Tax Rebalancing	Increase the number of passenger cars with lower CO2 emissions
EU CO2 Car/Van Regulation and EU CO2 HDV regulation	Increase the fuel efficiency of passenger cars and vans and HDVs
Support Scheme for Renewable Heat (SSRH)	To increase the use of renewable energy in the heat sector

Dimension Energy Efficiency	
<ul style="list-style-type: none"> • Social housing investment • Home Energy Grants (Better Energy (BE) Programme) incl. • Warmer Homes Scheme <ul style="list-style-type: none"> • W&W Pilot • Deep retrofit Pilot • BE Communities (Household & Communities) <ul style="list-style-type: none"> • BE Homes 	Provision of full/partial grand aid to upgrade residential dwellings
SME Programmes (Small to Medium Enterprises)	To support and assist small & medium-sized enterprises to achieve greater energy efficiency with lighting & energy costs
Supplier Obligation (EEOS) incl. <ul style="list-style-type: none"> • Non Grant Residential <ul style="list-style-type: none"> • Non Grant Non Residential • Non Grant Non Residential Transport 	Obliges energy suppliers to achieve energy savings targets
Building Energy Rating (BER) Advisory report	To classify energy efficiency of homes and provide guidance on upgrade options and costs
Large Industry Energy Network (LIEN)	To support the Large Energy users in Industry to improve their energy performance
EXEED (Excellence in Energy Efficiency design) Services and Industry	To influence and deliver new best practices in energy efficient design to improve energy management and asset performance
ACA (Accelerated capital allowance)	Provision of tax incentive to encourage purchasing of more energy efficient equipment/ machinery
Public Sector Strategy & Programme incl. <ul style="list-style-type: none"> • Optimising Power @ work • PS Capital exemplars 	To support and assist the public sector to achieve greater energy efficiency
NEAP Legacy (measures completed/ closed) incl. <ul style="list-style-type: none"> • SEEEP, • EERF, • Better • Energy Workplaces, <ul style="list-style-type: none"> • CHP, • Reheat 	Mix of measures for residential dwellings and workplaces to improve energy efficiency

<ul style="list-style-type: none"> • Building Regulations incl. • 2002 Dwellings • 2008 Dwellings • 2011 Dwellings • 2005/2008 other than dwellings • 2018 other than dwellings 	To put in place minimum efficiency standards for new dwellings.
<ul style="list-style-type: none"> • NEEP Legacy incl. • Greener Homes Scheme • EE Boiler Regulation • Domestic Lighting 	Grant aid to improve energy efficiency in residential dwellings (measures complete/ closed)
Dimension Internal Market	
DS3 System Services	To ensure a secure power system with increasing non-synchronous renewable generation
Energy Poverty strategy	Strategy to help combat energy poverty
Household Benefits Package	Scheme to assist with fuel payments
LNG projects	To increase the resilience of the gas network
Electricity interconnection	To increase electricity interconnection to Ireland and so improve sustainability, security of supply and competitiveness
Capacity Remuneration Mechanism	To facilitate efficient and transparent pricing in the electricity market
Accredited price comparison websites	To deliver cost savings and promote competition in the market
Dimension Energy Security	
National Framework for national emergencies	To bring coherence to preparedness and response to national emergencies including energy emergencies
Oil Stockholding	To provide for petroleum products security of supply

Oil Emergency Allocation Plan	To prioritise oil for societal needs, including critical infrastructure and vulnerable users during a prolonged oil emergency
Support for EU electricity and gas Projects of Common Interest (PCI)	Gas and electricity projects to improve security of supply
Supporting applications by project promoters of EU energy PCIs for EU Connecting Europe Facility (CEF) funding	To enable funding of projects to improve security of supply
UK-Ireland Emergency Planning Forum	Forum for regional cooperation of Ministries, Regulators, gas and electricity TSOs from the UK and Ireland
National Gas and Electricity Emergency Planning Group chaired by the CRU (the regulator)	National Forum for the ministry, CRU, electricity and gas TSOs and DSOs
Dimension Research, innovation and competitiveness	
Research, Development & Demonstration Programme run by SEAI	Support research, development, demonstration & innovation in low carbon technology / energy sector
EPA Climate Science Research Programme	Support research into climate science

Table 6: Summary table of current policies and measures

iii. Key issues of cross-border relevance

UK Exit from the EU

The UK's decision to leave the European Union has important implications, most of which will not be clear until such time as the final exit agreement emerges. In the meantime, the Irish authorities have been clear on energy issues. ^[18]

Four key energy priorities were identified in relation to Brexit:

- Maintaining trade in secure supplies of energy between the UK and Member States
- Maintaining the Single Electricity Market across the island of Ireland
- Accommodating Ireland's ability to meet EU obligations

¹⁸ <https://www.dcae.gov.ie/documents/Brexit%20and%20the%20Irish%20Energy%20Sector.pdf>

- Supporting energy infrastructure

The reality is that even though all expect that there will be continuing trade in energy, there will be a new energy relationship between the UK and countries of the European Union, but the UK has not yet set out how it anticipates it will trade with its neighbours. In addition to dialogue with stakeholders in Ireland, the issues that the Irish authorities have identified that will need to be addressed to ensure the functioning of markets were set out in a speech to Energy UK in London in February this year, including matters such as regulatory equivalence, control of State Aids, Environmental protection, data sharing and consumer data protection, market monitoring and disputes resolution.

Continued regional cooperation with the UK on emergency preparedness and response for electricity and gas security of supply is important. Additionally it will be important that Ireland retains access to EU funding for energy infrastructure projects to improve Ireland's energy security of supply.

Single Electricity Market

During Brexit negotiations, the Irish and UK governments and the European Commission consistently outlined their commitment to maintaining the existence of the all-island Single Electricity Market after the UK leaves the EU. Existing energy and trading arrangements between Ireland and the UK, ensuring the continuity of mutually dependent energy arrangements and maintaining the long standing history of beneficial cooperation in this sphere are very important to both jurisdictions on an enduring basis. Accordingly, the November 2018 UK Withdrawal Agreement included measures to protect the status quo and maintain the SEM. However, until the Withdrawal Agreement is formally ratified by the UK and European Parliaments, uncertainty will remain as to the consequences of Brexit for SEM and cross-border trade between Ireland and Great Britain

Electricity Interconnection

Ireland's high level policy position on interconnection as outlined in the 2018 National Policy Statement on Electricity Interconnection emphasises the important role of interconnection in the transition to a low carbon energy future. It reflects the increasing importance of interconnection to national and EU policy. It builds on clear commitments outlined in the 2015 Energy White Paper, including one of its measures to maintain and enhance energy security that commits the Department of Communications, Climate Action and Environment (DCCAE) to promoting and facilitating interconnection with other countries and regions. Ireland's peripheral location at the

north-western edge of mainland Europe presents obvious challenges to interconnection, not least in the area of costs, yet may also highlight the desirability of interconnection, particularly in the context of security and diversification of electricity supply.

The policy statement emerged following a public consultation that took place in early 2018 and it lays out the official policy position on electricity interconnection. It outlines the many drivers and benefits of interconnection, as well as the potential impacts electricity interconnection may have on the wider energy market. It will help to guide potential developers in better understanding the range of national policy drivers and the CRU (Ireland's energy regulator) in determining its regulatory approach to electricity interconnection, by drawing attention to key policy parameters for consideration in its evaluation of interconnection applications from project promoters.

Petroleum Products

Ireland is reliant on the UK for approximately 60% of its petroleum product imports and for about 25% of its crude oil imports. The UK's continuing adherence to the established European standards mechanisms and the close proximity of UK refineries to Ireland will mean a continuation of this trade, post the UK withdrawal from the EU. Also 21% of Ireland's emergency oil stockholding is currently held in the UK. Whether this may continue to be counted towards our EU stockholding obligation will depend on the final withdrawal agreement between the EU and the UK.

North Seas Energy Cooperation

Ireland is part of the wider North Seas region, which has a large renewable energy potential. Cross-border effects of generation and grid infrastructure projects on energy prices, security of supply, the environment and the pace of innovation may be enhanced. The North Seas countries could benefit greatly from cooperation.

The North Seas Energy Cooperation (NSEC) is a regional cooperation to facilitate the further cost-effective deployment of offshore wind capacity and interconnection in the North Seas region. The NSEC is a voluntary, bottom up, market-oriented initiative, seeking to avoid incompatibilities and to create synergies between policies. The aim is to ensure a sustainable, secure and affordable energy supply in the North Seas countries, through further interconnection and integration of wholesale electricity markets.

Research Innovation & Competitiveness

The importance of cross-border research and innovation is recognised by the Irish Government as part of Innovation 2020, Ireland's strategy for science & technology - research & development. Innovation 2020 states that continuing to expand Ireland's international engagement through participation with international research organisations and via Horizon 2020 are important enablers of achieving Ireland's vision of becoming a global innovation leader.

It also states that innovation is central to ensuring that Irish enterprise is resilient and internationally competitive. Innovation 2020 (i) aims for Ireland to have an internationally competitive research system that acts as a magnet and catalyst for talent and industry; (ii) pledges increased investment targeted at expanding Ireland's participation in international research activities; and (iii) indicates that it is crucial for Ireland to participate in international collaborative research for the benefit of Irish researchers, our enterprise base and public policy makers.

In March 2018 the Department of Business, Enterprise and Innovation published the revised Research Priority Areas 2018-2023 report¹⁹. Based on developments since 2012, including the increased urgency to address climate change and sustainability challenges, alongside the increased opportunities for enterprise within this wider context, the former Energy research priority theme has evolved to reflect these drivers and is renamed Energy, Climate Action and Sustainability, and the priority areas have been updated to Decarbonising the Energy System and Sustainable Living.

Brexit currently represents the foremost downside economic risk for Ireland. As set out in Ireland's National Competitiveness Council's 'Benchmarking Competitiveness Ireland & the UK 2017 report, the potential imminent structural shift in the UK's trading relations with the EU has far reaching implications for Irish competitiveness across a range of policy areas – including trade, investment, skills, and sector specific competitiveness impacts.

Ireland retains strong linkages to key international fora in the energy and climate sectors (e.g. Horizon 2020, SET Plan, UNFCCC, IEA etc.). It is expected that these key strategic engagements will assist Ireland in effectively responding to the uncertainties associated with Brexit and to consider any opportunities which may eventuate. The terms of the UK's withdrawal from the EU will determine the range and scale of opportunity and challenge for the Irish research, innovation and competitiveness sectors.

¹⁹ <https://dbei.gov.ie/en/Publications/Publication-files/Research-Priority-Areas-2018-to-2023.pdf>

A report by the Royal Irish Academy Brexit Taskforce titled 'Research and Higher Education on the Island of Ireland after Brexit'²⁰ outlines some of the key risks which may emanate for Irish higher education and research as a result of Brexit and proposes a number of actions to address these. Risks include: reduced east-west research collaboration with a corresponding decline in Ireland's international research profile (Ireland co-authors more scientific papers with UK authors than German and French combined); the loss of a significant collaborative partner in multi-country research collaborations competing for international funding, including EU research, structural and regional funds; and a decline in opportunities for cross-border research collaboration and cooperation.

Ireland's Department of Business, Enterprise & Innovation has carried out a number of research & analysis activities relating to Brexit²¹, including cross border exporting; intermediate goods inputs and the UK content of Irish goods exports; services and trade flows; skills needs and trade implications; cross border trade and supply chain linkages; and surveys of Irish SME's in relation to their views on Brexit.

Ireland's Department of Communications, Climate Action & the Environment hosted a civic dialogue on Brexit in 2017. The resulting report²² suggests that Brexit may result in a need for increased industry and academic research and innovation to investigate and develop ways to improve Ireland's security of energy supply as well as new methods of energy production. The report also indicates that this research and innovation activity would have a number of benefits as follows: helping Ireland reach renewable and emissions targets, increasing security of energy supply, increasing employment opportunities, and the associated health benefits.

iv. Administrative structure of implementing national energy and climate policies

The **Department of Communications, Climate Action, and Environment (DCCAE)** is the lead government department (ministry) with responsibility for setting Ireland's overall energy, climate, and environment policy.

The **Department of Transport, Tourism, and Sport (DTTAS)** is the ministry with overall responsibility for improving the sustainability of the transport sector. The two Departments (DCCAE and DTTAS) work closely together on sustainable transport and with bodies such as the National Transport Authority and Transport Infrastructure Ireland. DTTAS co-chairs the Low Emission Vehicle Taskforce with DCCAE.

²⁰ https://www.ria.ie/sites/default/files/roi_brexit_report_e-version-1.pdf

²¹ <https://dbei.gov.ie/en/What-We-Do/EU-Internal-Market/Brexit/Research/>

²² <https://www.dccae.gov.ie/documents/Brexit%20Civic%20Dialogue%20on%20Energy%20Report.pdf>

The **Department of Agriculture, Food, and the Marine (DAFM)** is the ministry responsible for leading, developing, and regulating the agri-food, forestry and seafood sectors. Consequently, DAFM has a crucial role to play in the development of bioenergy. Policies related to agriculture include continuing to support the Forestry Programme 2014 – 2020 and associated schemes and measures, encouraging and facilitating the innovative use of animal by-products for energy production, continuing to endorse the industry-led Wood Fuel Quality Assurance Scheme, and ensuring use of sustainable forest material through the implementation of the EU Timber Regulation.

The **Department of Planning, Housing & Local Government (DPHLG)** leads the overall development of national planning policy and legislation. The Minister also ensures that these policies are implemented at local and regional levels. Three Regional Assemblies are responsible for the Regional Spatial and Economic Strategies which coordinate planning and development in their areas.

An Bord Pleanála is Ireland's independent national planning appeals board. It also deals with the planning process for certain large strategic infrastructure projects. Planning at local level is the responsibility of local planning authorities. They are responsible for determining the majority of planning applications and for enforcement. They prepare development plans, local area plans and planning schemes which guide development in their areas. These detailed planning schemes are approved by Government and fast-track the planning process for development which is in line with the scheme. Some local authorities have Strategic Development Zones in their areas.

Local authorities draw up city or county Development Plans which are adopted by their elected members every six years. These Development Plans are informed by national and regional planning strategies and the guidance provided by the Minister and the Government. SEAI, together with the DCCAE, DPHLG and other key stakeholders, developed a methodology or template to act as a guide to assist local authorities in the preparation of their Local Authority Renewable Energy Strategy (LARES.)²³ Some local authorities have renewable energy agencies which promote and develop renewable energy projects.

The **Sustainable Energy Authority of Ireland (SEAI)** was established under the Sustainable Energy Act 2002. Its functions are set out in that Act and in Statutory Instrument 158 of 2012. The SEAI's functions include promoting renewable energy and energy efficiency, assisting in the reduction of greenhouse gas emissions related to energy, promoting and assisting research, development and demonstration of new technologies, providing advice to the Minister and to energy suppliers and users, providing information to the public on renewable energy and the environmental benefits of

²³ <https://www.seai.ie/resources/publications/Methodology-for-Local-Authority-Renewable-Energy-Strategies.pdf>

renewable energy sources, working with local and regional authorities on the promotion of renewable energy and energy efficiency and on the running of training programmes, ensuring certification schemes are in place relating to biomass, geothermal, heat pumps and solar systems, maintaining a list of renewable energy installers, making guidance available to planners and architects and promoting high efficiency Combined Heat and Power (CHP.)

The **Commission for Regulation of Utilities (CRU)**, formerly the Commission for Energy Regulation (CER), was established as the statutorily independent energy regulator by the Electricity Regulation Act, 1999. Under the Gas (Interim) (Regulation) Act 2002, CRU received statutory responsibility for regulating the natural gas market. Thereafter, CRU's duties and functions have continued to expand as a result of new legislation relating to the liberalisation of the EU energy market and via the introduction of new primary legislation, including the Energy (Miscellaneous Provisions) Act 2006, Electricity Regulation (Amendment) (Single Electricity Market) Act 2007, the Petroleum (Exploration and Extraction) Safety Act 2010, the Petroleum (Exploration and Safety) Act 2015, and the Energy Act 2016. CRU also has statutory responsibility for the water sector and is the designated national competent authority under the EU gas security of supply regulation 994/2010, which has been superseded by EU Regulation 2017/1938.

CRU's remit now covers areas including the development of the all-island energy market (SEM/I-SEM), customer protection, gas and electricity safety and security of supply, regulating offshore petroleum safety and economic regulation of energy and water. CRU continues to facilitate the safety regulation of Liquefied Petroleum Gas (LPG) and is responsible for evaluating applications for international interconnections. CRU has three Commissioners that work in a collegiate manner and is legally independent in carrying out its functions. It is held to account by the Oireachtas (Irish parliament) and may be summoned before Oireachtas (parliament) Committees to give account for its decisions and actions. CRU is funded by means of a levy (which it assesses on an annual basis) on electricity and gas undertakings, as well as income from licensing fees.

ESB Networks is responsible for the construction and maintenance of the entire electricity infrastructure in Ireland including the transmission, sub-transmission, medium and low voltage networks. ESB Networks is also the Distribution System Operator (DSO) for Ireland's electricity distribution system. ESB owns and funds all investment in the Transmission and Distribution systems in Ireland.

EirGrid plc is the state-owned national transmission system operator (TSO) in the electricity sector since 1 July 2006. EirGrid provides transmission and market services for the benefit of electricity

consumers. It puts in place the grid infrastructure needed to support competition in energy, to promote economic growth, to facilitate more renewable energy, and to provide essential services. EirGrid was established to act as the independent Transmission System Operator (TSO), in line with the requirements of the EU Electricity Directive.

EirGrid holds licences as independent electricity Transmission System Operator (TSO) and Market Operator (MO) in the wholesale trading system in Ireland, and is the owner of the System Operator Northern Ireland (SONI Ltd), the licensed TSO and market operator in Northern Ireland. The Single Electricity Market Operator (SEMO) is part of the EirGrid Group, and operates the Single Electricity Market on the island of Ireland.

Since November 2007, a regional electricity market (the 'Single Electricity Market' (SEM)) is in place on the island of Ireland. The SEM is regulated by the CRU, the Northern Ireland Authority for Utility Regulation (NIAUR) and the independent member(s) under the auspices of the Single Electricity Market Committee (the SEM Committee).²⁴

The **Single Electricity Market Operator (SEMO)**²⁵ facilitates the continuous operation and administration of the Single Electricity Market. SEMO is a joint venture between EirGrid plc and SONI Limited.

Bord na Móna²⁶ was founded as the State peat company. The company also provides products and services in the environmental, renewable energy, electricity generation and waste management business sectors.

The **National Oil Reserves Agency (NORA)** Act 2007 established NORA as a stand-alone state body under the aegis of the Minister for Communications, Climate Action, and Environment. NORA's main function is to maintain Ireland's 90 day strategic oil reserve, in line with the State's stockholding obligations to the EU and IEA. In addition to this responsibility NORA also administers the Biofuel Obligation Scheme. The Biofuel Obligation Scheme was introduced in 2010 by the Energy (Biofuel Obligation and Miscellaneous Provisions) Act 2010 which amended the 2007 Act.

The **Environmental Protection Agency (EPA)**²⁷ is responsible for protecting the environment in Ireland, through licensing, enforcement and guidance. The EPA is an independent public body

²⁴ <https://www.cru.ie/professional/energy/energy-market/wholesale-market-design/#governance>

²⁵ <https://www.cru.ie/professional/energy/energy-market/wholesale-market-design/#governance>

²⁶ www.bnm.ie

²⁷ www.epa.ie

established under the Environmental Protection Agency Act, 1992. The EPA derives further responsibilities from the Waste Management Act, 1996, the Protection of the Environment Act, 2003, and the Radiological Protection (Miscellaneous Provisions) Act, 2014.

The EPA ensures that Ireland's environment is protected, monitors changes in environmental trends to detect early warning signs of neglect or deterioration, and ensures that the people of Ireland are protected from the harmful effects of radiation. The primary responsibilities of the EPA include environmental licensing; enforcement of environmental law; environmental planning, education, and guidance; monitoring, analysing, and reporting on the environment; regulating Ireland's greenhouse gas emissions; environmental research development; strategic environmental assessment; waste management and radiological protection.

Coillte Teoranta established under the Forestry Act 1988 operates in forestry and related activities on a commercial basis and is a major biomass energy provider to the industrial and commercial heat sector. The company is co-owned by the Minister for Public Expenditure and Reform and the Minister for Agriculture, Food and the Marine.

Teagasc is the Irish Agriculture and Food Development Authority which provides research, advisory and training services to the agriculture and food industry and to rural communities. It plays a key role in cooperation with the Department of Agriculture, Food and the Marine and other relevant educational bodies in bioenergy research, development, demonstration, training, and advice provision, including in relation to the forest-based biomass supply chain. Teagasc also engages with the wider farming community through bioenergy research programmes and knowledge transfer to help develop biomass supply chains.

1.3. Consultations and involvement of national and Union entities and their outcome

i. Involvement of the national parliament

Committee on Climate Action

The parliamentary Committee on Climate Action was established on 3 July 2018 to consider the third report and recommendations of the Citizens' Assembly entitled *"How the State can make Ireland a Leader in tackling Climate Change."*²⁸ The Committee is to report its conclusions and recommendations to both parliamentary houses by 31 January 2019. To date the Committee has met multiple times²⁹ and the draft National Energy and Climate Plan is among the matters discussed with Secretaries General (Heads) of relevant Government Departments.

²⁸ <https://www.citizensassembly.ie/en/How-the-State-can-make-Ireland-a-leader-in-tackling-climate-change/Final-Report-on-how-the-State-can-make-Ireland-a-leader-in-tackling-climate-change/Climate-Change-Report-Final.pdf>

²⁹ <https://www.oireachtas.ie/en/committees/32/climate-action/debates/>

ii. Involvement of local and regional authorities

In January 2018 the Minister for Communications, Climate Action and Environment announced that his Department would provide €10m in funding over 5 years to the local authority sector to establish 4 Climate Action Regional Offices (CAROs). This commitment recognises the significant obligation which has been placed on local government to develop and implement its own climate action measures, as well as the need to build capacity within the sector to engage effectively with climate change – both in terms of mitigation and adaptation.

The CAROs are being operated by a lead local authority in 4 different regions, grouped according to shared climate change risks. The establishment of these offices will enable a more coordinated engagement across the whole of government and will help build on the experience and expertise which exists across the sector.

Under the National Adaptation Framework (NAF) the 31 local authorities in Ireland are required to develop their own adaptation strategies in line with guidelines to be developed for the sector (these are currently being reviewed and updated). Work on the development of strategies will be undertaken by individual local authorities with support from the Climate Action Regional Office in their region. Local authorities have also been set a deadline of 30 September 2019 for the completion of local strategies.

Regional Spatial and Economic Strategies (RSESs) are being prepared by the Regional Assemblies. Their main statutory purpose is to support the implementation of Project Ireland 2040 (National Planning Framework & National Development Plan) and the economic policies and objectives of the Government by providing a long-term strategic planning and economic framework for the development of the regions. The RSES are required under the Planning and Development Act 2000 (as amended) to address employment, retail, housing, transport, water services, energy and communications, waste management, education, health, sports and community facilities, environment and heritage, landscape, sustainable development and climate change. The RSES are a link between the National Planning Framework and local level City and County Development Plans and the Local Economic and Community Plans.

It is intended to make use of the aforementioned structures during 2019, as the Plan is being finalised.

iii. Consultations of stakeholders, including the social partners, and engagement of civil society and the general public

The ministry has met with NGOs and the environmental pillar of social partnership to discuss the draft NECP.

The ministry also presented to the Climate Change Advisory Council on the draft NECP in November 2018 and will consult with them formally during 2019.

The Government has also established a National Dialogue on Climate Action. The National Dialogue will provide an opportunity to create awareness, engagement and motivation to act (locally, regionally and nationally) in relation to the challenges presented by climate change, and will create structures and information flows to facilitate people gathering to discuss, deliberate and achieve consensus on appropriate responses to these challenges as well as enable and empower appropriate action. It is intended to use the National Dialogue on Climate Action to consult with a wide range of stakeholders on the NECP during 2019.

An initial public consultation was held in October-November 2018. This consultation explained the NECP template and process and asked a series of open questions. Over 60 responses were received. These were considered as the draft NECP was being compiled.

A summary of the main points raised in the responses received in respect of the questions asked in the public consultation can be found below.

Question 1: Taking into account the National Mitigation Plan, the National Development Plan 2018-2027 and Ireland's target under the Effort Sharing Regulation, what further measures to reduce non-ETS emissions do you believe Ireland should take?

A number of overarching measures are suggested including the need for a plan which incorporates and optimises the interaction between all three energy sectors - transport, electricity and heat. Ireland should plan its policies in the long-term to 2050 and aim to be a global leader in the green economy. It is suggested that Government determine a carbon budget with reduction targets for each respective sector of the economy, along with complementary and detailed policy measures to achieve this. There is also a suggestion that a reporting framework be developed, where progress is reported on a six monthly basis.

It is submitted that the National Development Plan needs to be reviewed and redrafted to ensure achievement of the National Transition Objective and the Paris Agreement goal. Similarly the National Mitigation Plan needs to be reviewed and integrated into the NECP process. Another proposal is that all Government decisions that could impact on emissions be accompanied by a climate audit. Many submissions mention the polluter pays principle, with others advocating effective and proportionate taxation, and there is a proposal that Government policy should specifically outline what it will mean for each person if Ireland misses its targets.

The need for the electrification of the heat and transport sectors using renewable electricity is widely proposed. Some suggested 70% of renewable electricity by 2030 through various measures including increased wind power and the development of cooperative renewable energy projects in hydro and wind energy. Other measures suggested are strengthening Ireland's electricity transmission system, reduction and removal of fossil fuel generation – and any subsidies for same – and increased interconnection complemented by flexible gas-fired generation. The construction of new batteries and the use of heat pumps and electric vehicles were also suggested in these sectors. District heating as part of a national heat plan is also proposed.

In the transport sector, reduced emissions are consistently mentioned with various submissions proposing a national sustainable transport network. Measures mentioned are varied, including a carbon tax, congestion charges, priority measures for low emission alternatives, electrification of public transport, the escalation of economy-wide GHG-emission pricing, a focus on cycling, temporary CNG in heavy vehicles and an earlier ban on sales of non-zero-emission vehicles.

A number of suggestions are made regarding the agriculture sector including the abandonment of Foodwise 2025, herd reduction, the immediate cessation of peat extraction and support for anaerobic digestion, as well as the need to build on scientific and technical knowledge and the constant review of metrics applied to ruminants. An industry submission is against a carbon tax but favours carbon tariffs on imports. There is also a suggestion to restore Ireland's peatlands as a means of emissions reduction/ sequestration.

In the construction sector it is suggested Ireland plan now for the ending of fossil fuel heating in new domestic and commercial properties as well as improving the building fabric and decarbonising heating sources, and strengthening Part L Building Regulations. Other submissions advocate

increased grants levels and access to low-interest finance for retrofits, continued energy efficiency grants and there is general advocacy for geothermal energy.

Other general proposals include implementation of the Citizens' Assembly recommendations, opposition to the building of LNG terminals, public-private partnerships at local and regional levels, a carbon price floor in the ETS sector, strong carbon pricing in order to incentivise change and a safe and secure regime for Carbon Capture and Storage (CCS).

Question 2: How do you believe Ireland's national contribution towards the EU's 2030 renewable energy target of 32% should be determined? Please include your reasoning.

Various suggestions were made about the target such as it should be challenging but manageable, proportional to our GDP/population size, it should be technically feasible, cost effective with a fair sharing of EU efforts determined by consumption/population and it should be determined on a least cost basis, with a whole system approach also mentioned as preferable. Ireland should also focus on developing our own indigenous renewables sources and national policies should aggressively favour renewable energy. It is also suggested that decarbonisation should be prioritised ahead of RES-E if a conflict exists. Across submissions there is a consistent call for a 70% RES-E target, with wind and solar suggested as the main sources of this electricity. There were suggestions of 45% and 50% targets by 2030, one suggesting a rise to 90% by 2040.

It is suggested that milestone targets be established to gauge progress and that they must be translated into regional and local contexts to drive delivery of market growth rates. One proposal is that the overall contribution should be calculated after a carbon emissions reduction strategy for the various sectors is defined. Another submission considers carbon reduction as more important than renewable penetration and a cross sectoral approach on reduction is advocated. There is a suggestion that Ireland aim for the highest possible ambition in each sector and that targets should reflect the importance of decarbonisation. There should be a focus on deep retrofit, heat pumps, solar panels and other renewables, including biomass, in the heat sector. The importance of biomass and the bio-economy and its potential to the Western region is highlighted, with district heating suggested as a potential use.

In transport there should be no limit to the ambition on rolling out EVs, including an obligation on same, and an increase in the use of biomethane and renewable hydrogen. There are proposals to

maximise biofuel usage, introduce petrol with increased bioethanol and for fleet adaptation to increase biofuel use. The development of a CNG and bioCNG strategy is mentioned as well as a suggestion that Ireland should not import from non-Paris agreement countries.

One submission supports wave energy development with State support for enterprise and through revenue measures, while another suggests diversification and less reliance on onshore wind generation. Other submissions favour geothermal energy and the prioritisation of community projects.

Question 3: How do you believe the contribution to be made from the individual sectors (i.e. electricity, heat and transport) should be determined? Please include your reasoning.

A number of submissions mention the importance of a large (70/75%)RES-E target as it will help to decarbonise the heat and transport sectors. It is also proposed that targets should be developed based on an over-arching evidence-based smart energy system plan. The establishment of sub targets for electricity, heat and transport is proposed, in the context of the carbon emissions reduction strategy and should be informed by SEAI modelling. There is also a suggestion of legally binding carbon reduction targets for each sector.

The RES-E system should be diversified with supports to all technology types including support for microgeneration and community owned projects, including district heating using waste heat, while there are proposals for the further exploitation of wind resources, including hydrogen generation) and renewable gas. It is also submitted that carbon reduction remains the most important goal with flexible electricity demand prices available. Another suggestion is that each sectoral contribution be made on the basis of the least marginal cost of carbon mitigation and that a radical effort is needed in the transport/ agriculture Non ETS sector with support voiced for the new RESS and SSRH Schemes. There is a further suggestion that the NECP must address GHG emissions from all sources.

Significant support for biogas production is mentioned as is the suggestion that offshore wind deployment could mean Ireland becomes a net exporter of renewable energy. Carbon sequestering through forestry is also encouraged as well as a strategy for removal of fossil fuel use and subsidies. There is a suggestion that the reasons for missing the 2020 targets be identified to inform future actions.

Question 4: What policies and measures do you believe Ireland should adopt to achieve its renewable energy contribution and what are the grounds for your recommendations?

There are a number of coordinated submissions calling for a 70% renewable electricity target by 2030, to be achieved by various measures including implementation of the RESS, increase in wind, solar and battery power. One submission suggests strengthening the grid to allow 90% renewable electricity at any one time. It is also proposed that a percentage of RESS funding to go towards developing technologies, and that there should be a wider range of technologies. Clear sector goals should be set, targets should be realistic and incentives used.

There is a suggestion that the route to market policy for RES-E projects must allocate risks to parties best able to manage them and that these projects can pursue a route to market as well as a proposal to streamline grid access and connection costs and the introduction of feed in tariffs for commercial and domestic microgeneration. Grid connection should also facilitate offshore wind projects. There is a call for a specific target for offshore renewable energy.

Electrification is suggested for much of heating and transport along with the development of electro-fuel (particularly hydrogen) for large scale energy storage. New energy and efficient storage systems should be incentivized, as should microgeneration and solar PV, and expanded in addition to offshore wind. There are calls for more interconnection, heat pumps, electric vehicles and a suggestion that carbon tax income be ring-fenced for carbon reduction projects.

On policy/regulatory matters it is suggested that Ireland use international aims and strategies as the basis for our policies and that Government support will be essential to reach targets as will stakeholder engagement and careful management of the planning process. It is also proposed that agencies should be resourced to support community ownership projects and that policies around small scale battery storage be developed to aid self-consumption. District heating and community participation should be encouraged along with the elimination of subsidies for peat burning,

One submission highlights the importance of mobilising indigenous biomass as well as the benefits of biomass co-firing, and there are others calling for increased biomass and financial incentives for their use over fossil fuels. There is support for renewable gas in the form of biomethane with a call for a national policy on same and a suggestion that anaerobic digestion, biofuels and district heating should be considered for areas not conducive to direct electrification. All ocean energy measures

should consider the environmental impact and the risks posed by non-native species should be taken into account in all policies relating to biofuels.

Question 5: Bearing in mind Ireland's current state of progress on energy efficiency, what contribution do you believe Ireland should make to the EU indicative energy efficiency target of 32.5% by 2030, and why?

There is general support for the EU target and for Ireland to make at least a proportionate contribution and take a leadership role, with one suggestion that targets be made legally binding in Europe.

There is a proposal that a national economic model is required showing how each sector can be decarbonised at least cost with the best technology or measure to do so, while another suggests a National Smart Energy System plan. It is also submitted that the targets can only be ascertained by the carbon reduction strategy and SEAI modelling and also that the targets should be based on the amount of energy use.

Many submissions advocate continued support through grants and tax incentives (e.g. deep retrofit) for energy efficiency and cost effective schemes, especially in the building sector. The overall transition needs to be balanced to ensure that it is cost effective.

There is mention of the benefit of High-Efficiency CHP plants where overall efficiency of 80% can be achieved by combining the production of heat and electrical power. Investment in specific measures such as micro-generation, electric vehicles, increased investment in public buildings, availing of waste heating and emerging technologies are proposed.

Question 6: What indicative national milestones for energy efficiency do you believe that Ireland should set for 2030, 2040 and 2050, and why?

It is suggested that Ireland's contribution to the efficiency target and the initiatives to achieve it be stipulated in the NECP, while another proposal advocates that the path forward be informed by a fully costed economy model. There is a suggestion that it is not sensible to set targets beyond 2030. Other proposals include the reduction of energy demand on a sliding scale to 75% by 2050 and an 80% improvement in energy efficiency by 2050.

The transition is a complex exercise which must look at competitiveness, energy efficiency, renewable energy penetration and security of supply. The biggest efficiency opportunities are in the heating sector according to one submission especially in relation to deep retrofit.

There is support across a wide range of submissions for a higher carbon tax for ETS & non-ETS energy consumers, a limit on energy consumption for household, business etc. and to promote investment in technology, with targets to avail of best available technology.

Question 7: What policies and measures do you believe Ireland should adopt to achieve its energy efficiency contribution and what are the grounds for your recommendations?

There was considerable endorsement from those making submissions of many of the approaches and measures already in place. There was a view expressed in many submissions that more should be done on awareness raising to better inform households and businesses about actions they could take which would benefit themselves and save energy and reduce carbon emissions.

There are a number of suggestions around the building sector especially with regard to public buildings, schools etc. Among these are a carbon tax, insulation measures, mandatory green procurement, reducing fossil fuel dependency, annual energy audits and deep retrofit as well as improved regulation and increased incentivisation of clean energy. Urgent launch of the full SSRH Scheme is recommended as are more specific measures in the overall efficiency strategy.

There is a lot of support for increased electrification of energy use to improve overall energy efficiency with proposals to incentivise local electricity generation, feed in tariffs, etc. There was a view expressed of the SEAI Triple E Register as being “too slow and cumbersome”. Investment schemes for new waste to energy and biomass to energy technologies are advocated.

Question 8: In terms of the areas of energy security identified in the template, are you satisfied with the resilience of Ireland’s national and regional (with other Member States) energy systems and if not, what suggestions would you make for improvement?

The general commentary is one of concern regarding the resilience of Ireland’s energy systems mainly due to reliance on imported fossil fuels and the depletion of our natural gas supplies. There

is a need to increase energy security through the development of indigenous zero or negative carbon energy resources such as wind, solar, PV, bioenergy, wave and tidal energy. There is a call for the development of more diverse gas supply including an LNG regasification terminal, the promotion and acceleration of renewable biogas injection into the existing infrastructure and more interconnection, though reservations are expressed about the cost of LNG.

A more supportive national framework is recommended, based upon more innovative concepts on how distribution networks are configured, managed and regulated. There is a suggestion that an equitable platform be provided for renewables to compete with fossil fuels in the electricity market, including a reduction in the rates for windfarms.

The project to twin and split the GB/Irish gas interconnector system, creating two separate systems is mentioned as a benefit to security of supply and there is also a proposal to develop a fully integrated North West European Electricity market. There is a suggestion that a regional approach to strategically locating battery storage facilities would take significant pressure off the national grid during periods of high demand and that the next round of battery auctions need to be energy based. Other suggestions include the development of large scale energy storage facilities, demand reduction and more ethanol and E10 petrol.

While there is a suggestion that there should be more promotion of indigenous exploration another submission suggests that no new licences be issued for exploration given the imperative to divest from fossil fuels. Concerns are expressed that reliance on fossil fuels creates price insecurity and that is a national security issue and that a failure to decarbonise and that a business as usual approach rooted in natural gas for electricity generation is itself a significant energy security risk.

Question 9: What policies and measures do you believe Ireland should adopt to achieve its energy security objectives and what are the grounds for your recommendations?

A number of suggestions were made across questions 8 and 9, primarily the need to improve energy security through the development of alternative and indigenous energy sources such as wind, solar, PV, bioenergy, wave and tidal energy and the conversion of the transport fleet to electrical or compressed gas run vehicles.

There is also a suggestion that the same distribution infrastructure and electricity generating plant be used but that renewable gas (such as biomethane or hydrogen) should be the main fuel used. There is a call for greater community and public engagement to ensure all citizens buy into a national renewable energy strategy and that relevant government policy measures are implemented, with the necessary financial supports, to underpin the transition.

A carbon tax for energy consumers is proposed with consumption limits on every household, building, business and vehicle whereby a tax is levied after an allowance or efficiency level is exceeded. This would promote investment in new technology and encourage more personal energy solutions. It would also generate revenue from bigger energy users and those who waste more.

Provision should be made for community owned energy developments and feed-in tariffs for domestic energy production, to allow the growth of bottom-up solutions for domestic energy sources, demand response and energy storage. There is a suggestion that renewables should have priority access to the grid and that the TSO should be held accountable for committed grid delivery dates and that future policy should include financial commitments from the TSO to deliver grid connections for renewable energy projects by agreed dates or else face penalties.

Biomass should only be considered for high demand periods when renewables are unavailable according to one submission and there is also a suggestion that the RESS and DS3 support mechanisms be implemented as soon as possible. Other suggestions are the utilisation of more of the already available indigenous energy sources, such as waste heat and the use of advanced technologies such as battery technologies.

There is a call not to support the Petroleum and Other Minerals Development (Amendment) (Climate Energy Measures) Bill 2018 as it is alleged it will likely make Ireland more dependent on energy imports as well as a call for no further oil and gas exploration in Irish waters.

Question 10: Taking into account the EU electricity interconnection target, what do you believe should be Ireland's priorities in terms of further electricity interconnection, and why?

There is unanimous support for interconnection with many submissions favouring the Celtic Interconnector and advocating increased interconnection with Europe. Cost benefit analysis of projects is suggested as is an analysis of optimum interconnection projects, with the development of

a roadmap of interconnection to 2050 also proposed. Derogation of the electricity interconnection target post Brexit is suggested as is calculation of any UK interconnection as part of any EU targets. There is also mention of increasing the 15% EU target.

Question 11: What policies and measures do you believe Ireland should adopt to achieve its electricity interconnection objective and what are the grounds for your recommendations?

Again widespread support for further interconnection, with cost benefit analysis, as well as investment in transmission infrastructure. Alignment with the development process for interconnection with other countries is recommended with a fit for purpose planning and regulatory environment in place here.

There is a proposal for evolving HVDC technology, enhancing convertor stations and developing offshore wind power in conjunction with interconnection. An expanded MOU with the French TSO is also suggested.

Question 12: What electricity and gas transmission infrastructure projects would you consider to be of greatest importance in terms of Ireland's achievement of the objectives, targets and contributions under the 5 dimensions of the Energy Union strategy?

There is widespread support for further electricity interconnection and in particular a North-South project, subject to cost benefit analysis. Building on the EirGrid's grid development plan, it is also widely suggested as well as upgrades for the existing grid. There are proposals to use old grid connections for offshore windfarms and for wide spread implementation of smart grid and battery technologies. One suggestion is for infrastructure to be constructed in response to market signals while another calls for new energy infrastructure investment in the West and North West.

There is also support for expansion of the gas network including carbon capture and storage, biomethane grid injection, a LNG terminal, compressed natural gas stations, power-to-gas and a hydrogen transmission network. One submission cautions that new gas infrastructure may 'lock in' the burning of fossil fuels. One suggests a route to market for biogas and an acceleration in the amount of biogas on the supply grid to 10%. Renewables projects are widely supported especially community based initiatives.

Question 13: What policies and measures do you believe Ireland should adopt to achieve its energy transmission objectives and what are the grounds for your recommendations?

There is general support for improved and increased gas and electrical infrastructure through efficient and effective projects, wide implementation of smart grid technology and a proposal for a new system to take projects from inception to delivery.

A new grid development strategy to support the NECP is suggested as is infrastructure to link high penetration of renewables in the South and West of Ireland to high demand regions in the East. Grid connection costs should be reduced and there is a submission to maximise the capacity utilisation of the gas grid. Certification for renewable and sustainable Power-to-Gas or Power-to-Chemicals or Power-to-X solutions is also proposed. There is a call for a stronger mandate to build out new overhead and underground cables as well as national planning objectives for renewable development.

Other suggestions are interconnectors that connect to Europe, an LNG terminal in Ireland, increased backbone infrastructure and the development of policies to enhance connections.

Question 14: Noting considerable progress on the regional integration of Ireland's wholesale electricity and gas markets with neighbours, for example via physical interconnection and changes to market arrangements and rules, what further objectives do you believe Ireland should set in the area of energy market integration as set out above and why?

Question 15: What policies and measures do you believe Ireland should adopt to achieve market integration objectives and what are the grounds for your recommendations?

There is a call on government to further support CRU/SEMO to ensure operational issues are addressed also for them to incentivise flexible conventional generation. There is a proposal that Ireland should be actively promoting UK participation in cross border initiatives post Brexit and ensure high levels of participation in all EU discussions on SEM development.

One submission proposes the construction of a LNG regasification facility as priority over a subsea gas pipeline as well as favouring High Efficiency Combined Heat and Power (HE CHP), Another

suggests a potential reverse flow across interconnection and LNG terminals. There is a recommendation that old power station connections be utilised for offshore windfarms and that new LNG terminals be linked to the gas grid to support security of supply and diversity of fuel mix.

It is recommended that value be given to renewable/ sustainable/indigenous resources such as biomass, biogas, hydrogen, electricity, etc. One proposal says the high cost of trading is prohibitive and suggests re-introducing proposed Aggregator of Last Resort, to provide options for small renewable generators to participate in wholesale electricity market.

Question 16: Ireland currently has an energy poverty strategy 2016-2019. Do you believe that a new strategy is required to cover the period up to 2030 and what objectives should it contain?

There is general support for the current strategy's approach and funding to alleviate energy poverty to be maintained with most suggesting a new strategy is required. Some concerns that the current strategy is out of date and not fully implemented but that a review of it could be used to develop a new strategy. It is highlighted that the rental sector is an important area to tackle for alleviating energy poverty. There is a suggestion that actions be integrated with decarbonisation and that there should be a long term plan on how renewable energy support schemes will affect those in energy poverty. Any strategy should ensure fair access to all for new technologies, with policies to incorporate new energy production (including heat pumps/district heating) and there should be information and engagement on smart technologies, e.g. smart meters.

There is a suggestion to incentivise cheaper, more efficient clean fuel and to introduce measures to reduce consumption. Other measures suggested are extending the Deep Retrofit Scheme, changing fuel types, minimum energy efficiency standards in the rented sector, raising awareness and that homes close to the gas grid be connected, with prepay meters installed to combat poverty.

Question 17: What policies and measures do you believe Ireland should adopt to achieve its energy poverty objectives and what are the grounds for your recommendations?

It is suggested that an Energy Poverty Policy 2020 – 2030 be reviewed every 3 years with ESRI and SEAI to assess and audit progress. There is a lack of incentivisation in the rented sector which is causing energy and health poverty but another submission proposes that a minimum BER be introduced for rented properties.

There is a call for investment in the retrofit of all public housing and buildings and that all new social housing/homeless hubs are built to high energy efficiency standards. It is also suggested that grant funding be increased for the Warmer Homes and Deep Retrofit Schemes with national training schemes provided for deep retrofit projects in conjunction with SEAI, while increasing the amount of fuel poor homes on the Deep Retrofit scheme to 50%

Consideration should be given to upscaling all schemes and incentivising Eco-design solid fuel appliances in energy poor homes with new policies required to enable the rollout of electrification of heat and transport among the Energy Poor.

Other measures suggested are discouraging the use of fossil fuel as heating, prioritising electrification and use of heat pumps, allowing sale of energy back to grid and increased focus on raising awareness and education.

Question 18: What objectives do you believe Ireland should set for the funding of research covering the five dimensions of the energy union, and why?

There are a number of submissions suggesting a collaborative approach to research between Government, academia, research bodies and industry, including the development of a costed model setting out the least cost pathway to decarbonisation. Another suggests further research is required on the integration of renewable electricity systems on the grid, on ion carbon sequestration, on bioenergy emissions and on the environmental impacts of renewable technologies.

There are proposals that priority be given to projects which will deliver increased security of supply (including LNG), reduce carbon and increase renewables, increase energy efficiency and competitiveness and utilise existing infrastructure. Research should be focussed on technologies at an advanced state of readiness already and which will prioritise system stability, demand side management, energy storage, floating wind and hybrid technologies, grid technologies and storage solutions and on making biofuels economically viable.

A proposal is made that research should focus on areas specific to Ireland such as agriculture and non-synchronous generation while another suggests that the focus be on integration of renewable electricity onto a power system; and for post 2030 high energy volume storage technologies research and power-to-gas technologies research.

Question 19: What policies and measures do you believe Ireland should adopt to achieve energy research objectives and what are the grounds for your recommendations?

There is a suggestion that involving An Post and credit unions would increase interest in green community schemes and that enterprise and investment agencies should enable access to funding for community shared ownership investment and that policy should facilitate open and transparent research funding competitions. There is a call for more discussion platforms to involve academia further and also for the oil and gas sectors to fund further research in third level institutions.

It is proposed that more funding be given towards demand response and a dedicated state body created. More should be done to support customers in their transition to flexible demand profiles and for research at transmission level with any learnings shared. The support shown that GNI projects should be replicated for biomethane, CHG, power-to-gas, hydrogen, and CCS projects. It is also suggested that energy research objectives should have targets set in supporting TSO and DSO research.

Question 20: Are there any other comments or observations that you wish to make?

A number of comments were made in conclusion, including a proposal for the creation of a single government department (and Minister) dedicated to Energy, Climate Action and the Environment. An integration of policies and plans across sectoral interests to prevent conflicts was also suggested for the Plan which, one submission says, has the potential to catalyse widespread societal engagement in response to climate challenges.

It is said that the Plan should support development of transparent, well-resourced policy coherence for a development mechanism to ensure delivery of our climate obligations. Some concern is expressed that protection of the agri-food sector has previously dominated government engagement.

Some respondents believe that there is a need to reevaluate our energy situation and make firm commitments to transition to energy independence through a diversified energy mix, powering electrified heat and transport sectors. The market needs certainty and early signals and there should be a facilitative grid connection policy with a defined support scheme. The focus should be on taking actions which are low regret in terms of achieving the most efficient overall transition.

There is a proposal which suggests that all sectors work together, with a working group set up to share knowledge, ideas and propose solutions and that Ireland should propose an overall reduction target, and not separate reduction targets for ETS and non-ETS sectors. Another suggestion is that Ireland aim to be above the EU average in all benchmarks relating to energy security.

One submission observes that no questions have addressed emissions from the non-energy sector and other climate related issues around adaptation while another proposes that Ireland commits to an upper limit on our net future cumulative emissions of long-lived GHGs.

It is suggested that hydrogen can offer solutions to the emissions problem but needs policy, government and industry support, according to one submission, while another supports further exploration of our own indigenous gas supplies and support for best in class energy efficiency e.g. High Efficient CHP, as well as the development of LNG infrastructure.

There is call for ambitious targets to be introduced and another says that any high level targets should also be translated into a regional context to drive a thriving low carbon economy and spread any benefits countrywide. There are a number of suggestions concerning retrofit contractors including a third-level energy efficiency course for future installers, tax relief for new installers and help in completing grant applications. Issues consistently raised were the need to phase out fossil fuels, a 70% renewable electricity target by 2030, the development of district heating, geothermal heating, feed in tariffs for solar PV, financial incentives for grid energy export and a review of development charges and rates on renewable projects.

iv. Consultations of other Member States

North Seas Energy Cooperation (NSEC)

In preparing the plan, Ireland made use of the NSEC, in which experts have given mutual feedback regarding specific aspects on offshore renewable trajectories, market integration and offshore grid infrastructure through the support groups in the NSEC (see section 1.4 below.)

Northern Ireland

The ministry met with counterparts from Northern Ireland's energy ministry to discuss their formulation of a new energy strategy to 2030, their input to the UK NECP and the preparation of Ireland's draft NECP.

v. Iterative process with the Commission

The iterative process with the Commission in respect of Ireland's draft NECP 2021-2030 will take place during 2019.

1.4. Regional cooperation in preparing the plan

i. Elements subject to joint or coordinated planning with other Member States

North Seas Energy Cooperation (NSEC)

Ireland is part of the wider North Seas region, which has a large renewable energy potential. The European Commission has estimated that offshore wind from the North Seas can cover up to 12% of the electric power consumption in the EU by 2030.

Offshore wind generation and grid infrastructure projects may have cross-border effects on energy prices, security of supply and the environment, including availability of marine space as well as the pace of innovation. The North Seas countries therefore have great benefits to gain from cooperation.

The North Seas Energy Cooperation (NSEC) is a voluntary, bottom up, market-oriented, regional cooperation initiative established in 2016, which seeks to create synergies and to avoid incompatibilities between national policies and to foster joint strategies where possible and beneficial. The aim is to coordinate and facilitate further cost-effective deployment of offshore renewable energy, in particular wind, ensuring a sustainable, secure and affordable energy supply in the North Seas countries through increased and better coordinated offshore wind deployment as well as potential joint projects or cluster projects. The NSEC focuses on a step-by-step approach with the perspective of further integration and increased efficiency of wholesale electricity markets in the longer term, while contributing to a reduction of greenhouse gas emissions, in average wholesale price spreads and enhancing security supply in the region.

The North Seas Energy Cooperation consists of 10 countries with participation from the European Commission: Belgium, the Netherlands, Luxembourg, France, Germany, UK, Ireland, Norway, Sweden and Denmark.

The support groups under the cooperation focuses on the following subjects:

SG1: Maritime Spatial Planning

SG2: Development and regulation of offshore grids and other offshore infrastructure

SG3: Support framework and finance for offshore wind projects

SG4: Standards, technical rules and regulations in the offshore wind sector

ii. Explanation of how regional cooperation is considered in the plan

North Seas Energy Cooperation

As regards to preparing this plan, Ireland made use of the NSEC, in which experts in the support groups shared information and experiences on specific aspects, for example on offshore wind development and in particular development on aggregation of national renewable energy trajectories for offshore wind until 2030 (2.1.2) and market integration (2.4.1).

As regards to measures, Ireland benefits from the NSEC in several ways. The work in the NSEC provides a platform for exchange of best practice as regards to the design of support schemes and to exchange and work on new concepts tackling new challenges as regards support for offshore wind. The NSEC also serves as a platform to jointly work on concepts for potential joint wind offshore projects (3.1.2) and for coordinated electricity infrastructure, including transmission infrastructure.

Other:

During 2019, during preparation of the final NECP 2021-2030, Ireland will engage in additional regional cooperation with regional partners.

2 **NATIONAL OBJECTIVES AND TARGETS**

2.1. **Dimension decarbonisation**

2.1.1. **GHG emissions and removals³⁰**

i. The elements set out in point (a)(1) of Article 4

National Objectives and Targets

On 20 July 2016, the European Commission presented two legislative proposals for the non-ETS sector:

- the Effort Sharing Regulation (ESR), which set out the binding emissions reductions for energy, industrial processes and product use, transport, agriculture and waste, and;
- The land use, land use change and forestry (LULUCF) proposal, which set out the accounting rules for emissions and removals from the categories of afforested land, deforested land, managed cropland, managed grassland, managed forest land and managed wetland.

Effort Sharing Regulation

The "Effort Sharing Regulation" (ESR), sets out binding annual greenhouse gas emission targets for Member States for the period 2021–2030. These targets cover sectors of the economy that fall outside the scope of the EU Emissions Trading System (EU ETS). These sectors, including transport, buildings, agriculture and waste management, account for almost 60% of total EU emissions. The Regulation is the follow-up to the Effort Sharing Decision, which established national emissions targets for Member States in the non-ETS sectors between 2013 and 2020.

The key elements of the ESR include:

- A starting point of the trajectory calculation is set for May 2020, as proposed by the Commission, and based on average emissions from 2016 to 2018;
- Existing flexibilities set out in the current Effort Sharing Decision have been maintained, including the banking and borrowing of annual emission allocations from one year to another within the 2021-2030 period, as well as transfers between countries;
- New flexibilities, including a one-off cancellation of ETS allowances (to the value of 4% for Ireland) and use of LULUCF (land use, land-use change and forestry) flexibilities have also been included;

³⁰

Consistency to be ensured with long-term strategies pursuant to Article 15.

- A safety reserve for less wealthy Member States which, despite meeting their 2020 targets, may struggle to reach their 2030 targets (this reserve will contain a total of 115 million tonnes of CO₂ equivalent, which will be made available in 2032, and eligible Member States will have to comply with strict conditions, including first having to make use of the other flexibilities available under the ESR before being eligible to access the safety reserve);
- A provision that the safety reserve can only be used in case the EU as a whole fulfils its 2030 target, thereby making sure the ambition of the EU climate policy is maintained; and
- A small (2 million tonnes) additional adjustment of the allocation for Member States in exceptional circumstances, namely Latvia and Malta.

For the ESR, targets have been assigned to Member States based on GDP per capita and the cost-effectiveness of domestic emissions reductions within individual Member States. The ESR enshrines a greenhouse gas emissions target for Ireland of 39%, reduced to 30% to reflect the cost-effectiveness of measures.

Based on the latest emissions projections for Ireland (May 2018), total emissions are projected to increase from current levels (2016) by 1% and 4% by 2020 and 2030 respectively under the With Existing Measures scenario. Under the With Additional Measures scenario, emissions are estimated to increase by 2% by 2020 and decrease by 1% by 2030. However, it should be noted that these figures do not take into account ongoing policy development (especially in the agriculture sector) as well as the migration to a new energy, environment and economy model that has been developed for use in Ireland's emissions projections and will be used for the purposes of future model runs.

The incorporation of significant measures under Ireland's 2018 National Development Plan (NDP), as well as a range of policies and measures that have been identified by Ireland's agricultural research authority Teagasc, will make significant improvement to Ireland's emissions projections to 2030. Using the EU Reference Scenario oil price, it is calculated that ESR emissions in Ireland (i.e. emissions outside the EU ETS) would be 41.12MT under the With Additional Measures scenario. Assuming Ireland uses its full flexibilities under the ESR, Ireland would exceed its carbon budget by approximately 7MT CO₂-eq. over the 2021-2030 period in this scenario which incorporates key climate action measures, but does not include agriculture measures that have been identified by Teagasc.

There are no individual targets for each sector in the ESR. The 30% reduction target that will be set for Ireland will cover all non-ETS sectors, including transport, buildings, agriculture and waste

management. In December 2017, the European Parliament and European Council reached a provisional agreement on the ESR file, which was formally endorsed by both the Parliament and Council in May 2018.

Flexibilities

Ireland may need to avail of flexibility options built into the ESR agreement. These will allow Ireland to transfer 4% of credits from the EU Emissions Trading System (ETS) to assist in the achievement of the ESR target, plus an additional 5.6% attributable to sustainable land use, land-use change and forestry (LULUCF). If exercised, collectively, these flexibilities would combine to reduce Ireland's effective 2030 emissions target to 20.4%.

ETS flexibility: Eligible Member States have to notify the Commission before 2020 of the amount of this flexibility they will use over the period. Since the transfer is strictly limited in volume, and decided beforehand, predictability and environmental integrity are maintained. Ireland will be able to avail of a transfer of 4% of its 2005 emissions to be used for compliance under the ESR, for every year in the 2021-2030 period.

LULUCF flexibility: All Member States are eligible to make use of this flexibility, while access is higher for Member States with a larger share of emissions from agriculture (IE received highest %- 5.6% - this equates to a maximum amount of 26.8 Mt to be taken from the LULUCF sector). In line with EU leaders' guidance, this recognises that there is a lower mitigation potential for emissions from the agriculture sector.

Ireland's agriculture accounts for 33% of national emissions whereas agriculture in the EU 28 represents only 10% of EU-28 emissions. As a portion of the non-ETS sector (for which the State is responsible under EU law), agriculture represents over 45% of non-ETS GHGs in Ireland, but only 18% of EU-28 non-ETS emissions. Recognition of the unusually large contribution of agriculture to our national emissions is vitally important to Ireland. The EU has already recognised (including in European Council conclusions) the multiple objectives of the agriculture and land use sector with their lower mitigation potential.

Land Use, Land Use Change and Forestry (LULUCF)

The LULUCF Regulation sets out the accounting rules for emissions and removals from the categories of afforested land, deforested land, managed cropland, managed grassland, managed forest land and managed wetland.

The inclusion of LULUCF is seen as reflective of the recognition in the Paris Agreement of the role of balancing sources and sinks in climate action and the lower mitigation potential of agriculture. Final agreement of the LULUCF Regulation was reached at COREPER in December 2017.

Key targets and commitments for Ireland include:

- Ireland will have access to a flexibility of 26.8 MT of removals from LULUCF over two accounting periods (2021-2025 and 2026-2030) through Article 7 of the ESR.
- For Ireland, afforestation, net of deforestation, is forecast to contribute 22 MT with 4.8 MT forecast to come from increased soil carbon in cropland and grassland over the period 2021-2030.
- Under Article 4 LULUCF (the “no-debit rule”), emissions cannot exceed removals in the land accounting categories, thus if there are cases where LULUCF as a whole produces net emissions this will make meeting the overall reduction targets more challenging.
- Afforestation and deforestation are accounted on a gross-net basis over a 20 period (or 30 years for afforestation depending on national conditions) i.e. all removals and emissions of GHG in forests less than 30 years, in each accounting period, are accounted.
- Managed forest land is accounted against a forward looking baseline representing historic management practices in 2000-2009, but taking account of forest conditions (e.g. age class) during the accounting period.
- Managed cropland, grassland and wetland are accounted on a net-net basis against the average emissions and removals in 2005-2009.
- Accounting of managed wetland will be voluntary for the first period but will become mandatory for the second period subject to a Commission review.
- The reference level and its method of construction must be submitted to the Commission as part of a national forestry accounting plan by 31st December 2018 for the period from 2021 to 2025 and by 30th June 2023 for the period from 2026 to 2030.
- Compliance reports must be submitted by 15th March 2027 and by 15th March 2032 which includes the balance of total emissions and removals within each land accounting category for the periods 2021-2025 and 2026- 2030, respectively.

Ireland’s National Policy Position

The extent of the challenge to reduce greenhouse gas emissions in line with Ireland’s International and EU obligations is well understood and is reflected also in Ireland’s National Policy Position on Climate Action and Low Carbon Development (2014) and the Climate Action and Low Carbon Development Act 2015. Both the policy position and legal framework are key elements of the effort

to progress the national low carbon transition agenda. The National Policy Position establishes the fundamental national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050. It sets out the context for the objective, clarifies the level of GHG mitigation ambition envisaged, and establishes the process to pursue and achieve the overall objective.

Specifically, the National Policy Position envisages that policy development will be guided by a long-term vision based on:

- an aggregate reduction in carbon dioxide (CO₂) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and,
- in parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

As the first of a series of successive National Mitigation Plans required by the 2015 Act, the first Mitigation Plan cannot set out precisely how Ireland will achieve the national transition objective. However, it demonstrates the scale of the deep decarbonisation that will be required by 2050 and lays the initial foundations for this to happen.

- ii. Where applicable, other national objectives and targets consistent with the Paris Agreement and the existing long-term strategies. Where applicable for the contribution to the overall Union commitment of reducing the GHG emissions, other objectives and targets, including sector targets and adaptation goals, if available

Climate adaptation

Summary of Impacts and Vulnerabilities

The Intergovernmental Panel on Climate Change's (IPCC) Special Report on Global Warming of 1.5°C³¹ has unequivocally confirmed that we are already seeing the negative impacts of climate change. Observations show that Ireland's climate is changing and the observed scale and rate of change is consistent with regional and global trends. The most immediate risks to Ireland which can be influenced by climate change are predominantly those associated with changes in extremes, such as floods, precipitation and storms.

This section gives a summary of the main adaptation policies and measures currently in place in Ireland and provides and considers Ireland's progress under the Commission's adaptation preparedness scoreboard.

³¹ <http://www.ipcc.ch/report/sr15/>

The Environmental Protection Agency (EPA) first published “A Summary of the State of Knowledge on Climate Change Impacts for Ireland”³² in 2009. In 2017 the EPA published its second “State of Knowledge” report to take account of new data, analyses and knowledge.³³ This report provides a more comprehensive picture of how Ireland might be impacted by climate change. While uncertainties remain on the exact scale of the impacts, it is becoming apparent that trends in the temperature and precipitation records as well as those relating to sea level measurements and ecosystems are a cause for concern and that projections indicate these trends are set to continue. Table 7 provides a summary of the main observed and projected impacts of climate change for Ireland.

Parameter	Observed	Projected	Example of Biophysical Impacts
Temperature	<p>Average temperatures have increased by 0.8°C since 1900, an average of 0.07°C per decade.</p> <p>The number of warm days (over 20°C) has increased while the number of cold days (below 0°C) has decreased.</p>	<p>Projections indicate an increase in average temperatures across all seasons (0.9-1.7°C).</p> <p>The number of warm days is expected to increase and heat waves are expected to occur more frequently.</p>	<p>Incidences of cold stress are likely to decrease while incidences of heat stress will increase.</p> <p>The duration of the growing season will increase, occurring earlier and extending farther.</p>
Precipitation	<p>Increase in average annual national rainfall of approximately 60mm or 5% in the period 1981-2010, compared to the 30-year period 1961-1990.</p> <p>The largest increases are observed over the west of the country.</p>	<p>Significant reductions are expected in average levels of annual, spring and summer rainfall.</p> <p>Projections indicate a substantial increase in the frequency of heavy precipitation events in Winter and Autumn (approx. 20%).</p>	<p>The increased occurrence of dry spells will result in increased pressure on water supply.</p> <p>An increase in the frequency of extreme precipitation events will result in increased fluvial and pluvial flood risk.</p>
Wind Speed and Storms	<p>No long-term change in average wind speed or direction can be determined with confidence.</p> <p>The number and intensity of storms in the North Atlantic has increased by approx. three storms per decade since 1950.</p>	<p>Projections indicate an overall decrease in wind speed and an increase in extreme wind speeds, particularly during winter.</p> <p>The number of very intense storms is projected to increase</p>	<p>Increases in extreme wind speeds may impact on wind turbines and the continuity of power supply.</p> <p>Infrastructure will be at risk due to the increased occurrence of intense storms (e.g. winter</p>

³² [https://www.epa.ie/pubs/reports/research/climate/CCRP1\(low\).pdf](https://www.epa.ie/pubs/reports/research/climate/CCRP1(low).pdf)

³³ https://www.epa.ie/pubs/reports/research/climate/EPA%20RR%20223_web.pdf

Parameter	Observed	Projected	Example of Biophysical Impacts
		over the North Atlantic region. Projections suggest that the winter track of these storms may extend further south and over Ireland more often.	2013/2014).
Sea Level and Sea Surface Temperature	<p>Historically, sea level has not been measured with the necessary accuracy to determine sea level changes around Ireland. However, measurements from Newlyn, in southwest England, show a sea level rise of 1.7cm per decade since 1916. These measurements are considered to be representative of the situation to the South of Ireland.</p> <p>Sea surface temperatures have increased by 0.85°C since 1950, with 2007 the warmest year in Irish coastal records.</p>	<p>Sea levels will continue to rise for all coastal areas, by up to 0.8 m by 2100. The south of Ireland will likely feel the impacts of these rises first.</p> <p>Sea surface temperatures are projected to continue warming for the coming decade. For the Irish Sea, projections indicate a warming of 1.9°C by the end of the century.</p>	<p>Significant increase in areas at risk of coastal inundation and erosion.</p> <p>Increased risk to coastal aquifers and water supply.</p> <p>Change in distribution fish species;</p> <p>Implications for fisheries and aquaculture industries.</p>

Table 7 – Summary of observed and projected climate changes and impacts for Ireland³⁴

In 2012, Ireland published the first policy response to climate change impacts with the non-statutory National Climate Change Adaptation Framework.³⁵ The publication in 2018 of Ireland's first statutory National Adaptation Framework (NAF)³⁶ represents Ireland's current national policy response to the challenges posed by the impacts of climate change. The NAF, which was prepared under Section 5 of the Climate Action and Low Carbon Development Act 2015 (the Climate Act) was approved by Government on 19 December 2017 and was subsequently published and laid before both Houses of the Oireachtas on 19 January 2018. Its publication followed a six week public consultation on a draft National Adaptation Framework in September/October 2017.³⁷

³⁴ Table 2, Page 33, National Adaptation Framework

³⁵ <https://www.dccae.gov.ie/en-ie/climate-action/publications/Documents/4/National%20Climate%20Change%20Adaptation%20Framework.pdf>

³⁶ <https://dccae.gov.ie/en-ie/climate-action/publications/Documents/10/FINAL%20National%20Adaptation%20Framework-Planning%20for%20a%20Climate%20Resilient%20Ireland.pdf>

³⁷ A draft NAF was the subject of a statutory [public consultation](#) held between 15 September and 27 October 2017. The NAF was also the subject of a public consultation held in Spring 2016 prior to its development.

The National Adaptation Framework sets out the national strategy for the application of adaptation measures in different sectors and by local authorities in their administrative areas in order to reduce the vulnerability of the State to the negative effects of climate change and to avail of any positive impacts that may occur. The National Adaptation Framework does not identify specific locations or propose adaptation measures or projects in relation to sectors. Respecting the principle of subsidiarity, detailed adaptation measures will be developed across sectors and local government, in accordance with the National Adaptation Framework.

The NAF identifies 12 priority actions and related supporting objectives that are to be progressed in order to support and advance the implementation of climate adaptation policy at national, regional and local level in Ireland.

Key actions of the NAF include:

- Preparation of sectoral adaptation plans by 7 Government departments for 12 key sectors.
- Putting in place revised governance and reporting arrangements.
- Formalising the status of existing adaptation guidelines and decision making supports - these include the online climate information platform Climate Ireland, adaptation planning guidelines for the 12 key sectors and local authority adaptation strategy development guidelines.
- Increasing awareness around climate adaptation and resilience.
- Integrating climate adaptation into key national plans and policies.
- **2.1.2. Renewable energy**
 - i. The elements set out in point (a)(2) of Article 4

The following tables set out the estimated trajectory for the overall share of renewable energy. This is done for each of the four scenarios:

- NECP 1: With existing measures, high oil price
- NECP 2: With additional measures, high oil price
- NECP 3: With existing measures, low oil price
- NECP 4: With additional measures, low oil price

The tables also provide a comparison between the estimated trajectory and that set out in the Governance Regulation.

The tables below set out the evolution of RES-E, RES-H and RES-T over the four modelled scenarios, historically and for future projected years. The modelling indicates Ireland's overall renewable energy share (RES) of gross final energy consumption across the 3 energy sectors, historically and for two projected years, 2020 and 2030 (and 2040). The impact of planned policies and measures can be

observed by comparing the NECP 1 with NECP 2 and NECP 3 with NECP 4. The impact of planned policies on Ireland's overall renewable energy share is described in further detail section 5.

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Renewable Trajectories	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
RES-H&C (%)	6.8%	8.8%	9.5%	10.4%	11.3%	12.4%	13.5%	14.6%	15.8%	16.9%	18.0%	19.2%	23.3%
RES-E (%)	30.1%	38.5%	39.7%	37.4%	37.0%	36.7%	36.7%	36.9%	37.1%	38.3%	39.9%	41.2%	40.7%
RES-T (%)	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.0%	4.0%	3.7%
Overall RES share (%)	10.6%	13.3%	13.9%	14.1%	14.6%	15.1%	15.6%	16.1%	16.7%	17.4%	18.3%	19.2%	21.7%
Article 4(a)(2) target for RES increase				18.0%			43.0%		65.0%			100.0%	
RES min trajectory (%)		16.0%		16.6%			17.4%		18.1%			19.2%	
RES projected trajectory (%)		13.3%		14.1%			15.6%		16.7%			19.2%	
Shortfall (%)		2.7%		2.4%			1.8%		1.4%			0.0%	

Table 8: Scenario: NECP 1 (With existing measures, high oil price) Modelled trajectories - existing policies and measures, high oil price, on renewable heating and cooling, renewable electricity, and renewable transport, 2017-2040

Renewable Trajectories	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
RES-H&C (%)	6.8%	9.8%	10.6%	11.8%	13.1%	14.2%	16.0%	17.9%	20.0%	22.1%	24.1%	26.3%	34.5%
RES-E (%)	30.1%	38.9%	40.2%	37.9%	38.9%	42.7%	44.6%	46.8%	48.6%	50.1%	51.3%	53.8%	54.2%
RES-T (%)	4.1%	5.6%	5.6%	5.6%	5.9%	6.5%	7.1%	7.7%	8.2%	8.6%	9.0%	9.3%	7.7%
Overall RES share (%)	10.6%	14.3%	15.0%	15.3%	16.4%	18.2%	19.7%	21.2%	22.8%	24.3%	25.8%	27.7%	33.0%
Article 4(a)(2) target for RES increase				18.0%			43.0%		65.0%			100.0%	
RES min trajectory (%)		16.0%		18.1%			21.0%		23.6%			27.7%	
RES projected trajectory (%)		14.3%		15.3%			19.7%		22.8%			27.7%	
Shortfall (%)		1.7%		2.8%			1.3%		0.8%			0.0%	

Table 9: Scenario: NECP 2 (With additional measures, high oil price) Modelled trajectories - additional policies and measures, high oil price, on renewable heating and cooling, renewable electricity, and renewable transport, 2017-2040

Renewable Trajectories	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
RES-H&C (%)	6.8%	8.0%	8.3%	8.7%	9.2%	9.7%	10.2%	10.7%	11.2%	11.7%	12.3%	12.9%	15.2%
RES-E (%)	30.1%	38.2%	39.2%	36.8%	36.3%	35.8%	35.6%	35.8%	35.9%	36.9%	38.4%	39.6%	39.1%
RES-T (%)	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.0%	4.0%	4.0%	3.7%
Overall RES share (%)	10.6%	12.3%	12.7%	12.8%	13.0%	13.2%	13.5%	13.7%	14.0%	14.5%	15.2%	15.8%	17.7%
Article 4(a)(2) target for RES increase				18.0%			43.0%		65.0%			100.0%	
RES min trajectory (%)		16.0%		16.0%			15.9%		15.9%			15.8%	
RES projected trajectory (%)		12.3%		12.8%			13.5%		14.0%			15.8%	
Shortfall (%)		3.7%		3.2%			2.4%		1.9%			0.0%	

Table 10: Scenario: NECP 3 (With existing measures, low oil price) - Modelled trajectories - existing policies and measures, low oil price, on renewable heating and cooling, renewable electricity, and renewable transport, 2017-2040

Renewable Trajectories	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
RES-H&C (%)	6.8%	8.4%	8.9%	9.6%	10.3%	10.9%	12.0%	13.2%	14.4%	15.7%	16.9%	18.3%	22.9%
RES-E (%)	30.1%	38.6%	40.3%	39.0%	40.7%	45.0%	47.5%	50.1%	52.3%	54.2%	55.9%	57.1%	54.0%
RES-T (%)	4.1%	5.6%	5.6%	5.6%	5.9%	6.5%	7.0%	7.6%	8.1%	8.6%	9.0%	9.3%	8.1%
Overall RES share (%)	10.6%	13.2%	13.8%	14.2%	15.1%	16.8%	18.1%	19.5%	20.8%	22.1%	23.4%	24.8%	27.8%
Article 4(a)(2) target for RES increase				18.0%			43.0%		65.0%			100.0%	
RES min trajectory (%)		16.0%		17.6%			19.8%		21.7%			24.8%	
RES projected trajectory (%)		13.2%		14.2%			18.1%		20.8%			24.8%	
Shortfall (%)		2.8%		3.4%			1.6%		0.9%			0.0%	

Table 11: Scenario: NECP 4 (With additional measures, low oil price) - Modelled trajectories – additional policies and measures, low oil price, on renewable heating and cooling, renewable electricity, and renewable transport, 2017-2040

ii. Estimated trajectories for the sectoral share of renewable energy in final energy consumption from 2021 to 2030 in the electricity, heating and cooling, and transport sector

The tables at (i) above set out the estimated trajectories for the share of renewable energy by sector for each of the four scenarios. It should be noted that the figures provided for RES-T are based on actual energy share and do not include the use of multipliers as set out in the Renewable Energy Directive.

iii. Estimated trajectories by renewable energy technology that the Member State projects to use to achieve the overall and sectoral trajectories for renewable energy from 2021 to 2030 including expected total gross final energy consumption per technology and sector in Mtoe and total planned installed capacity (divided by new capacity and repowering) per technology and sector in MW

Table 12: NECP Scenario 1 (With Existing Measures, high oil price) – Modelled trajectories by renewable energy technology, existing policies and measures, high oil price, 2017-2040.

Renewable Electricity - installed capacities (MW)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Hydro	234	234	234	234	234	234	234	234	234	234	234	234
Biodegradable Municipal Solid Waste	24	40	40	40	40	40	40	40	40	40	40	40
Biogas	54	54	54	54	54	54	54	54	54	54	54	54
Biomass CHP	0	60	60	60	60	60	60	60	60	60	60	60
Biomass co-firing	29	110	110	110	110	110	110	110	110	110	110	0
Onshore wind	3259	4225	4364	4503	4643	4782	4921	5060	5201	5342	5474	6058
Offshore wind	0	25	25	25	25	25	25	25	198	396	592	1513
Solar PV	20	80	90	100	100	100	100	118	125	131	137	200
Ocean	0	0	0	0	0	0	0	0	0	0	0	0

Renewable Electricity - generation by source (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Hydro	61.6	62.8	63.5	63.2	63.8	63.3	62.8	63.0	63.2	63.0	63.0	63.1
Biodegradable Municipal Solid Waste	13.0	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.7	22.8	22.8
Biogas	17.0	11.3	11.4	11.4	11.6	10.3	10.5	10.4	10.3	10.2	9.6	9.0
Biomass	32.8	113.9	113.9	113.9	114.1	113.9	113.9	113.9	114.0	113.9	113.9	30.7
Onshore wind	644.7	899.0	934.2	964.5	989.9	1015.3	1045.5	1074.5	1103.6	1131.1	1157.2	1267.8
Offshore wind	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	38.3	100.1	156.5	387.4
Solar PV	0.9	6.6	7.5	8.3	8.3	8.3	8.3	9.8	10.3	10.9	11.4	16.6
Ocean	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Renewable Transport - consumption by source (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Ethanol - Total	29.6	29.5	29.9	30.0	30.1	30.0	30.7	31.4	31.9	32.2	32.2	28.6
Part A, Annex IX Ethanol	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Part B, Annex IX Ethanol	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food or Feed Ethanol	29.6	29.2	29.6	29.7	29.8	29.7	30.4	31.1	31.6	31.9	31.9	28.3
Biodiesel - Total	131.0	151.0	151.8	151.9	150.6	149.2	149.7	150.9	151.8	152.4	152.7	147.6
Part A, Annex IX Biodiesel	0.0	5.6	11.2	16.9	22.3	27.6	34.7	42.1	49.5	56.9	64.1	70.8
Part B, Annex IX Biodiesel	131.0	145.4	140.5	135.0	128.3	121.6	115.0	108.8	102.3	95.6	88.6	76.7
Food or Feed Biodiesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biofuels - Total	160.6	180.5	181.6	181.9	180.6	179.2	180.5	182.3	183.8	184.7	184.9	176.2

Renewable Heat - generation by source and sector (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Industry												
Biogas	2.2	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Biomass	198.6	222.9	233.7	249.1	268.9	289.2	310.6	332.4	352.1	370.9	391.4	403.0
Renewable portion of heat pumps	0.0	2.9	4.1	5.2	6.3	7.3	8.2	9.3	10.4	11.6	13.2	17.8
Solar thermal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Industry	200.8	228.1	240.2	256.7	277.6	298.9	321.2	344.1	364.9	384.9	406.9	423.2
Residential												
Biogas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biomass	26.9	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8
Renewable portion of heat pumps	24.0	74.0	87.6	102.0	117.1	132.9	148.9	164.7	180.6	196.6	213.0	371.3
Solar thermal	12.5	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
Total Residential	63.3	120.6	134.2	148.5	163.6	179.5	195.4	211.3	227.1	243.2	259.6	417.8
Tertiary												
Biogas	7.6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
Biomass	21.1	27.5	27.4	27.6	27.8	28.2	28.8	29.6	30.1	30.6	31.2	31.2
Renewable portion of heat pumps	17.3	35.0	48.4	59.1	70.1	81.0	91.7	103.1	114.6	127.5	143.5	170.5
Solar thermal	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Tertiary	46.1	69.7	83.1	94.0	105.2	116.5	127.8	139.9	151.9	165.3	182.0	208.9

Table 13: NECP Scenario 2 (With Additional Measures, high oil price) - Modelled trajectories by renewable energy technology, additional policies and measures, high oil price, 2017-2040.

Renewable Electricity - installed capacities (MW)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Hydro	234	234	234	234	234	234	234	234	234	234	234	234
Biodegradable Municipal Solid Waste	24	40	40	40	40	40	40	40	40	40	40	40
Biogas	54	54	54	54	54	54	54	54	54	54	54	54
Biomass CHP	0	60	60	60	60	60	60	60	60	60	60	60
Biomass co-firing	29	110	110	110	181	181	181	181	181	181	181	0
Onshore wind	3259	4215	4355	4495	4636	4776	4916	5056	5196	5336	6435	6393
Offshore wind	0	25	25	247	469	691	913	1134	1356	1578	1800	3600
Solar PV	20	187	229	271	447	622	798	973	1149	1324	1500	1918
Ocean	0	0	0	5	5	5	5	5	5	5	5	5

Renewable Electricity - generation by source (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Hydro	61.6	63.1	63.7	63.2	63.7	63.5	63.2	63.6	63.7	63.4	63.1	63.5
Biodegradable Municipal Solid Waste	13.0	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
Biogas	17.0	11.4	11.4	11.4	11.6	10.6	10.5	10.6	10.6	10.6	9.6	9.0
Biomass	32.8	113.9	113.9	113.9	167.3	167.3	167.3	167.4	167.4	166.9	167.3	31.0
Onshore wind	644.7	901.7	936.5	966.2	990.4	1015.8	1045.7	1075.3	1105.6	1134.3	1285.7	1357.3
Offshore wind	6.0	6.0	6.0	48.2	119.9	181.1	238.3	293.9	341.7	392.0	443.4	870.2
Solar PV	0.9	15.5	19.0	22.5	37.1	51.7	66.2	80.7	95.5	109.8	124.3	159.3
Ocean	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Renewable Transport - consumption by source (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Ethanol - Total	29.6	30.3	30.6	33.8	36.9	40.3	44.9	49.2	53.1	56.2	60.2	40.0
Part A, Annex IX Ethanol	0.0	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.4
Part B, Annex IX Ethanol	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food or Feed Ethanol	29.6	30.0	30.3	33.5	36.5	39.9	44.4	48.7	52.6	55.6	59.6	39.6
Biodiesel - Total	131.0	218.3	219.4	229.8	251.0	270.5	293.7	317.3	339.6	360.2	376.1	339.1
Part A, Annex IX Biodiesel	0.0	8.1	16.2	25.5	37.2	50.0	68.1	88.5	110.7	134.4	157.9	162.8
Part B, Annex IX Biodiesel	131.0	210.2	203.1	204.3	213.9	220.4	225.6	228.8	228.9	225.9	218.1	176.3
Food or Feed Biodiesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biofuels - Total	160.6	248.6	250.0	263.6	287.9	310.8	338.6	366.5	392.7	416.4	436.3	379.1

Renewable Heat - generation by source and sector (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Industry												
Biogas	2.2	2.4	2.4	2.4	2.4	9.8	17.2	24.6	32.0	39.4	46.8	46.8
Biomass	198.6	244.6	257.7	274.4	286.5	297.1	308.0	327.5	345.3	362.4	382.2	389.3
Renewable portion of heat pumps	0.0	4.9	6.5	7.6	8.8	9.8	10.8	11.9	13.0	14.2	15.8	21.0
Solar thermal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Industry	200.8	251.9	266.6	284.4	297.7	316.7	335.9	363.9	390.2	416.0	444.7	457.0
Residential												
Biogas	0.0	0.0	0.0	0.0	0.0	11.2	22.5	33.7	44.9	56.2	67.4	67.4
Biomass	26.9	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8
Renewable portion of heat pumps	24.0	76.8	92.4	110.4	131.9	158.9	187.3	215.6	244.0	272.5	301.4	553.2
Solar thermal	12.5	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
Total Residential	63.3	123.3	139.0	157.0	178.4	216.7	256.3	295.9	335.5	375.2	415.3	667.1
Tertiary												
Biogas	7.6	7.3	7.3	7.3	7.3	11.6	15.9	20.2	24.5	28.7	33.0	33.0
Biomass	21.1	31.7	33.1	38.2	38.0	37.9	37.8	38.4	38.6	38.9	39.4	38.5
Renewable portion of heat pumps	17.3	48.5	69.5	84.1	97.4	110.1	121.4	134.0	146.7	160.8	178.1	204.5
Solar thermal	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Tertiary	46.1	87.4	109.8	129.6	142.8	159.6	175.1	192.5	209.8	228.4	250.5	276.0

Table 14: NECP Scenario 3 (With Existing Measures, low oil price) - Modelled trajectories by renewable energy technology, existing policies and measures, low oil price, 2017-2040.

Renewable Electricity - installed capacities (MW)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Hydro	234	234	234	234	234	234	234	234	234	234	234	234
Biodegradable Municipal Solid Waste	24	40	40	40	40	40	40	40	40	40	40	40
Biogas	54	54	54	54	54	54	54	54	54	54	54	54
Biomass CHP	0	60	60	60	60	60	60	60	60	60	60	60
Biomass co-firing	29	110	110	110	110	110	110	110	110	110	110	0
Onshore wind	3259	4225	4372	4519	4667	4814	4961	5108	5256	5403	5547	6405
Offshore wind	0	25	25	25	25	25	25	25	200	400	600	1600
Solar PV	20	80	90	100	100	100	100	118	125	131	137	200
Ocean	0	0	0	5	5	5	5	5	5	5	5	5

Renewable Electricity - generation by source (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Hydro	61.6	62.9	63.5	63.3	63.7	63.2	63.1	63.2	63.4	63.0	63.1	63.5
Biodegradable Municipal Solid Waste	13.0	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
Biogas	17.0	11.3	11.3	11.4	11.6	10.3	10.4	10.4	10.4	10.4	9.6	9.0
Biomass	32.8	113.9	113.9	113.9	114.1	113.9	114.1	114.2	114.1	113.7	114.1	31.0
Onshore wind	644.7	898.4	934.2	966.5	993.5	1021.1	1053.0	1084.3	1115.1	1145.0	1174.1	1361.9
Offshore wind	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	38.3	100.1	156.5	387.4
Solar PV	0.9	6.6	7.5	8.3	8.3	8.3	8.3	9.8	10.3	10.9	11.4	16.6
Ocean	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Renewable Transport - consumption by source (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Ethanol - Total	29.6	37.4	38.3	39.1	39.6	40.0	41.1	42.0	42.8	43.2	43.3	40.4
Part A, Annex IX Ethanol	0.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Part B, Annex IX Ethanol	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food or Feed Ethanol	29.6	37.0	38.0	38.7	39.2	39.6	40.7	41.6	42.3	42.8	42.9	40.0
Biodiesel - Total	131.0	166.2	169.4	172.1	172.8	173.1	175.0	177.3	179.0	180.0	180.7	180.9
Part A, Annex IX Biodiesel	0.0	6.2	12.5	19.1	25.6	32.0	40.6	49.5	58.3	67.2	75.9	86.8
Part B, Annex IX Biodiesel	131.0	160.1	156.9	153.0	147.2	141.1	134.4	127.8	120.6	112.9	104.8	94.1
Food or Feed Biodiesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biofuels - Total	160.6	203.6	207.8	211.2	212.4	213.1	216.1	219.3	221.7	223.2	224.0	221.3

Renewable Heat - generation by source and sector (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Industry												
Biogas	2.2	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Biomass	198.6	214.6	215.3	219.0	225.4	231.8	238.9	246.8	254.5	264.0	274.5	289.7
Renewable portion of heat pumps	0.0	2.6	3.5	4.1	4.7	5.1	5.6	6.1	6.7	7.3	8.1	11.2
Solar thermal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Industry	200.8	219.5	221.1	225.5	232.6	239.4	246.8	255.2	263.6	273.6	284.9	303.2
Residential												
Biogas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biomass	26.9	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8
Renewable portion of heat pumps	24.0	73.8	87.2	101.3	115.7	130.9	146.0	161.0	175.9	190.8	205.8	359.3
Solar thermal	12.5	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
Total Residential	63.3	120.4	133.7	147.8	162.3	177.4	192.6	207.5	222.4	237.3	252.3	405.8
Tertiary												
Biogas	7.6	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3
Biomass	21.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.1	27.2
Renewable portion of heat pumps	17.3	34.2	45.7	53.8	61.3	67.9	74.0	80.3	86.6	93.4	101.5	126.6
Solar thermal	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Tertiary	46.1	68.6	80.1	88.2	95.7	102.3	108.4	114.7	121.0	127.8	135.9	161.0

Table 15: NECP Scenario 4 (With additional measures, low oil price) Modelled trajectories by renewable energy technology, additional policies and measures, low oil price, 2017-2040

Renewable Electricity - installed capacities (MW)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Hydro	234	234	234	234	234	234	234	234	234	234	234	234
Biodegradable Municipal Solid Waste	24	40	40	40	40	40	40	40	40	40	40	40
Biogas	54	54	54	54	54	54	54	54	54	54	54	54
Biomass CHP	0	60	60	60	60	60	60	60	60	60	60	60
Biomass co-firing	29	110	110	110	181	181	181	181	181	181	355	355
Onshore wind	3259	4363	4650	4938	5226	5514	5801	6089	6377	6665	6952	7452
Offshore wind	0	25	25	247	469	691	913	1134	1356	1578	1800	3600
Solar PV	20	187	229	271	447	622	798	973	1149	1324	1500	1918
Ocean	0	0	0	5	5	5	5	5	5	5	5	5

Renewable Electricity - generation by source (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Hydro	61.6	63.2	63.5	63.0	63.3	63.4	63.3	63.2	63.5	62.9	62.5	63.3
Biodegradable Municipal Solid Waste	13.0	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
Biogas	17.0	11.4	11.4	11.3	11.4	10.4	10.5	10.4	10.5	10.4	9.7	8.9
Biomass	32.8	113.9	113.9	113.9	167.3	167.2	167.3	167.4	167.4	166.9	167.2	31.0
Onshore wind	644.6	920.8	990.4	1043.2	1116.7	1182.6	1246.0	1306.0	1353.3	1372.8	1415.4	1585.1
Offshore wind	6.1	6.0	6.0	59.5	114.7	168.6	223.0	277.9	294.1	315.6	337.1	866.8
Solar PV	0.9	15.6	19.0	22.5	37.0	51.7	66.2	80.1	95.1	109.3	123.9	159.1
Ocean	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Renewable Transport - consumption by source (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Ethanol - Total	29.6	38.4	39.4	44.1	48.8	54.0	60.4	66.5	72.1	76.8	83.4	64.7
Part A, Annex IX Ethanol	0.0	0.4	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.6
Part B, Annex IX Ethanol	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food or Feed Ethanol	29.6	38.0	39.0	43.7	48.3	53.5	59.8	65.8	71.4	76.0	82.6	64.1
Biodiesel - Total	131.0	240.4	244.9	260.4	288.3	314.1	343.7	373.4	401.3	427.1	447.6	424.3
Part A, Annex IX Biodiesel	0.0	8.9	18.1	28.9	42.7	58.1	79.7	104.2	130.8	159.3	188.0	203.7
Part B, Annex IX Biodiesel	131.0	231.5	226.8	231.5	245.6	256.0	264.0	269.2	270.5	267.8	259.6	220.6
Food or Feed Biodiesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biofuels - Total	160.6	278.8	284.3	304.6	337.0	368.1	404.1	439.9	473.4	503.9	531.0	489.0

Renewable Heat - generation by source and sector (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Industry												
<i>Biogas</i>	2.2	2.4	2.4	2.4	2.4	10.0	17.6	25.2	32.8	40.5	48.1	48.1
<i>Biomass</i>	198.6	217.3	220.1	226.9	227.1	227.9	228.2	230.6	237.0	244.6	252.6	265.5
<i>Renewable portion of heat pumps</i>	0.0	5.0	6.5	7.6	8.3	8.8	9.3	9.9	10.6	11.2	12.1	16.6
<i>Solar thermal</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Industry	200.8	224.7	229.0	236.8	237.8	246.7	255.1	265.7	280.4	296.3	312.7	330.2
Residential												
<i>Biogas</i>	0.0	0.0	0.0	0.0	0.0	11.2	22.5	33.7	45.0	56.2	67.5	67.5
<i>Biomass</i>	26.9	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8	32.8
<i>Renewable portion of heat pumps</i>	24.0	76.6	92.0	109.7	130.5	156.9	184.5	211.9	239.3	266.6	294.1	541.2
<i>Solar thermal</i>	12.5	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
Total Residential	63.3	123.1	138.5	156.2	177.1	214.7	253.5	292.2	330.8	369.4	408.2	655.2
Tertiary												
<i>Biogas</i>	7.6	7.3	7.3	7.3	7.3	11.3	15.4	19.5	23.5	27.6	31.7	31.7
<i>Biomass</i>	21.1	29.4	29.5	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.8	29.7
<i>Renewable portion of heat pumps</i>	17.3	48.1	67.7	80.6	90.8	99.4	106.4	114.0	121.4	129.4	138.7	169.5
<i>Solar thermal</i>	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Tertiary	46.1	84.8	104.5	117.9	128.0	140.7	151.7	163.4	174.9	186.9	200.2	230.8

iv. Estimated trajectories on bioenergy demand, disaggregated between heat, electricity and transport, and on biomass supply by feedstocks and origin (distinguishing between domestic production and imports). For forest biomass, an assessment of its source and impact on the LULUCF sink

The following tables set out estimated trajectories on bioenergy demand sector and biomass supply.

Table 16: NECP Scenario 1 (With existing Measures, high oil price) - Modelled trajectories, high oil price, existing policies and measures, bioenergy demand, biomass supply by feedstock, 2017-2030.

Bioenergy Demand, Total Final Consumption (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Electricity											
<i>Solid Biomass</i>	32.8	113.9	113.9	113.9	114.1	113.9	113.9	113.9	114.0	113.9	113.9
<i>Biogas</i>	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
<i>Landfill Gas</i>	13.3	7.6	7.7	7.7	8.0	6.7	6.8	6.8	6.6	6.6	5.9
<i>Biodegradable Municipal Solid Waste</i>	13.0	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.7	22.8
<i>Sewage Sludge Gas</i>	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Heat											
<i>Solid Biomass</i>	246.5	283.1	293.9	309.4	329.5	350.2	372.2	394.8	414.9	434.2	455.4
<i>Biogas</i>	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
Transport											
<i>Ethanol</i>	29.6	29.5	29.9	30.0	30.1	30.0	30.7	31.4	31.9	32.2	32.2
<i>Biodiesel</i>	131.0	151.0	151.8	151.9	150.6	149.2	149.7	150.9	151.8	152.4	152.7

Biomass Supply by Feedstock (ktoe)	2017	2020	2030
Biomass from Forestry	230	283	579
<i>Domestic</i>	182	220	469
<i>Imported</i>	47.7	63.2	110
Biomass from agricultural crops	67.8	70.0	123
<i>Domestic</i>	3.4	7.6	54.1
<i>Imported</i>	64.4	62.4	69.3
Biomass from agricultural residues	0.5	0.9	150
<i>Domestic</i>	0.5	0.4	150
<i>Imported</i>	0.0	0.5	0.6
Biomass from waste	402	454	359
<i>Domestic</i>	165	184	207
<i>Imported</i>	237	270	152

Table 17: NECP Scenario 2 (With additional Measures, high oil price) - Modelled trajectories bioenergy demand, biomass supply by feedstock 2017-2030, additional policies and measures, high oil price

Bioenergy Demand, Total Final Consumption (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Electricity											
<i>Solid Biomass</i>	32.8	113.9	113.9	113.9	167.3	167.3	167.3	167.4	167.4	166.9	167.3
<i>Biogas</i>	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
<i>Landfill Gas</i>	13.3	7.7	7.8	7.7	7.9	6.9	6.9	6.9	7.0	6.9	6.0
<i>Biodegradable Municipal Solid Waste</i>	13.0	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
<i>Sewage Sludge Gas</i>	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Heat											
<i>Solid Biomass</i>	246.5	309.0	323.5	345.4	357.3	367.8	378.5	398.6	416.7	434.1	454.3
<i>Biogas</i>	9.7	9.7	9.7	9.7	9.7	32.6	55.5	78.4	101.4	124.3	147.2
Transport											
<i>Ethanol</i>	29.6	30.3	30.6	33.8	36.9	40.3	44.9	49.2	53.1	56.2	60.2
<i>Biodiesel</i>	131.0	218.3	219.4	229.8	251.0	270.5	293.7	317.3	339.6	360.2	376.1

Biomass Supply by Feedstock (ktoe)	2017	2020	2030
Biomass from Forestry	230	311	713
<i>Domestic</i>	182	220	505
<i>Imported</i>	48.3	90.7	209
Biomass from agricultural crops	67.8	71.8	206
<i>Domestic</i>	3.4	7.6	76.6
<i>Imported</i>	64.4	64.2	130
Biomass from agricultural residues	0.5	1.0	430
<i>Domestic</i>	0.5	0.4	429
<i>Imported</i>	0.0	0.5	1.1
Biomass from waste	402	510	715
<i>Domestic</i>	165	184	279
<i>Imported</i>	237	327	436

Table 18: NECP Scenario 3 (With Existing Measures, Low oil price) Modelled trajectories, low oil price, existing policies and measures, bioenergy demand, biomass supply by feedstock, 2017-2030

Bioenergy Demand, Total Final Consumption (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Electricity											
<i>Solid Biomass</i>	32.8	113.9	113.9	113.9	114.1	113.9	114.1	114.2	114.1	113.7	114.1
<i>Biogas</i>	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
<i>Landfill Gas</i>	13.3	7.6	7.7	7.8	7.9	6.7	6.7	6.7	6.8	6.7	6.0
<i>Biodegradable Municipal Solid Waste</i>	13.0	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
<i>Sewage Sludge Gas</i>	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Heat											
<i>Solid Biomass</i>	246.5	274.4	275.1	278.8	285.3	291.7	298.7	306.6	314.4	323.9	334.3
<i>Biogas</i>	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7	9.7
Transport											
<i>Ethanol</i>	29.6	37.4	38.3	39.1	39.6	40.0	41.1	42.0	42.8	43.2	43.3
<i>Biodiesel</i>	131.0	166.2	169.4	172.1	172.8	173.1	175.0	177.3	179.0	180.0	180.7

Biomass Supply by Feedstock (ktoe)	2017	2020	2030
Biomass from Forestry	230	274	444
<i>Domestic</i>	182	220	390
<i>Imported</i>	47.7	53.4	53.4
Biomass from agricultural crops	67.8	70.0	80.0
<i>Domestic</i>	3.4	7.6	10.7
<i>Imported</i>	64.4	62.4	69.3
Biomass from agricultural residues	0.5	0.9	150
<i>Domestic</i>	0.5	0.4	150
<i>Imported</i>	0.0	0.5	0.6
Biomass from waste	402	454	346
<i>Domestic</i>	165	184	194
<i>Imported</i>	237	270	152

Table 19: NECP Scenario 4 (With additional measures, low oil price) Modelled trajectories bioenergy demand, biomass supply by feedstock 2017-2030, additional policies and measures, low oil price

Bioenergy Demand, Total Final Consumption (ktoe)	2017	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Electricity											
<i>Solid Biomass</i>	32.8	113.9	113.9	113.9	167.3	167.2	167.3	167.4	167.4	166.9	167.2
<i>Biogas</i>	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
<i>Landfill Gas</i>	13.3	7.7	7.7	7.6	7.8	6.7	6.8	6.8	6.8	6.7	6.0
<i>Biodegradable Municipal Solid Waste</i>	13.0	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
<i>Sewage Sludge Gas</i>	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Heat											
<i>Solid Biomass</i>	246.5	279.5	282.4	289.6	289.8	290.6	290.9	293.3	299.7	307.2	315.1
<i>Biogas</i>	9.7	9.7	9.7	9.7	9.7	32.6	55.5	78.4	101.4	124.3	147.2
Transport											
<i>Ethanol</i>	29.6	38.4	39.4	44.1	48.8	54.0	60.4	66.5	72.1	76.8	83.4
<i>Biodiesel</i>	131.0	240.4	244.9	260.4	288.3	314.1	343.7	373.4	401.3	427.1	447.6

Biomass Supply by Feedstock (ktoe)	2017	2020	2030
Biomass from Forestry	230	276	546
<i>Domestic</i>	182	220	489
<i>Imported</i>	48.3	56.1	57.1
Biomass from agricultural crops	67.8	87.7	220
<i>Domestic</i>	3.4	7.6	40.8
<i>Imported</i>	64.4	80.1	180
Biomass from agricultural residues	0.5	1.1	501
<i>Domestic</i>	0.5	0.4	499
<i>Imported</i>	0.0	0.7	1.5
Biomass from waste	402	626	760
<i>Domestic</i>	165	184	266
<i>Imported</i>	237	443	494

- v. Where applicable, other national trajectories and objectives, including those that are long term or sectoral (e.g. share of renewable energy in district heating, renewable energy use in buildings, renewable energy produced by cities, energy communities and self-consumers, energy recovered from the sludge acquired through the treatment of wastewater)

The development process of the final NECP 2021-2030 (due for submission 31/12/19) may lead to additional trajectories/objectives.

2.2. Dimension energy efficiency

- i. The elements set out in point (b) of Article 4

*Demand side savings (primary energy equivalent) only.

Energy Efficiency Policies (GWh)	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Primary Energy Savings	17,448	21,674	22,808	23,602	24,301	24,973	25,663	26,378	27,132	27,944	28,831	29,832
Final Energy Savings	15,927	19,664	20,661	21,364	21,974	22,590	23,231	23,852	24,541	25,320	26,158	27,111
Energy Efficiency Target Achievement	10.9%	13.6%	14.3%	14.8%	15.2%	15.6%	16.1%	16.5%	17.0%	17.5%	18.1%	18.7%
Total Primary Energy Consumption	168,787	179,223	180,761	185,326	186,925	191,994	193,837	195,961	197,422	200,650	201,660	202,665
Total Final Energy Consumption	136,579	143,726	145,697	149,026	150,266	150,923	151,181	151,986	152,949	153,880	154,919	156,008

Table 20: NECP Scenario 1 (With Existing Measures, high oil price) Modelled trajectories energy efficiency, 2017-2030, existing policies and measures, high oil price

Energy Efficiency Policies (GWh)	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Primary Energy Savings	17,448	22,643	24,113	25,917	27,497	28,791	30,182	32,079	33,636	35,298	37,201	39,377
Final Energy Savings	15,927	20,455	21,711	23,172	24,505	25,714	27,046	29,238	30,725	32,320	34,166	36,290
Energy Efficiency Target Achievement	10.9%	14.2%	15.1%	16.2%	17.2%	18.0%	18.9%	20.1%	21.1%	22.1%	23.3%	24.7%
Total Primary Energy Consumption	168,787	176,909	178,596	182,942	184,927	189,841	192,221	179,668	180,692	183,636	183,984	185,232
Total Final Energy Consumption	136,579	143,051	144,909	148,048	149,094	149,499	149,464	149,865	150,437	150,923	151,351	151,652

Table 21: NECP Scenario 2 (With Additional Measures, high oil price) Modelled trajectories energy efficiency, 2017-2030, additional policies and measures, high oil price

Energy Efficiency Policies (GWh)	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Primary Energy Savings	17,448	21,885	23,043	23,862	24,588	25,283	25,994	26,725	27,494	28,315	29,211	30,219
Final Energy Savings	15,927	19,885	20,917	21,653	22,329	22,979	23,726	24,385	25,112	25,904	26,763	27,713
Energy Efficiency Target Achievement	10.9%	13.7%	14.4%	14.9%	15.4%	15.8%	16.3%	16.7%	17.2%	17.7%	18.3%	18.9%
Total Primary Energy Consumption	168,787	189,060	192,261	197,798	198,794	203,903	203,729	206,183	207,805	211,606	213,212	214,779
Total Final Energy Consumption	136,579	154,379	157,801	162,617	165,564	167,574	169,243	171,078	173,134	174,766	176,589	178,182

Table 22: NECP Scenario 3 (With Existing Measures, low oil price) Modelled trajectories energy efficiency, 2017-2030, existing policies and measures, low oil price

Energy Efficiency Policies (GWh)	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Primary Energy Savings	17,448	22,912	24,414	26,249	27,865	29,186	30,603	32,610	34,190	35,866	37,808	40,038
Final Energy Savings	15,927	20,730	22,046	23,562	25,017	26,305	27,839	29,866	31,388	33,024	34,920	37,128
Energy Efficiency Target Achievement	10.9%	14.4%	15.3%	16.4%	17.5%	18.3%	19.2%	20.4%	21.4%	22.5%	23.7%	25.1%
Total Primary Energy Consumption	168,787	187,332	190,659	196,779	197,433	201,739	200,461	197,309	199,608	201,816	203,229	202,009
Total Final Energy Consumption	136,579	153,705	157,014	161,640	164,386	166,152	167,537	168,980	170,666	171,853	173,065	173,871

Table 23: NECP Scenario 4 (With Additional Measures, low oil price) Modelled trajectories energy efficiency, 2017-2030, additional policies and measures, low oil price

Cumulative amount of energy savings to be achieved over the period 2021-2030 under Article 7(1)(b) on energy saving obligations of Directive 2012/27/EU [version as amended in accordance with proposal COM(2016)761]:

Based on an estimated average annual final energy figure of 137,500 GWh for the years 2016 to 2018 and applying the factor of 0.8%, when taken over 10 years, the cumulative target for the years 2021 to 2030 will be **60,500 GWh** (or the equivalent of delivering **1,100 GWh** of new savings for each year).

ii. The indicative milestones for 2030, 2040 and 2050, the domestically established measurable progress indicators and their contributions to the Union's energy efficiency targets as included in the roadmaps set out in the long-term renovation strategies for the national stock of residential and non-residential buildings, both public and private, in accordance with Article 2a of Directive 2010/31/EU

This relates to a new requirement for the Long Term Renovation Strategy under the revised Energy Performance of Buildings Directive (EU) 2018/844. In due course in accordance with Directive 2018/844, Ireland's next Long Term Renovation Strategy will outline these milestones and indicators which will be used to populate the final version of the NECP.

iii. Where applicable, other national objectives, including long term targets or strategies and sectoral targets, and national objectives in areas such as energy efficiency in the transport sector and with regard to heating and cooling

n/a

2.3. Dimension energy security

i. The elements set out in point (c) of Article 4

Ireland has a small population base and consequent high cost per capita to fund infrastructure. Its peripheral location at the end of the European electricity and gas grids, with relatively high dependence on imported gas, low import route diversity for gas, potential increasing role of gas in the energy mix for heat, transport and power generation, including as a back-up for intermittent power generation, means that our energy security profile is different to most other Member States. Following the exit of the UK from the EU, we will no longer be physically connected to the EU Internal Energy Market.

In addition, existing policy is to cease using coal for electricity generation by 2025. This will remove the ESB-owned 900MW coal-fired Moneypoint generating plant from the electricity generating portfolio. While this action will have a positive impact on harmful emissions, it will reduce our diversified fuel mix, and will impact on security of supply.

Furthermore, Bord na Móna will cease harvesting peat for electricity generation before 2030. There are three peat-fired generating plants, totalling 350MW of electricity. Depending on several issues, including fuel supply, compliance with EU and national objectives, and economic viability (carbon price, fuel costs, sustainability, etc.) these plants may be converted to biomass over time, thus maintaining fuel diversity and possibly an indigenous fuel source if sufficient biomass can be produced locally.

Given this profile, our objectives are:

In the most cost effective way,

- to maintain and, where necessary, facilitate the enhancement of resilience of the gas and electricity networks,
- to improve diversity of our gas and electricity supply and import routes, including exploring the potential for LNG and gas storage, and
- to increase indigenous production of clean energy sources;
- to facilitate, as a preference, commercial investment through policy and regulatory certainty;
- to ensure close cooperation on security of supply at EU and regional level, in particular continued cooperation with the UK.

- Continue to examine how emissions from the energy mix can be reduced, including the potential role that Carbon Capture and Storage technology could have in facilitating the high level of natural gas in the energy mix.

Oil

Given that the Irish oil market is characterised by a lack of indigenous oil production, with no commercially viable finds having been discovered there is limited scope for reducing petroleum import dependency in the short to medium term. Also, Ireland's domestic downstream oil industry is fully privatised and largely de-regulated with the origin of imports being determined by cost and logistical factors.

Ireland's objectives are based around:

- providing a policy and regulatory framework to facilitate the commercial oil companies in their supplying of product to the domestic market;
- facilitating the continued operation of sufficient infrastructure to import and supply oil to the market place;
- support for renewable and sustainable alternatives to petroleum products, including electric vehicles, biofuels and CNG in transport;
- continuing to engage in oil emergency planning, including the measures specified in iv, below.

ii. National objectives with regard to increasing: the diversification of energy sources and supply from third countries for the purpose of increasing the resilience of regional and national energy systems

Given that Ireland has a small synchronous island electricity system, and the envisaged increasing integration of renewable Energy Sources for heat, transport and power generation, including intermittent renewable sources, our objectives are:

- To ensure that there is sufficient flexibility in the energy system to maintain energy security of supply and facilitate the integration and transition to clean energy sources in the most cost effective way
- To support further electricity interconnection to improve the functioning and flexibility of the national energy system

Oil

There is no substantial domestic production of biofuels or other alternative fuels, and therefore as things stand, little alternative to the continued import of petroleum products. The sourcing of oil products is largely determined by pricing and logistics considerations. Crude oil is sourced mainly from Norwegian North Sea production and product is imported primarily from UK refineries, in particular from Valero's refinery at Pembroke. Some diesel is imported from elsewhere, including the Russian Federation and the Gulf Coast of the United States. Ireland will continue to ensure the oil industry has the flexibility to obtain sufficient oil supplies of the necessary quality by:

- continuing to utilise European and international standards for petroleum products, through its membership of by the European Committee for Standardisation (CEN);
- continuing to enforce fuel quality standards by confirming quality compliance and specifying instances of non-compliance periodically to the Commission under Article 8 of the Fuel Quality Directive.

iii. Where applicable, national objectives with regard to reducing energy import dependency from third countries, for the purpose of increasing the resilience of regional and national energy systems

Given that Ireland has been identified as vulnerable to a gas supply disruption in particular due to our reliance on gas for electricity, our low import route diversity, Ireland's relatively high dependence on imported gas which is likely to increase once Corrib depletes, and the potential increasing role of gas in the energy mix for heat, transport and power generation including as a back-up for intermittent power generation, our objectives are:

- To ensure the resilience of the gas network to a long-duration supply disruption, in the context of EU and national climate objectives
- If deemed necessary, to identify options needed to enhance our security, including examining the potential role of LNG and gas storage
- To actively participate in EU and regional initiatives to maintain and enhance security of supply including national, regional and EU cooperation on emergency planning and response for gas and electricity networks, including risk assessments, preventative plans and emergency plans

- Continued strong regional cooperation between Ireland and the UK on matters related to gas and electricity security of supply, including emergency preparedness and response and solidarity in an emergency situation.

Oil

Objectives for renewable energy and alternative fuels in heat and transport.

iv. National objectives with regard to increasing the flexibility of the national energy system, in particular by means of deploying domestic energy sources, demand response and energy storage

Given that Ireland has a small synchronous Island electricity system, and the envisaged increasing integration of renewable energy sources for heat, transport and power generation, including intermittent renewable sources, our objectives are:

- In the most cost effective way, to ensure that there is sufficient flexibility in the energy system to maintain energy security of supply and facilitate the integration and transition to clean energy sources
- Support further electricity interconnection to improve the functioning and flexibility of the national energy system

Oil

Ireland has no indigenous oil supplies and as things stand limited domestic production of sustainable fuels. All oil imports are transported by sea and placed on the market through an oil terminal. Taking this vulnerability into account, Ireland will continue to maintain existing policy measures and develop additional capacity to deal with an oil supply emergency, including:

- the ongoing maintenance of Ireland's strategic oil reserve of 90 days of net imports, stored in Ireland or within the EU, as required by EU legislation and IEA rules;
- continued regional cooperation with Northern Ireland to ensure sufficient import capacity in the event of prolonged infrastructure disruption;
- continued development of demand restraint measures aimed at reducing oil usage during a prolonged emergency, in particular in the transport sector;
- further development of policy around Government intervention to ensure the supply of oil to critical infrastructure and for societal need, if required.

2.4. Dimension internal energy market

2.4.1. Electricity interconnectivity

i. The level of electricity interconnectivity that the Member State aims for in 2030 in consideration of the electricity interconnection target for 2030 of at least 15 %, with a strategy with the level from 2021 onwards defined in close cooperation with affected Member States, taking into account the 2020 interconnection target of 10 % and the following indicators of the urgency of action:

- (1) Price differential in the wholesale market exceeding an indicative threshold of EUR 2/MWh between Member States, regions or bidding zones;
- (2) Nominal transmission capacity of interconnectors below 30 % of peak load;
- (3) Nominal transmission capacity of interconnectors below 30 % of installed renewable generation.

Each new interconnector shall be subject to a socioeconomic and environmental cost-benefit analysis and implemented only if the potential benefits outweigh the costs

Following changes to the way electricity is traded in the all-island Single Electricity Market (SEM), introduced on 1 October, the Irish wholesale electricity market is now market coupled with other EU markets. These changes, including the introduction of new day ahead and intra-day markets, are anticipated to increase efficiency in the allocation of capacity and trade across the two existing interconnectors between the island of Ireland and Great Britain. However, as of November 2018, it should be noted that there is considerable uncertainty as to how the UK departure from the EU in March 2019 will impact cross-border trade across interconnectors.

Electricity Interconnection

Ireland's high level policy position on interconnection as outlined in the 2018 National Policy Statement on Electricity Interconnection emphasises the important role of interconnection in the transition to a low carbon energy future. The policy statement builds on clear commitments outlined in the 2015 Energy White Paper, including a measure to maintain and enhance energy security that commits the Department of Communications, Climate Action and Environment (DCCAE) to "promoting and facilitating interconnection with other countries and regions." Ireland's peripheral location at the north-western edge of mainland Europe presents obvious challenges to interconnection, not least in the area of costs, yet may also highlight the desirability of interconnection, particularly in the context of security and diversification of electricity supply.

The National Policy Statement on Electricity Interconnection published in July 2018, reflected the increasing importance of interconnection to national and EU policy. The policy statement emerged following a public consultation that took place in early 2018. This policy statement lays out the official policy position on electricity interconnection. It outlines the many drivers and benefits of interconnection, as well as the potential impacts electricity interconnection may have on the wider energy market. It will help to guide potential developers in better understanding the range of national policy drivers and the CRU (Ireland's energy regulator) in determining its regulatory approach to electricity interconnection, by drawing attention to key policy parameters for consideration in its evaluation of interconnection applications from project promoters.

Interconnection is also viewed as critical infrastructure by the European Commission – underlined by its Projects of Common Interest (PCI) process – in order to move to a genuinely integrated electricity market. The second pillar of the EU's Energy Union strategy is the delivery of a fully-integrated internal energy market using interconnectors to allow energy to flow freely across the EU. In 2014, the European Commission committed to working with Member States to ensure speedy implementation of PCIs and other measures to meet an indicative EU interconnection target of at least 10% of installed electricity production capacity for all Member States by 2020 and 15% by 2030.

Ireland currently has electricity interconnection with Northern Ireland, as part of the single electricity market, and with Great Britain through the 500MW East-West Interconnector. Ireland's level of interconnection is currently reported by the European Commission as 7.4%. When the UK leaves the EU, Ireland will have no direct electrical interconnection with the rest of the EU.

There are currently two separate proposed interconnectors from Ireland that are recognised as PCIs. Greenlink is a 500MW interconnector that is proposed to run from the South East of Ireland to Pembroke in Wales. This is a merchant proposition with Element Power being its promoter. The Celtic Interconnector project is a 700MW interconnector that is proposed to run from the south coast of Ireland to the north-west coast of France. The project is jointly proposed by EirGrid, Ireland's Transmission System Operator (TSO), and its French counterpart, Réseau de Transport d'Électricité (RTÉ). Ireland has supported both the Greenlink and Celtic projects at all stages of the recent PCI process that concluded with the publication of the third PCI list in November 2017. At present, the CRU is considering formal applications from the promoters of both projects. In October 2018 the CRU announced that the Greenlink interconnector is in the public interest and should be supported with a new regulatory regime.

This decision follows a public consultation by the CRU over the summer on the ‘significant’ positive impacts that will be realised for Irish electricity consumers and the increased security of supply that Greenlink will bring to the island of Ireland. The CRU examined the project’s Cost Benefit Analysis to assess if it would be in the public interest for it to be considered as part of the Irish transmission system. The CRU also conducted its own CBA of Greenlink with support from independent advisors and, like Ofgem in the UK, concluded that the public interest test was met. CRU confirmed that in the first half of 2019 it will go on to consult on the proposed ‘Cap and Floor’ regulatory regime to support Greenlink.

Greenlink Interconnector Limited’s latest application for a grant under the European Commission’s Connecting Europe Facility has been successful, with the award of €4.8 million in grant aid. To date the Celtic Interconnector has received almost €8m in CEF grant aid.

EirGrid lodged an “investment request” under the PCI process with the CRU for the Celtic Interconnector in September 2018. This investment request will be considered by CRU who will issue a decision on whether the project is in the public interest within six months. Provided the decision is positive, and is mirrored in France by the French regulator, then the project promoters will proceed to lodge an application for EU funding next April for approximately half the cost of its construction. The regulators will also reach a determination called a “Cross Border Cost Allocation” on how the balance of the construction costs should be allocated between the two countries.

North Seas Energy Cooperation(NSEC)

The North Seas Energy Cooperation works to increase electricity transmission capacity among the countries involved as well as to the rest of Europe. The NSEC aims to ensure a sustainable, secure and affordable energy supply in the North Seas region through further integration of wholesale electricity markets. A key element in this integration is to increase the interconnection between countries in the region that could be promoted through the NSEC.

2.4.2. Energy transmission infrastructure

i. Key electricity and gas transmission infrastructure projects, and, where relevant, modernisation projects, that are necessary for the achievement of objectives and targets under the five dimensions of the Energy Union Strategy

See 2.4.1 on electricity interconnection and (ii) below

- ii. Where applicable, main infrastructure projects envisaged other than Projects of Common Interest (PCIs)³⁸

Electricity Transmission Network

EirGrid is the Transmission System Operator (TSO), and operates the 400 kV, 220 kV and 110 kV transmission grid in Ireland with the exception of the 110 kV network in the Dublin area which is operated by the Distribution System Operator, ESB Networks. ESB Networks is also the Transmission Asset Owner (TAO). Customers wishing to connect to the grid have the option of constructing their own connection assets. The ownership of these assets transfer to the TAO once they are complete.

The transmission network comprises over 200 transmission stations and approximately 6400 km of transmission circuits:

- 400 kV: circa 440 km
- 220 kV: circa 1900 km
- 110 kV circa 4000 km

EirGrid owns and operates the East West Interconnector which is in operation since 2012. The East West Interconnector is a 500 MW High Voltage Direct Current (HVDC) link between the electricity transmission grids of Ireland and Great Britain. At 500 MW it is one of the largest voltage source conversion (VSC) HVDC links in operation worldwide.

Major upgrades or extensions planned or in progress

North South Interconnector Project:

This project comprises the addition of a new 400 kV overhead line connecting the electricity grids of Ireland and Northern Ireland. Currently there is only one interconnector between the two jurisdictions. The introduction of a second interconnector will improve the security of electricity supply across the island of Ireland, and improve the capacity and reliability of both grids. It will help to improve the efficiency of the electricity system, reducing costs and ultimately saving money for the end user, the electricity consumer. Increased capacity in the grids will help in facilitating the connection of more renewable electricity to the grid, and will also increase capacity of the electricity network in the north east which will help attract inward investment and jobs. The project has

³⁸

In accordance with Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009 (OJ L 115, 25.4.2013, p. 39).

received planning permission in both Ireland and Northern Ireland but is under legal challenge in both jurisdictions.

West Dublin Project:

This project is in response to a significant local increase in the demand for electricity. This increase is associated with major multinational customers at Grange Castle Business Park. A 220/110 kV gas insulation switchgear substation is being installed and this will connect into an existing 220 kV double circuit line. This line runs from Inchicore to Maynooth. This improved infrastructure will meet current demand for electricity in the area and it will also create the potential for future growth.

Laois/Kilkenny Project:

This project will address quality and security of supply problems in Kilkenny, Carlow, Kildare and Laois due to increases in existing demand and projected future growth. The project comprises a new 400/110 kV substation near Portlaoise which will be looped into an existing 400 kV and 110 kV line. A new 110/38 kV substation will be developed in Kilkenny and new 110 kV overhead line will be built between this station and the new 400/110 kV station. This will address the quality and security of supply concerns and allow the region to compete for new business.

Celtic Interconnector:

The Celtic Interconnector is a proposed 700 MW electricity interconnector that will run from the North-West coast of France to the East coast of Cork. The project is jointly proposed by EirGrid, Ireland's Transmission System Operator (TSO), and its French counterpart, Réseau de Transport d'Électricité (RTÉ). The project was designated as an EU Project of Common Interest (PCI) on the 2013 and 2015 PCI lists and has also been accepted onto the most recent list which was published on 23 November 2017. Projects of Common Interest are considered key infrastructure projects by the EU Commission and are intended to help the EU achieve its energy policy and climate objectives. The project has also received European funding of almost €8m for studies, through the Connecting Europe Facility.

EirGrid lodged an "investment request" with the CRU for the Celtic Interconnector in September 2018. This investment request will be considered by CRU who will issue a decision on whether the project is in the public interest within six months. If the decision is a positive one and if is mirrored in France by the French regulator, then the project will proceed to lodge an application for EU funding next April for approximately half the cost of its construction. The regulators will also reach a

determination called a “Cross Border Cost Allocation” on how the balance of the construction costs should be allocated between the two countries.

Gas

Project	Project promoter	Description	Status
Twinning of SWSOS	GNI (UK) Ltd	Twinning of previously unparalleled section of pipeline, providing security of supply benefit. Moffat capacity will also rise to 375 GWh/d as a result.	Funding provided by Connecting Europe Facility (30%) and through regulatory capital allowance, in construction phase. . Project was on the first EU PCI list and has been completed in November 2018, apart from some ongoing re-instatement works. The next step is the commissioning of the pipeline.
Physical Reverse Flow at Moffat	GNI (UK) Ltd	Moffat Entry point is currently physically unidirectional. This project is looking at making this bi-directional.	Project included on the 3 rd PCI list (2017). Feasibility studies currently ongoing, Funding provided by Connecting Europe Facility (50%). Earliest commissioning date would be 2021.
Shannon LNG	Shannon LNG Limited	Proposed LNG terminal near Ballylongford in Co. Kerry. The initial phase will involve the construction of LNG process tanks, and re-gasification facilities with a maximum export capacity of up to 191.1 GWh/d.	Project included on the 3 rd PCI list (2017). Planning permission received. Earliest commissioning date would be 2021.

Table 24: Gas: Planned Infrastructure developments

In July 2017, a US LNG export company, signed a memorandum of understanding with the Port of Cork company to study the possible development of a floating storage and regasification unit (FSRU) and the associated LNG import terminal infrastructure in Cork, in the South of Ireland.

The distribution network currently delivers gas to over 680,000 customers across Ireland and the network has been extended to Nenagh and Wexford towns. GNI has completed work to extend distribution to Listowel in the South West of Ireland and the town has been connected to the network. Work has also commenced on the 29km extension to the CenterParcs leisure development in Co. Longford.

2.4.3. Market integration

i. National objectives related to other aspects of the internal energy market such as increasing system flexibility, in particular related to the promotion of competitively determined electricity prices in line with relevant sectoral law, market integration and coupling, aimed at increasing the tradeable capacity of existing interconnectors, smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, re-dispatching and curtailment, and real-time price signals, including a timeframe for when the objectives shall be met

The new wholesale market rules for the Single Electricity Market (SEM) include the introduction of day ahead, intra-day and balancing markets went live on 1 October 2018. Following State Aid clearance by the European Commission in November 2017, a new Capacity Remuneration Mechanism (CRM) involving competitive bidding for future capacity to ensure future system security has also been introduced. The first auction for the new CRM took place in December 2017, for the period 1 October 2018 to 30 September 2019.

The benefits of these new market arrangements include more competitive wholesale electricity prices for consumers through more efficient market trading; efficient dispatch of interconnection to other markets; and increased security of supply for Ireland.

Alongside the new competitive CRM, the new market design seeks to generate maximum competition by concentrating trading in the day-ahead and intra-day markets. Those markets will be directly linked to similar markets across Europe via the rules of the electricity Target Model, increasing the efficiency in trade across the two existing interconnectors between the island of Ireland and Great Britain, and reducing the need for curtailment of wind generation. It is anticipated that this will provide efficient and transparent pricing in the short term markets that will also support trading in the forwards, financial markets. A new balancing market, introducing balance

responsibility for all market participants, is also being rolled out to comply with EU internal market rules.

In addition to the above, system stability and flexibility are being enhanced through the implementation by the TSO, EirGrid, of the multi-year 'Delivering a Secure Sustainable Electricity System' (DS3) programme. The DS3 Programme is designed to ensure that the TSO can securely operate the power system with increasing amounts of variable non-synchronous renewable generation over the coming years. The DS3 Programme is made up of 11 workstreams, which fall under the three pillars of System Performance, System Policies and System Tools, and brings together many different strands, including development of financial incentives for better plant performance, and the development of new operational policies and system tools to use the portfolio to the best of its capabilities.

ii. Where applicable, national objectives related to the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets including a timeframe for when the objectives are to be met

Under national and EU legislation, renewable generation currently receives priority dispatch in the Irish wholesale electricity market, notwithstanding that there are occasions when system security necessitates TSO curtailment of non-synchronous generation.

As regards Demand Side Units, 500 MW of capacity in Ireland cleared the first Capacity Market auction to take place under new rules held in December 2017. This represents double the DSU capacity that had been previously available. Demand Side Units also have non-discriminatory access to wholesale electricity markets in Ireland.

iii. Where applicable, national objectives with regard to ensuring that consumers participate in the energy system and benefit from self-generation and new technologies, including smart meters;

Smart Meters

In September 2017 the CRU announced its delivery plan for smart meters in Ireland. The plan provides for the phased rollout of smart meters to every home and business in the country over a six year period from 2019.

Smart Meters are the next generation of electricity and gas meter and are being rolled out across Europe and internationally. This new technology will replace older, mechanical meters, bringing benefits to Irish consumers, the economy and the environment.

This is a very significant energy infrastructure project. It will involve the installation of new meters for some 2.25 million customers nationwide. The rollout will occur in a structured and phased basis, commencing with an initial delivery of 250,000 meters across 2019-2020 and approximately 500,000 meters in each of the four subsequent years. The initial priority is to replace older meters which are approaching the end of their life expectancy and to facilitate those consumers who request a smart meter.

The delivery plan will phase in smart services from 2021 giving consumers more choice and information, enabling them to be more proactive in their use of electricity and save money. The CRU has completed a Cost-Benefit Analysis on the plan and is satisfied that the investment involved represents value for money.

The national installation of smart meters is a key enabler for the energy transition to a decarbonised system. A raft of smart services that would benefit both the consumer and the state are dependent on the availability of smart meters.

The day-to-day rollout of the delivery plan will be the responsibility of ESB Networks and is subject to oversight by a Steering Group consisting of CRU, DCCAE, ESB Networks, SEAI and industry representation.

iv. National objectives with regard to ensuring electricity system adequacy, as well as for the flexibility of the energy system with regard to renewable energy production, including a timeframe for when the objectives are to be met

A core objective of changes to market trading rules being introduced is to facilitate a more flexible energy system, increase the efficiency of cross border trade across interconnectors, and additional volumes of renewable energy production.

In addition, system adequacy and flexibility in Ireland are being enhanced through the implementation by the TSO, EirGrid, of the multi-year DS3 programme. The DS3 Programme is designed to ensure that the TSO can securely operate the power system with increasing amounts of variable non-synchronous renewable generation over the coming years. The DS3 Programme is made up of 11 workstreams, which fall under the three pillars of System Performance, System Policies and System Tools, and brings together many different strands, including development of financial incentives for better plant performance, and the development of new operational policies and system tools to use the portfolio to the best of its capabilities.

- v. Where applicable, national objectives to protect energy consumers and improve the competitiveness of the retail energy sector

While Ireland's independent energy regulator, the Commission for Regulation of Utilities (CRU) no longer regulates energy retail prices, it does monitor electricity and gas retail markets to ensure that competition continues to develop. The CRU also oversees non-price aspects of competition, and has taken steps to facilitate market access for new supplier firm entrants, and increase transparency and consumer engagement in retail markets. The CRU conducts regular scrutiny of supply costs, and will continue to closely monitor future developments.

In addition to its continued responsibility for ensuring wholesale and retail market competition, the CRU has an important customer protection role, and regularly updates the Supplier Handbook to ensure suppliers adhere to best practices. The CRU is also responsible for customer protection by resolving complaints that customers have with energy companies.

2.4.4. Energy poverty

Where applicable, national objectives with regard to energy poverty including a timeframe for when the objectives are to be met

Ireland's Strategy to combat energy poverty³⁹ is the current policy on alleviating energy poverty which sets out current objectives.

2.5. Dimension research, innovation and competitiveness

- i. National objectives and funding targets for public and, where available, private research and innovation relating to the Energy Union including, where appropriate, a timeframe for when the objectives are to be met

A key metric for the assessment of innovation activity is R&D intensity (R&D expenditure as a percentage of GNP) which reflects the extent of research and innovation activities undertaken in a country in terms of resources input. Ireland's intensity rate in 2016 was 1.84% of GNI*. Gross Expenditure on R&D (GERD) as a percentage of GDP, GNP and GNI* in was 1.18% of GDP, 1.46% of GNP and 1.84% of GNI* in 2016.

In 2016, the estimated EU (28 countries) average for civil GERD as a percentage of GDP was 1.93% and 2.24% for the total OECD. Therefore, using GNI* as the comparator, we are just below the EU 28 average for this indicator. The Europe 2020 strategy (a 10-year strategy developed by the European Commission in 2010) sets a 3% objective for R&D intensity in EU Countries by 2020. The Irish

³⁹<https://www.dcae.gov.ie/en-ie/energy/publications/Documents/5/A%20Strategy%20to%20Combat%20Energy%20Poverty%20-%20Web%20Version.pdf>

Government has adopted an R&D intensity target for Ireland of 2.5% of GNP, to be achieved by 2020.

Innovation 2020 is Ireland's five-year strategy on research and development of science and technology. Innovation 2020 sets out the roadmap for continuing progress towards the goal of making Ireland a Global Innovation Leader, driving a strong sustainable economy and a better society. Innovation 2020 recognises energy as one of six enterprise themes which are of particular importance to Ireland, and calls for greater use of RDI funding to find solutions to pressing societal challenges in areas such as energy. Innovation 2020 indicates that a productive (energy) research environment will help to develop the tools for transitioning to a sustainable low-carbon environment and to make Ireland a world leader in the energy transition. It can also help to create economic opportunities and to provide long-term societal and environmental benefits. It refers to the six priorities set out in the energy green paper in respect of innovation in energy: empowering energy citizens; markets and regulation; planning and implementing essential energy infrastructure; ensuring a balanced and secure energy mix; putting the energy system on a sustainable pathway; and driving economic opportunity.

Research Priority Areas align the majority of competitively awarded public research funding with areas that deliver economic and societal impact. Public research funding is prioritised in research priority areas. In March 2018 this Department published the revised Research Priority Areas 2018-2023 report⁴⁰. Based on developments since 2012, including the increased urgency to address climate change and sustainability challenges, alongside the increased opportunities for enterprise within this wider context, the former Energy research priority theme has evolved to reflect these drivers and is renamed Energy, Climate Action and Sustainability, and the priority areas have been updated to Decarbonising the Energy System and Sustainable Living.

The Department of Business, Enterprise and Innovation is spearheading the Government's new €500 million Disruptive Technologies Innovation Fund. This is one of four funds under the National Development Plan 2018-2027. Applications under this fund must align with the aforementioned research priority areas, which include the Energy, Climate Action and Sustainability theme, and "Decarbonising the Energy System" research priority area. This Fund is about doing something additional on top of existing innovation programmes and exploiting collaborative research to deliver new technologies and new solutions.

⁴⁰ <https://dbe.i.gov.ie/en/Publications/Publication-files/Research-Priority-Areas-2018-to-2023.pdf>

As outlined above, Ireland's level of public investment in R&D as measured by R&D intensity is low relative to the target set by the European Commission. Our vision is one of continuing to develop the Irish energy research, development & demonstration community to one which is considered to be world class. In order to address the current and historic underinvestment in energy RD&D, it is intended to significantly increase the amount of public funding invested in energy R&D, to instigate new initiatives, expand current activities, develop strategic collaborative partnerships with national & international organisations and further strengthen the capacity of the energy RD&D system in Ireland. This increased investment in energy RD&D will also assist Ireland in meeting its low-carbon transition targets & obligations, and will unlock enterprise opportunities for Irish businesses.

Ireland has had a lot of success with wind energy generating renewable electricity but this has not been without its challenges. Currently, Ireland relies on natural gas for approximately 50% of its electricity generation and is committed to not burning coal and peat for power generation past 2025 and 2030 respectively. Ireland will need flexible and dispatchable generators to provide the back up for its increasing renewable portfolio and these will need to be low carbon if Ireland is to meet its decarbonisation goals. In the absence of nuclear generation and with very limited hydro powered generation, Carbon Capture and Storage (CCS) seems to be the most promising technology available to decarbonise the electricity generation sector at scale. Subject to economically viable and secure development, the Government recognises CCS as a potential bridging technology that could support the transition ⁴¹to a low carbon energy future.

Ireland, through its commercial semi-state body Ervia, is carrying out a feasibility study into the potential for carbon dioxide (CO₂) storage in a depleted gas field off the Irish coast. An Assessment of the Potential for Geological Storage of Carbon Dioxide for the Island of Ireland prepared for the SEAI and others in 2008 identified storage potential in the depleted Kinsale Head natural gas field in the Celtic Sea Basin, with a calculated practical capacity of 330 million tonnes CO₂. Ervia is looking at the potential of capturing the emissions from power stations and Ireland's only oil refinery (potentially up to 2.5 million tonnes of CO₂) located in the Cork area of Ireland and storing the CO₂ in the depleted Kinsale Head gas field. There is also the potential to capture other industrial emissions in the future. The Cork CCS Feasibility study has been recognised as a potential project to achieve European Union SET Plan CCS ambitions. Initial findings from the feasibility study are positive and a successful project could be developed before 2030 with European ETS Innovation Funding.

Another low carbon technology that is being assessed for its potential to fully decarbonise the Irish gas network is hydrogen. Hydrogen is a carbon free flammable gas that can be used in much the

⁴¹ <https://www.dccae.gov.ie/documents/Energy%20White%20Paper%20-%20Dec%202015.pdf>

same way as natural gas and can be stored indefinitely. Two hydrogen pathways are being examined. The current lowest cost large scale production methods reform natural gas into hydrogen. A successful CCS project would enable the production of clean hydrogen⁴² where the vast majority of the carbon dioxide is captured. Further work on the potential for hydrogen to fully decarbonise the gas network in Ireland will take place over the coming years. The production of hydrogen from the electrolysis of water is currently a higher cost method but is carbon free, if renewable electricity is available. Hydrogen at smaller scales may be used for methanation or blending. Methanation is the production of methane by combining hydrogen with carbon dioxide. This may significantly increase the production of biomethane in Ireland as part of the anaerobic digestion process. Blending is the addition of up to 20% hydrogen with natural gas or biomethane would enable the retention of current appliances used in Ireland.

- ii. Where available, national 2050 objectives related to the promotion of clean energy technologies and, where appropriate, national objectives including long term targets (2050) for deployment of low-carbon technologies, including for decarbonising energy- and carbon-intensive industrial sectors and, where applicable, for related carbon transport and storage infrastructure

The National Energy RD&D and Ocean Energy Prototype Development Funding Programmes fund the deployment of research, development & demonstration stage energy/ low-carbon technology pilot facilities. This funding aims to stimulate and accelerate the development & deployment of energy/low-carbon technology related products, processes & systems in the Irish marketplace, to grow Ireland's national capacity to carry out internationally leading RD&D activities; and to support solutions that enable technical & other barriers to market uptake of energy/low-carbon technology related products, processes & systems to be overcome.

Electricity Infrastructure: EirGrid is the Transmission System Operator (TSO) in Ireland, and operates the 400 kV, 220 kV and 110 kV transmission grid in Ireland with the exception of the 110 kV network in the Dublin area which is operated by the Distribution System Operator. A number of major electricity infrastructure upgrades/extensions are planned or are in progress, including the North-South Interconnector Project (new 400kV line connecting Ireland and Northern Ireland); the West Dublin Project (220/110kV substation installation connecting to an existing 220kV double circuit line) to meet local demand for electricity; the Laois/Kilkenny Project (new 400/110kV substation near

⁴² Clean hydrogen is the term for hydrogen produced from SMR/CCS

Portlaoise looped into an existing 400kV and 110kV line, connected to a new 110/38kV substation in Kilkenny by new 110kV lines); and the Celtic Interconnector (proposed undersea interconnector between Ireland and France – an ‘EU Project of Common Interest’).

Transport Infrastructure: The Department of Transport, Tourism, and Sport (DTTAS) is the ministry with overall responsibility for improving the sustainability of the transport sector. DCCAE and DTTAS work closely together on sustainable transport and with bodies such as National Transport Authority and Transport Infrastructure Ireland. DTTAS and DCCAE co-chair the Low Emission Vehicle Taskforce.

Funding and rollout of electric vehicle charging points has been supported by a Commission for Regulation of Utilities (CRU) decision to allow ESB Networks to invest and install electric vehicle infrastructure up to a maximum of €25 million and recover these costs from the Distribution Use of System network charges. This decision has allowed ESB eCars to deliver an extensive public network of both normal and fast charging points across Ireland, and there are now approximately 847 EV charge points installed across Ireland of which 87 are fast chargers.

In 2017, Ireland published its National Policy Framework on Alternative Fuels Infrastructure for Transport in Ireland 2017 to 2030. This sets out plans in relation to compressed natural gas refuelling infrastructure (one publicly accessible CNG station is due to open shortly) as well as in relation to other alternative fuels, with the intention of reducing dependence on oil derived fuels in the transport sector.

Ireland’s National Planning Framework (Project Ireland 2040) includes Government commitments to investments in several public transport infrastructure projects. The Framework refers to the following transport infrastructure-related targets: at least 500,000 electric vehicles on the road by 2030 with additional charging infrastructure to cater for planned growth; transitioning to a low emission urban public bus fleet with no diesel-only buses purchased from 1 July 2019; and investing in sustainable travel measures, including improved cycling and walking networks for metropolitan areas.

Storage infrastructure: The only large scale energy storage device in Ireland is a pumped hydro station at Turlough Hill, consisting of 4 x 73MW generators, and with a storage capacity of 1750MWhrs. The Government’s Energy Policy (White) Paper, Ireland’s Transition to a Low Carbon Energy Future 2015-2030, states that Carbon Capture & Storage (CCS) is recognised as a potential bridging technology that could support the transition to a low carbon economy. Ireland adopted a 5-year CCS review process, which will inform any decision to commit resources to put regulatory and

permitting systems in place. Ireland's National Mitigation Plan 2017 includes a specific action for DCCAE to carry out an exploration of the feasibility of utilising suitable reservoirs for CO₂ storage.

Support for Deployment of Low-Carbon Technologies in Ireland: The SEAI technology team provides energy/low carbon technology sector market support and technology-related policy support to DCCAE. It covers areas such as wind & electricity, heat & bioenergy, solar, ocean and smart grids. The group develops technology roadmaps (informed by SEAI modelling), promotes the growth of relevant supply chains, represents Ireland in technology fora, develops guidance relevant to technology sub-sectors for suppliers, installers, manufacturers and consumers, and supports critical supply chain development, often in collaboration with partner state agencies such as the Industrial Development Authority of Ireland (IDA Ireland) and Enterprise Ireland.

Circular economy and biomass

The circular economy in principle seeks to reduce, reuse and recycle (e.g. biomass) as much as possible and the Department of Agriculture, Food and the Marine believes research in this field will need to tease out the role of biomass and longer term considerations around the cascading use of biomass residues. While biomass is required in the short and medium term to meet climate and energy targets, there may be circular economy and bio-economy opportunities that may seek to keep materials in circulation, where they have value and to make biomass only available for bioenergy purposes only after undergoing e.g. bio-refining and where the value in the biomass has diminished.

National Policy Developments on the bio-economy

In the *EU 2050 long-term strategy on Climate Action - Factsheet on the Long Term Strategy Greenhouse Gas Emissions Reduction* the bio-economy is outlined as one of the strategic priorities in the road to a climate neutral economy. The Department of Agriculture, Food and the Marine and the Department of Communications, Climate Action and Environment co-chair the national bio-economy implementation group at present and this group are currently putting preparing a report to government on bio-economy developments in 2018. A National policy statement on the bio-economy⁴³ was published in 2018.

⁴³ https://www.taoiseach.gov.ie/eng/News/Government_Press_Releases/Bioeconomy.pdf

iii. Where applicable, national objectives with regard to competitiveness

Ireland's National Competitiveness Council (NCC) reports to the Taoiseach (Ireland's Prime Minister) and the Government on key competitiveness issues facing the Irish economy and provides recommendations on policy actions required to enhance Ireland's competitiveness position. Details in this section are drawn from Ireland's Competitiveness Challenge 2018 report, published in December 2018. The following overarching themes and challenges have been identified as areas of competitiveness which need to be carefully managed:

- Stable and sustainable public finances are a prerequisite for national competitiveness. To enhance the resilience of Ireland's economy, the Government must continue its efforts to reduce the debt and deficit levels and avoid any narrowing of the tax base. It is also critical that windfall gains are invested wisely to support the resilience of the economy as well as to invest in the economic infrastructure required to enhance Ireland's future competitiveness.
- The concentrated nature of the Irish economy, reflected in the reliance on a small number of companies delivering our productivity performance, while the majority of Irish-owned firms export a small number of products to a small number of destinations, necessitates achieving a more balanced growth based on increasing contributions from the indigenous sector of the economy. Broadening the enterprise and export base by strengthening support for indigenous business to scale and internationalise is of crucial importance.
- As a small open economy, cost competitiveness is a major factor in ensuring that Ireland's overall competitiveness performance is strong in an international context, that the growth of the economy is sustainable, and that Ireland remains an attractive location in which to do business.
- Ireland's strong overall productivity performance is heavily influenced by a small cohort of enterprises which disguises, to a degree, underperforming sectors and boosts Ireland's productivity levels. Increasing investment in knowledge-based capital (e.g. intellectual property, software, organisational changes, training and design) is vital in bridging the productivity gap that exists between the most productive firms and lagging firms and for achieving sustainable growth prospects in the indigenous sector. There is further scope for establishing deeper linkages between the indigenous and foreign sectors as a means of boosting diffusion of knowledge and technology and therefore increasing the competitiveness and productivity of indigenous firms.
- The presence of a talent pipeline combining knowledge and skills is key in improving Ireland's productivity performance. A future-proofed funding model for higher education,

which will guarantee a steady output of well-educated graduates with the necessary skillsets for the evolving workplace of the 21st century, and which will ensure that Ireland stays ahead of the competitiveness curve, remains a priority.

- Continued economic growth, demographic pressures and an under-investment in the last decade means that Irish infrastructure continues to lag its main competitors. The Council considers that the Government faces a critical challenge to deliver effectively-connected infrastructure projects, under Project Ireland 2040, that drive future productivity growth and maximise returns on investment while at the same time avoid overheating the economy and ensure value for money.
- Transforming Ireland into a leading digital economy requires an integrated approach, across the many stakeholders, in delivering the Digital Single Market Strategy and producing and implementing an ambitious, future-proofed and target-based National Digital Strategy.

Competitiveness is a multidimensional concept incorporating many interlinked and interdependent factors. Reflecting this complexity, Ireland's Competitiveness Scorecard analyses over 170 measures, each of which articulates an aspect of Ireland's competitiveness performance. Competitiveness performance reflects the interaction of a wide range of factors that, combined, determine the ability of firms to compete successfully in international markets. Ireland's performance across several international competitiveness indices has improved in recent years.

The 2017/2018 World Economic Forum Global Competitiveness Report showed Ireland ranked 24th most competitive economy. The World Bank's 2017 Ease of Doing Business report placed Ireland 17th out of 190 economies.

The 2018 Globalisation Report ranks Ireland the most globalised economy in the EU. Exports and Imports as a percentage of GDP were 120 per cent and 88 per cent respectively in 2017. Trade as a proportion of GDP in Ireland is significantly above Euro area and OECD averages.

3. POLICIES AND MEASURES

3.1. Dimension decarbonisation

3.1.1. GHG emissions and removals

i. Policies and measures to achieve the target set under Regulation (EU) 2018/842 as referred in point 2.1.1 and policies and measures to comply with Regulation (EU) 2018/841, covering all key emitting sectors and sectors for the enhancement of removals, with an outlook to the long-term vision and goal to become a low emission economy and achieving a balance between emissions and removals in accordance with the Paris Agreement

As mentioned in Section 2.1.1, the Effort Sharing Regulation (ESR) sets out binding annual greenhouse gas emission targets for Member States for the period 2021–2030. These targets cover sectors of the economy that fall outside the scope of the EU Emissions Trading System (EU ETS). These sectors, including transport, buildings, agriculture and waste management, account for almost 60% of total EU emissions. The proposal is the follow-up to the Effort Sharing Decision, which established national emissions targets for Member States in the non-ETS sectors between 2013 and 2020. Ireland's target under the ESR is to reduce emissions by 30% relative to 2005 levels in the non-ETS sector by 2030.

In December 2017, the European Parliament and Council reached a provisional agreement on the ESR which confirmed Ireland's proposed target of a 30% emissions reduction. This was formally endorsed by both Parliament and Council in 2018, and the Regulation was adopted on 14 May 2018.

Land Use, Land Use-Change and Forestry (LULUCF)

On 20 July 2016 the European Commission presented a legislative proposal to integrate greenhouse gas emissions and removals from land use, land use-change and forestry (LULUCF) into the 2030 climate and energy framework. The proposal follows the agreement with EU leaders in October 2014 that all sectors should contribute to the EU's 2030 emission reduction target, including the land use sector. It is also in line with the Paris Agreement, which points to the critical role of the land use sector in reaching our long-term climate mitigation objectives. The main elements of the LULUCF Proposal are:

- the “no-debit rule” which states that the aggregate emissions and removals of the land categories: afforestation, deforestation, managed cropland, managed grassland and managed forest land must be less than zero (a net sink), with the possible inclusion of managed wetland from 2026;

- the rules accounting for emissions and removals for afforestation and deforestation on a gross-net basis;
- the rules accounting of emissions and removals from grassland and cropland on a net-net basis in reference to average emissions between 2005-2009;
- the accounting of managed forest land (forest older than 20 or 30 years) through the use of a forward looking reference level.

Ireland has significant potential to contribute to the enhancement and conservation of sinks in the main due to an ongoing afforestation scheme, low levels of deforestation due to national legislation, sustainable forest management practices and initiatives within the cropland and grassland management area. As currently forecast, removals from afforestation less deforestation are estimated to amount to 22 m tonnes over the period, with removals from cropland and grassland providing the remainder of the 26.8m tonnes.

National Mitigation Plan

As a means of addressing the challenge to meet the 2030 targets, Ireland's first statutory National Mitigation Plan was published in July 2017. It provides a framework to guide investment decisions by Government in domestic measures to reduce greenhouse gas emissions. A key objective of the Plan is to close the gap to Ireland's 2020 EU target and to prepare for the EU targets that Ireland will take on for 2030. The Plan sets out over 70 individual mitigation measures and 106 related actions to reduce emissions in the four sectors with the most significant contribution to national emissions (Electricity Generation; the Built Environment; Transport; and Agriculture, Forestry and Land Use.) Although the Plan does not provide a complete roadmap to achieve either Ireland's proposed 2030 target or the 2050 transition objective, it has established the framework for the development and implementation of medium-to-long-term policy options so as to achieve progressive emissions reductions in each of its four key sectors.

The National Mitigation Plan has been prepared in accordance with the Climate Action and Low Carbon Development Act 2015 and the Government has met its obligations under the Act. The complexity of the issues and time horizon involved means that, while this Plan clearly sets Ireland on the path to long-term decarbonisation and provides a roadmap to that end, between now and the achievement of our 2050 objective the Plan will of course be supplemented, continuously reviewed and updated accordingly to ensure that it remains an appropriate and active Plan capable of addressing, incorporating and responding to all of the developing issues and technologies. The Plan

will be subject to formal review in accordance with the 2015 Act at least once every five years and will become a 'living' document which will be updated on an on-going basis as analysis, dialogue and technological innovation generate further cost-effective sectoral mitigation options.

This process will also take into account the outcomes from the examination of the issue of climate action by the "Citizens' Assembly"⁴⁴ as well as the work of the National Dialogue on Climate Action. This continuous review process, which is built into the 2015 Act, reflects the broad and evolving nature of the sectoral challenges outlined in the Plan, coupled with the continued development and deployment of emerging low carbon and cost effective technologies across different sectors of the economy. As this first statutory Plan moves into the implementation phase, this process will enable it to be amended, refined and strengthened over time and assist in keeping Ireland on target to meet our obligations. The continuous review process will mean that actions stemming from the Plan are and will be based on substantive policy and resourcing decisions.

To support the inclusive nature of this work, the Government has also established a National Dialogue on Climate Action referred to above. The National Dialogue will provide an opportunity to create awareness, engagement and motivation to act (locally, regionally and nationally) in relation to the challenges presented by climate change, and will create structures and information flows to facilitate people gathering to discuss, deliberate and achieve consensus on appropriate responses to these challenges as well as enable and empower appropriate action.

The Plan collates many of the existing measures that will help to reduce emissions across different sectors of the economy, including:

- Emissions Trading Scheme;
- Carbon tax;
- Renewable electricity support schemes;
- Renewable energy prototype development funding;
- Financial supports, through SEAI, for housing energy efficiency improvements;
- Social housing energy efficiency upgrades;
- Near Zero Energy building standards;
- Building Energy Rating Certificates;
- SEAI Large Industry Energy Network and SME Support schemes;

⁴⁴ <https://www.citizensassembly.ie/en/>

- Public Sector Energy Efficiency Strategy;
- Public transport investments;
- Smarter Travel Initiative;
- Tax and financial incentives for low emissions vehicles;
- Biofuels Obligation Scheme;
- Animal breeding programme
- Agri-environmental scheme;
- Targeted Agricultural Modernisation Scheme
- Forestry Programme.

The Plan also presents potential longer term measures for further measures to reduce emissions, potential implementation depending on the evolution of more short and medium measures.

These include:

- Renewable Electricity Support Scheme;
- Increased electricity interconnectivity;
- Consideration of the future role of Moneypoint;
- Renewable heat incentive;
- Smart metering;
- Minimal thermal standards in rental properties;
- Voluntary Housing Association upgrades;
- Further low emission vehicle incentivisation;
- Further public transport investment;
- Supports and incentives to modal shift;
- Taxation policy development;
- Biofuels obligation scheme development;
- Eco-driving;
- Switch in fertilizer type
- Forest cover expansion post-2020.

In addition to setting out the full range of measures that the Government has already implemented or is considering to reduce Ireland's greenhouse gas emissions, the Plan includes 106 individual actions to be implemented across Government in order to advance the national transition agenda. These actions are the individual building blocks that will enable the Government and wider society

to implement deeper reductions in emissions in the years ahead. This will be an ongoing process aimed at incremental and permanent decarbonisation.

This is a whole-of-Government Plan, reflecting in particular the central roles of the key Ministers responsible for the sectors covered by the Plan – Electricity Generation, the Built Environment, Transport and Agriculture, as well as drawing on the perspectives and responsibilities of a range of other Government Departments. Ireland has already implemented a wide range of policies and measures to reduce greenhouse gas emissions across the economy and is actively developing proposals to further expand measures already in place and to implement additional measures. This Plan describes in detail these existing measures and those under consideration.

The following pages will give an overview of the various policies and measures covering all key emitting sectors in the National Mitigation Plan, with an outlook to the long-term vision and goal to become a low emission economy based on the following principles:

- an aggregate reduction in carbon dioxide (CO₂) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and
- in parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

Electricity Generation

Energy is indispensable to contemporary social and economic functioning, while energy policy seeks to balance the sometimes competing aspects of sustainability, competitiveness and security of supply. Given the scale, scope and extent of energy use, it inevitably has significant environmental aspects including greenhouse gas emissions arising from power generation, heating and transport. Harnessing Ireland's renewable energy resources will play a key role in the transition towards a sustainable, secure and competitive energy system. A key sector in this transition is electricity generation which since 2005, has been subject to the EU's ETS.

While representing just under a third of emissions from the energy sector, electricity has been an area of considerable decarbonising success and a target area for future progress. Under the Renewable Energy Directive 2009/28/EC, Ireland is legally bound to deliver 16% of its final energy requirements from renewable sources by 2020. Ireland has committed to meeting this overall

renewable target by achieving 40% renewable electricity, 12% renewable heat and 10% renewable transport by 2020.

The key measures for the *Electricity Generation* sector include:

- Oversee the establishment of Bord na Móna Bioenergy.
- Finalise and progress actions on bioenergy as part of the NECP process
- Carry out and Interim Review of the Offshore Renewable Energy Development Plan (OREDPP).
- Develop a regulatory policy for electricity interconnectors for Ireland.
- Carry out a study to identify the most suitable replacement low carbon technology for the Moneypoint generation plant.
- In line with Bord na Móna's sustainability strategy, oversee review of future of peat generation plants.

Built Environment

Improving energy efficiency is central to the transition to a low carbon economy. Using less energy, and using it in a more flexible way, is the most cost-effective and accessible way to tackle climate change. This is why conserving energy is the first step to take in the process of decarbonising the built environment. In addition, the more energy use is reduced through efficiency measures, the lower the effort required to achieve renewable energy targets.

The Energy White Paper recognises that in terms of energy efficiency, attaining the objective of a low carbon future will involve radically changing behaviour as citizens, industry and Government and becoming significantly more energy efficient.

Energy efficiency upgrades to the fabric of buildings by for example, carrying out works such as insulation and airtightness reduces the amount of energy needed for heating and cooling and reduces the CO₂ emissions connected with our energy use in those homes and workplaces. However, this is just the first step. To actually decarbonise the built environment, the switch from using fossil fuel as the source for the energy used in buildings to alternative energy sources will be vital.

There are two main options for switching away from fossil fuels: renewable fuels such as biomass or electrification of heat using technologies such as heat pumps. However, it is critical that the fabric of a building is upgraded first so that the desired levels of comfort and function are maintained in

homes and workplaces when a less energy intensive renewable energy system is then used. The principle of 'fabric first' is now embedded in existing support for energy efficiency upgrades and will continue to define the ongoing development of measures to combine energy efficiency improvements with the fuel switching necessary to make real progress on decarbonising Ireland's built environment.

The key measures for the *Built Environment* sector include:

- Commission study on the wider economic costs and benefits – including in the areas of climate, decarbonisation and rural development – of potential extensions of the Irish Natural Gas network, and related funding options;
- Rollout of the Warmth and Wellbeing Scheme – 1,500 homes will be upgraded for occupants who qualify for the scheme;
- Implement the Deep Retrofit pilot. This pilot scheme was launched by SEAI in 2017 to establish how best to support deeper levels of renovation in the residential sector, with a view to gaining practical experience of how to develop a residential energy efficiency offering post-2020;
- New BER Advisory report to be introduced;
- Roll out the EXEED Programme;
- Provide support to Small and medium-sized enterprises (SMEs);
- Establish a new Behavioural Economic Unit in SEAI;
- Implementation of Public Sector Energy Efficiency Strategy (PSEES).

Transport

Moving to a low carbon society represents a significant challenge for Ireland's expanding transport sector where the use of fossil fuels is firmly embedded in driving culture and travel demand is increasing in response to population and economic growth. To address the challenge of transitioning from conventionally fuelled vehicles to alternative fuels and technologies an ambitious national target was established whereby all new cars sold in Ireland will be zero carbon emission or zero emission-capable by 2030 as well as many of our public transport buses and rail lines. The ultimate aim is to decarbonise the national passenger car fleet by 2050 and increase the use of alternative fuels in the freight sector.

A mix of further measures, developments and initiatives will be needed to continue to respond to the climate challenge into the future. New technology deployment and behavioural change initiatives need to be advanced across the transport sector, stimulating changes to the way people travel and the types and amounts of fuels that are used. Further measures being progressed are the implementation of the National Planning Framework, which aims to ensure better integration of land use and transport planning policy in order to reduce commuter travel demand and support more efficient patterns of development and travel; increasing public transport capacity and securing a shift, where feasible alternatives exist, away from private car use; encouraging the take-up of alternative fuels to petrol and diesel; and the increase of the obligation under the Biofuels Obligation Scheme to further reduce the concentration of high-emitting fuels. In addition, the potential role of taxation, the impact of eco-driving and driving behaviours are all also being examined and advanced.

Alongside national policy objectives, the transport sector is also bound by certain commitments at EU level. The Renewable Energy Directive specifies a legally binding 10% renewable energy in transport target to be achieved by all Member States by 2020. The Biofuels Obligation Scheme is the primary mechanism being deployed to achieve this target by 2020. Progress is being made in increasing the share of renewable energy in Ireland's transport energy. By end 2017 this share was 4.1% or 7.4% are applied in accordance with the Directive.

The key measures for the *Transport* sector include:

- Undertaking a review of public transport policy;
- Investment in more capacity and quality improvements in public transport provision
- Implementation of Smarter Travel programmes and measures
- Rollout of the National Transport Authority's 'BusConnects' programme which aims to increase bus passenger numbers in the Dublin region by 50%;
- A commitment under the National Development Plan to purchase no diesel only public service urban buses from July 2019 onwards;
- Commitment to supporting the early transition to alternative fuels by maintaining and building upon existing tax and financial incentives for low emissions vehicles;
- A commitment to advance the existing biofuels obligation scheme by consulting on moving to higher biofuels concentrations in our fuel mix;

- An ambition that all new cars and vans sold in Ireland from 2030 will be zero emission (or zero emissions-capable), in line with the *National Policy Framework: Alternative Fuels Infrastructure for Transport in Ireland: 2017-2030*.

Agriculture and Forest Sector

The long term vision for the agriculture, forest and land use sectors is based on an approach to carbon neutrality in these sectors, which does not compromise capacity for sustainable food production. This effectively means that agricultural emissions are balanced by reducing emissions of methane, nitrous oxide and carbon dioxide in so far as the best available science allows, increasing carbon-sequestration through forests and land use and displacing fossil fuel and energy intensive materials with renewable sources. This vision aligns with the Paris Agreement, European Council Conclusions of October 2014 and also the Programme for a Partnership Government which sets out the objective to be achieved in this sector as to balance the control of agricultural emissions with the economic and social objective of promoting the sustainable development of a rural economy.

The Irish agriculture sector is committed to ensuring that growth continues on the basis of sustainability so that Ireland can play its part in meeting the increasing global food demand while having regard to Ireland's climate obligations. The sector is also committed, through proactive use of research, technology and institutional arrangements, to demonstrate how sustainable agricultural and land management and resource efficiency can reduce emissions while improving the resilience of food production systems and contributing to climate action. The sector must be in a position to anticipate and adapt to the negative impacts of climate change in order to build resilience and enable sustainable development.

The scale of the challenge facing the sector in this regard is recognised at national, EU and international levels, with increasing emphasis on linking additional demand for food, fuel and fibre production in the sector with improving environmental credentials. The multiple objectives of the agriculture and land use sector with their lower mitigation potential were clearly recognised in the October 2014 European Council Conclusions. In Ireland, the sector not only produces sustainable food products, displaces fossil fuels and energy intensive materials through supply of biomass and wood products; it also sequesters carbon while providing other essential eco system services including those related to water and biodiversity. The development of the Irish agriculture sector is supported by the European Union's Common Agriculture Policy (CAP) through a combination of

direct payments to farmers, financial assistance towards investments in rural development and environmental protection and market support measures.

The key measures in the *Agriculture and Forest* sector are focusing on:

- efficient multi trait animal breeding strategies
- efficient use and recycling of nutrients which optimise nitrogen use efficiency and reduce losses of reactive nitrogen to the environment
- feeding strategies
- support of improvements to animal health and welfare
- support of Information Communication Technology (ICT) in agriculture to aid the delivery of sustainable intensification.
- Provision of sustainable biomass materials for renewable energy generation, the improvement of energy efficiency at farm level and adoption of RE technologies at farm level.
- The multi-annual Rural Development Programme (RDP) which is co-funded by the European Union is worth €4 billion over 7 years and is strongly targeted towards environmental benefits.
- Examples of schemes within the RDP which have a specific climate focus include the Beef Data and Genomics Programme (BDGP) and the GLAS agri-environment scheme. Both of these schemes combined have a budget of approximately €1.5bn over the lifetime of the RDP and will provide measurable climate related benefits for Ireland and Irish agriculture. In addition the Targeted Agricultural Modernisation Scheme (TAMS) provides support for energy efficiency measures and adoption of renewable energy technologies across the sector.
- The objective of the Beef Data and Genomics Programme is to lower the intensity of GHG emissions by improving the quality and efficiency of the national beef herd. This programme has recently passed a milestone of having over 1,000,000 animals registered in the database, which is also the world's largest for beef cattle;
- The Green, Low-Carbon, Agri-Environment Scheme (GLAS) scheme supports low carbon agriculture through a range of cross-cutting measures, and promotes the delivery of targeted environmental advice and best practice at farm level.
- The Origin Green programme operates on a national scale, uniting government, the private sector and food producers through Bord Bia. It involves a process of continuous improvement – inspecting, advising, improving and setting targets. The reporting tools used

are designed to be practical and easily understood by farmers and food companies. Over 197,000 carbon assessments have been carried out across beef and dairy farms.

- The Forestry Programme, under which over 312,000 hectares have been afforested as a result of state supports since 1990, and supports an industry providing employment to 12,000 people and contributes €2.3bn to GDP. The Programme includes a number of measures aimed at increasing forest cover and mobilising the existing timber resource such as the afforestation and forest road schemes and forest management plans.
- Undertake research to further elaborate the concept of carbon neutrality from an Irish agriculture and land use perspective, and develop pathway scenarios;
- Engage with the DCCAE led cross departmental working group to analyse the feasibility of including Wetland Draining and Rewetting in the national inventory;
- Progress with DCCAE implementation of the high level strategy on the Bioeconomy in Ireland to maximise the societal and economic opportunities from a transition to a low carbon, climate resilient economy.

All-of- Government Climate Action Plan

Building on the National Mitigation Plan and the measures already in place to reduce Ireland's greenhouse gas emissions, the Minister for Communications, Climate Action and Environment is now preparing a new all-of-government plan, whose central ambition will be to make Ireland a leader in responding to climate change. The Minister will work with colleagues across Government to develop new initiatives across all sectors that contribute to greenhouse gas emissions in Ireland. The new plan will have a strong focus on implementation, including actions with clear timelines and steps to needed to achieve each action, assigning clear lines of responsibility for delivery. The new plan will also be informed by successful approaches in other countries, where such approaches could be adapted for implementation in Ireland.

Other National Policies

The extent of the challenge to reduce greenhouse gas emissions in line with Ireland's International and EU obligations is well understood and is reflected also in Ireland's National Policy Position on Climate Action and Low Carbon Development (2014) and the Climate Action and Low Carbon Development Act 2015. Both the policy position and legal framework are key elements of the effort to progress the national low carbon transition agenda. The National Policy Position establishes the fundamental national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050. It sets out the context for the objective, clarifies the level of GHG mitigation ambition envisaged, and establishes the process to pursue and achieve the overall objective. Specifically, the National Policy Position envisages that policy development will be guided by a long-term vision based on:

- an aggregate reduction in carbon dioxide (CO₂) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and,
- in parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

As the first of a series of successive National Mitigation Plans required by the 2015 Act, the first Mitigation Plan cannot set out precisely how Ireland will achieve the national transition objective. However, it demonstrates the scale of the deep decarbonisation that will be required by 2050 and lays the initial foundations for this to happen.

Sectoral Adaptation Plans

In outlining a whole of Government approach to climate adaptation, the NAF identifies 12 key sectors under the remit of 7 Government Ministers where sectoral adaptation plans are to be prepared. Sectoral plans must be submitted to Government for approval no later than 30 September 2019. Plans are to be developed in line with the national "Sectoral Planning Guidelines for Climate Change Adaptation"⁴⁵ which were published in May 2018. Table 25 below sets out the sectors and lead Government departments required to prepare plans under the NAF. Sectors required to prepare sectoral plans that may be of particular relevance in terms of this NECP include Electricity and Gas Networks, Transport Infrastructure and Flood Risk Management.

⁴⁵<https://dcae.gov.ie/en-ie/climate-action/publications/Pages/Sectoral-Planning-Guidelines-for-Climate-Change-Adaptation.aspx>

Theme	Sector Level	Lead Department for Sectoral Adaptation Plans
Natural & Cultural Capital	Seafood	Department of Agriculture, Food and the Marine
	Agriculture	
	Forestry	
	Biodiversity	Department of Culture, Heritage and the Gaeltacht
	Cultural, Built and Archaeological Heritage	
Critical Infrastructure	Transport infrastructure	Department of Transport, Tourism and Sport
	Electricity and Gas Networks	Department of Communications, Climate Action and Environment
	Communications Networks	
Water Resource & Flood Risk Management	Flood Risk Management	Office of Public Works
	Water Quality	Department of Housing, Planning and Local Government
	Water Services Infrastructure	
Public Health	Health	Department of Health

Table 25 - Sectors and lead Government Departments required to prepare sectoral adaptation plans under the National Adaptation Framework

Some sectors (i.e. Agriculture and Forestry⁴⁶; Transport⁴⁷; Electricity and Gas Networks⁴⁸ and Flood Risk Management⁴⁹) have already developed non-statutory plans during 2017 and 2018 under the 2012 National Climate Change Adaptation Framework. These plans will be revised and updated in line with the requirements of the NAF and the Climate Act.

⁴⁶ <https://www.agriculture.gov.ie/media/migration/ruralenvironment/climatechange/ApprovedAdaptationPlanning040817.pdf>

⁴⁷ <http://www.dttas.ie/sites/default/files/publications/public-transport/english/developing-resilience-climate-change-irish-transport-sector/developing-resilience-climate-change-irish-transport-sector.pdf>

⁴⁸ <https://dcae.gov.ie/en-ie/news-and-media/publications/Documents/25/DCCAE%20National%20Adaptation%20Plan%20for%20Electricity%20and%20Gas%20Networks.pdf>

⁴⁹ <https://www.opw.ie/en/climatechange/>

Institutional governance and monitoring

Since 2015 sectoral coordination of national adaptation policy has taken place under the auspices of the National Adaptation Steering Committee which is chaired by the Department of Communications, Climate Action and Environment. As a key action under the NAF, the National Adaptation Steering Committee has been reviewed and restructured to ensure that a coordinated, comprehensive and coherent approach continues to operate in implementing actions under the NAF. The need for appropriate cross sectoral coordination and consultation is identified as crucial in the NAF and the Climate Act and the Steering Committee will have a key role to play in promoting and encouraging work in this regard.

Members of the Steering Committee include: Departments preparing sectoral plans under the NAF; Department of Foreign Affairs and Trade; Irish Water; EPA; regional and local government; the National Standards Authority of Ireland; and Met Éireann.

The National Adaptation Steering Committee reports to the Climate Action High Level Steering Group, which was established under the National Mitigation Plan and is chaired by the Minister for Communications, Climate Action and Environment. Since summer 2018, this group now addresses both climate mitigation and adaptation. In terms of adaptation, the High Level Steering Group will:

- monitor progress by sectors and agencies in delivering on climate change adaptation actions for which they are responsible; and
- ensure that a coordinated and coherent approach is adopted and maintained towards achieving a climate resilient Ireland.

Regional and local level adaptation

National climate action policy in Ireland recognises the potential which exists within the local government sector to contribute to the transition to a low carbon and climate resilient future. The National Adaptation Framework identifies the critical role to be played by local authorities in addressing climate change adaptation. In January 2018 the Minister for Communications, Climate Action and Environment announced that his Department would provide €10m in funding over 5 years to the local authority sector to establish 4 Climate Action Regional Offices (CAROs). This commitment recognises the significant obligation which has been placed on local government to develop and implement its own climate action measures, as well as the need to build capacity within the sector to engage effectively with climate change – both in terms of mitigation and adaptation.

The Climate Action Regional Offices are being operated by a lead local authority in 4 different regions grouped according to shared climate change risks. The establishment of these offices will enable a more coordinated engagement across the whole of government and will help build on the experience and expertise which exists across the sector.

Under the NAF the 31 local authorities in Ireland are required to develop their own adaptation strategies in line with guidelines to be developed for the sector (these are currently being reviewed and updated with a view to publication in Q4 2018). Work on the development of strategies will be undertaken by individual local authorities with support from the Climate Action Regional Office in their region. Local authorities have also been set a deadline for the completion of local strategies of 30 September 2019.

Monitoring at local level

A National Local Authority Climate Change Steering Committee monitors the CAROs and implementation of their annual work programmes. The CAROs and the local authority sector are also integrated into national oversight bodies for climate action, with representatives on the National Adaptation Steering Committee, Climate Action High Level Steering Group and the Adaptation Committee of the Climate Change Advisory Council (CCAC).⁵⁰

Progress under EU Strategy on Adaptation to Climate Change

Ireland is committed to ensuring comprehensive and transparent reporting on adaptation in line with the requirements of the Governance of the Energy Union and Climate Action Regulation and facilitating the EU's commitments on adaptation under the UNFCCC and the Paris Agreement.

As part of the EU Strategy on Adaptation to Climate Change the Commission developed an adaptation preparedness scoreboard, which identifies key indicators for measuring Member States' level of progress in terms of adaptation policy. The assessment of Ireland's performance under the indicators in the scoreboard completed in 2018 shows that Ireland has made significant progress in meeting many of the indicators under the scoreboard particularly in terms of putting in place the coordinating structure required for adaptation at national level, putting in place climate observations systems, filling knowledge gaps and in terms of knowledge transfer. The assessment did however show a number of indicators where progress is needed including in terms of integrating climate change into national disaster risk management plans, mainstreaming adaptation into insurance or alternative policy instruments and monitoring of progress on adaptation at local and

⁵⁰ <http://www.climatecouncil.ie/aboutus/governance/>

regional level. Monitoring of local and regional adaptation has been considered above and the following discusses the areas of insurance and risk prevention and disaster risk management.

Alignment of Climate Adaptation and DRR

Recent reports and policy briefs from the European Environment Agency⁵¹ and the PLACARD (Platform for Climate Adaptation and Risk Reduction) project⁵² have noted that efforts to reduce disaster risk and at the same time adapt to a changing climate presents challenges and opportunities in both Europe and globally.

The NAF acknowledges the requirement to enhance coherence and complementarity between the Paris Agreement, the Sendai Framework for Disaster Risk Reduction as well as the UN Sustainable Development Goals. Ways to enhance coherence between adaptation and disaster risk reduction policies and practices in Ireland have also been considered in recent research reports published by the EPA in 2018.⁵³ National and International research and best practice, such as the outcomes of PLACARD, will continue to inform Irish policy in this regard and work on policy integration and indicators are identified as future research priorities in the NAF.

The NAF recognises that effective climate adaptation can minimise risks and costs and also protect lives and property by building resilience into existing systems. This can ultimately help minimise the emergency response that is necessary in response to severe weather events.

In Ireland statutory responsibility for emergency planning lies across a number of Government departments. For example, the Department of Housing, Planning and Local Government is designated as the Lead Government Department for coordinating the response to severe weather emergencies. “Strategic Emergency Management National Structures and Framework”⁵⁴ sets out the national arrangements for the delivery of effective emergency management. It outlines the structures for coordinating a “whole of Government” approach and the framework for achieving a systems approach to emergency management. This Framework will be complemented by a series of ‘Strategic Emergency Management (SEM) Guidelines’ dealing with specific aspects of strategic emergency management. This will include a Guideline on climate change.

⁵¹ Climate change adaptation and disaster risk reduction in Europe Enhancing coherence of the knowledge base, policies and practices https://www.eea.europa.eu/publications/climate-change-adaptation-and-disaster/at_download/file

⁵² <http://www.placard-network.eu/about-us>

⁵³ National Preparedness to Adapt to Climate Change: Analysis of State of Play http://www.epa.ie/pubs/reports/research/climate/Research_Report_256.pdf, Climate Resilient Ireland http://www.epa.ie/pubs/reports/research/sss/Research_Report_252.pdf

⁵⁴ <https://www.emergencyplanning.ie/system/files/media/file-uploads/2017-11/SEM.pdf>

The NAF contains a specific objective to “Ensure continued alignment with emergency planning for extreme weather events including where plans related to emergencies assigned to a sectoral department as Lead Government Department under the “Strategic Emergency Management National Structures and Framework”. The NAF also specifically recommends that sectors developing sectoral plans ensuring that plans related to emergencies assigned to a sectoral department as Lead Government Department under the Strategic Emergency Management National Structures and Framework are climate proofed. The NAF also identifies the need for climate research and modelling programmes should support climate adaptation by delivering climate services at a local level across all sectors of the economy, including emergency management.

Local authorities are designated as the lead agency for coordinating and delivering the response on the ground to severe weather emergencies and lead the local response in collaboration with the other Principal Response Agencies – An Garda Síochána (Ireland's National Police Service) and the HSE (Health Services Executive). The Climate Action Regional Offices (CAROs) will further improve alignment between adaptation policy and emergency responses at local level.

The NAF identifies the importance of any developments in the area of emergency management undertaken in line with the NAF should recognise existing structures and the policies underpinning them at national level. The NAF therefore seeks to ensure coherence between how the impacts of climate change will influence responses to both adaptation planning and national emergency planning for extreme weather events. This approach will help to align with the key responsibilities outlined under the Strategic Emergency Management National Structures and Framework and the associated guidance documents.

Insurance

The NAF recognises that the private sector has significant experience in quantifying, pricing, reducing risk and managing weather-related risks across the relevant sectors. In partnership with Government, therefore, it can play an important role in collecting and disseminating data on weather and catastrophe risk, financing risk assessments, and supporting the design and provision of insurance schemes. One project that sought to examine climate impacts on the insurance industry was the Adaptive Responses to Climate impacts (ARC) project. The aim of the ARC project, funded by the EPA, was to develop a framework for costing the impacts of climate change on the Irish economy and assessing the options for adaptation, with a specific focus on the role of key stakeholders. The study applied a framework to the specific case of flood risk in Cork and the South West region of Ireland.

The ARC project included a stakeholder forum, comprised of policy makers, local authorities, business groups and the insurance industry, to assess information needs and concerns of those exposed to current and future climate risks. It proceeded to examine two parallel but interlinked strands of research:

1. Empirical estimates of the costs of climate impacts without adaptation, particularly focused on flooding; and
2. The range of adaptation options available, including the appropriate role for insurance.

The outputs from this project included: costs of flooding; recommendations on the use of tools and methods for costing climate impacts; policy recommendations on the design of adaptation strategies; and implications for the private sector, including insurance.

The benefits of a proactive adaptive approach and the role of insurance in this is identified as a research priority under the NAF. Awareness raising is a key action under the NAF and part of this will help individuals and businesses to reduce their own risk profiles. Information platforms such as Climate Ireland can help address both of these issues by providing insures with more accurate information on households risk level e.g. through flood mapping while also supporting households in taking actions to lower their risk level.

Conclusion

The National Adaptation Framework discusses Ireland's reporting obligations at International, EU and National levels and Ireland will continue to meet these to ensure oversight and review and evaluation of adaptation policy performance and activities

- ii. Where relevant, regional cooperation in this area

Purchasing Carbon Credits

Regarding regional cooperation, it is foreseen that Ireland will commence discussions with Member States that are likely to have surplus emissions credits for both the 2020 ESD and 2030 ESR with a view to setting in place a strategy for purchasing compliance. While the preferred route to compliance is through productive capital investment, it is recognised that the Irish Government's ability to invest in climate change mitigation measures has been constrained owing to the deep recession of 2009-2013 and the ongoing Budgetary adjustment that have been taking place in successive years. Therefore, it is anticipated that some degree of compliance purchasing will be required to meet both the 2020 ESD and 2030 ESR emissions targets.

- iii. Without prejudice to the applicability of state aid rules, financing measures, including Union support and the use of Union funds, in this area at national level, where applicable

Climate Action Fund: The National Development Plan 2018-2027 sets out the need to create a €500m Climate Action Fund. In May 2018, the Government approved the development of the Climate Action Fund with the objective of funding initiatives that contribute to the achievement of Ireland's climate and energy targets in a cost effective manner or offer the potential for innovative interventions in these sectors and which, in the absence of support from the Fund, would not otherwise be developed. The Government Decision also approved the repurposing of part of the existing petroleum products levy (also known as the National Oil Reserves Agency or NORA levy) to provide financing to the Climate Action Fund. In July 2018, the first Call for Applications under the Climate Action Fund was issued. This is the first such call and the outcome will help inform the structure and focus of future calls for applications.

Financing the domestic transition envisaged under the National Mitigation Plan as well as the agenda under Article 2 of the Paris Agreement on making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development is an important issue for Ireland. On the side of the private sector, green and sustainable finance is an emerging high-growth international financial services sub-sector. Importantly from a financial markets perspective the significant funding requirement to achieve this transition to a sustainable climate resilient world is well recognised. Over the next 15 years, the G20 estimates that the world will need to invest around US\$90 trillion in sustainable infrastructure assets.

Turning to state-funded green finance, Ireland has a strong record of supporting international climate action, making significant advances in the delivery of climate finance in recent years. A consistent approach to programming climate support, based on policy prioritisation on addressing climate finance, is improving the predictability of Irish climate finance. The majority of Ireland's financial support of €175m to be provided over the period 2016 to 2020 is provided through Irish Aid. The proposed contributions to be provided by the Irish Government as contributions towards the \$100bn goal entail an additional contribution by Ireland towards this goal.

3.1.2. Renewable energy

i. Policies and measures to achieve the national contribution to the binding 2030 Union target for renewable energy and trajectories as referred to in point (a)(2) Article 4, and, where applicable or available, the elements referred to in point 2.1.2, including sector- and technology-specific measures⁵⁵

Ireland has a range of policy measures in place aimed at decarbonising the energy system. These include a number of support schemes for renewable electricity such as:

- a) the Alternative Energy Requirement (AER) scheme,
- b) three Renewable Electricity Support schemes (REFIT 1, 2 and 3), and
- c) a Prototype Development Fund which supports investment in the development of offshore renewable energy devices up to commercial stage.

There are also a number of policy measures currently being developed/piloted. These include:

- d) a new Renewable Electricity Support Scheme (RESS),
- e) Microgeneration Scheme

Additionally:

- f) a new Support Scheme for Renewable Heat (SSRH) to support the uptake of heat pumps, biomass heating systems and anaerobic digestion heating systems in the non-residential sector
- g) increased electricity interconnection (See Section 3.4), and
- h) decisions around the future role of coal in power generation.

In addition, the following policy measures are in place to support decarbonisation in the transport sector:-

- i) the Biofuels Obligation Scheme, and
- j) a range of supports to promote the uptake of electric vehicles (see section 3.1.3iii)

Further detail on each of these is set out below.

a) Alternative Energy Requirement (AER) Scheme The AER scheme was launched by the then Department of Transport, Energy and Communications in 1996 and was the first step towards a market support for wind energy as part of the Department's programme to promote the generation

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When planning those measures, Member States shall take into account the end of life of existing installations and the potential for repowering.

of electricity from renewable resources. The programme involved the tendering for contracts of certain fixed amounts of capacity, by potential renewable energy generators. The AER will remain in place until 2021.

b) REFIT 1, was open for applications until 31 December 2009. The technologies covered in REFIT 1 are small wind (< 5MW), large wind (>5MW), Hydroelectricity and Biomass/Landfill gas. The support is provided for a period of 15 years. Due to delays in grid roll-out for REFIT 1 projects, and with State Aid approval in August 2013, the backstop date for REFIT 1 was extended by two years to 2027.

REFIT 2, which succeeded REFIT 1, came into operation in March 2012. It provides for up to 4,000MW of renewable generation. The technologies covered are small wind (< 5MW), large wind (>5MW), Hydroelectricity and Biomass/Landfill gas.

The backstop date for REFIT 2 is 2032.

REFIT3 aims to support the addition of 310MW of biomass technologies including anaerobic digestion (AD) and Combined Heat and Power (CHP). Combined Heat and Power (CHP) is the simultaneous generation of useable heat and electricity in a single process and is regarded as a highly efficient energy production process. It makes use of the heat produced in electricity generation instead of releasing it into the atmosphere. The heat generated in a CHP plant can be used for many purposes including district heating and displacing industrial heat demand.

The backstop date for REFIT 3 is 2030.

c) The Prototype Development Fund provides Exchequer support for ocean energy test sites and prototype development through the DCCAE Vote. The Sustainable Energy Authority of Ireland (SEAI) manages the Prototype Development Fund on behalf of the Department. The main focus of the fund is on stimulating industry-led projects for the development and deployment of ocean energy devices and systems. Government has provided €4.75mn in 2018 towards ocean energy development.

d) The Renewable Electricity Support Scheme is being developed with the primary aim of assisting Ireland in meeting its renewable energy contribution to EU-wide renewable energy target of 32% out to 2030 within a competitive auction based, cost effective framework. The High Level

Design of the Scheme was approved by Government in July and is currently undergoing EU State Aid approval. The Scheme aims to deliver a broader range of objectives including :

- Providing pathways and supports for communities to participate in renewable energy projects
- Broadening the renewable technology mix (the diversity of technologies)
- Increasing energy security, energy sustainability and ensuring the cost effectiveness of energy policy

The first RESS auction is due to take place in 2019, this initial auction under RESS (RESS-1) will focus on 'shovel ready' projects and closing the gap to our 2020 targets.

Wind Energy Development Guidelines (WEDG)

Updated Wind Energy Guidelines are expected to be published by the Department of Planning, Housing & Local Government in 2019 following the conclusion of a strategic environmental assessment process. A key aspect of the new Guidelines will be new noise regulations for wind turbines that are in line with World Health Organisation recommendations. In addition, the DCCAE is working collaboratively with Local Authorities and the EPA on the most suitable approach to noise monitoring and enforcement for wind energy with a focus on a flexible and enforceable approach. This may potentially include a regional structure that mirrors the Local Government 'shared services' approach adopted in other areas such as waste management and climate adaptation.

Renewable Energy Policy and Development Framework (REPDF)

Work is being progressed by the Department to develop a framework, known as the *Renewable Energy Policy and Development Framework* or REPDF, that will guide the development of renewable electricity projects which are key objectives of Irish energy policy.

e) In July the Government announced a new pilot scheme to support micro generation. This first phase of support for micro generation is targeting solar PV installation and domestic customers for self-generation. A grant of up to a maximum €3,800 is now available (max 4kWp + battery) for homes built pre 2011. The new solar PV support scheme also aligns with the recently agreed recast Renewable Energy Directive which brings the 'prosumer' to the heart of new energy policy across the EU. Ireland strongly supports the ambitions behind the establishment of the rights and entitlements associated with both renewable self-consumers and renewable energy communities within the Directive.

There is a 6 month in-built review which will explore opportunities for broadening the scheme to include other micro renewable technologies and also to expand the scheme out to target other customer groups such as farmers and small businesses.

f) Support Scheme for Renewable Heat: In December 2017, the Government approved the introduction of the Support Scheme for Renewable Heat which will financially support the adoption of renewable heating systems by commercial, industrial, agricultural and other non-domestic heat users in the non-emissions trading (non-ETS) sector. District heating schemes, including those supplying heat to domestic users, will also be eligible for the scheme. The scheme is designed to increase the energy generated from renewable sources in the heat sector by circa three percentage points and consists of two phases. The first phase of the scheme, the installation grant for heat pumps, opened for applications in September 2018. The level of support provided is a grant of up to 30% of the installation cost of the heat pump system. The second phase of the scheme, an operational support for biomass boilers and anaerobic digestion heating systems, will open for applications subject to European Commission State aid approval. The operational support will be a multiannual payment (for a period of up to 15 years) on the basis of prescribed tariffs. The potential for the third phase of the scheme, to provide support for biomethane grid injection, is being considered. By 2030, biomethane grid injection has the potential to make a significant contribution to increasing the level of renewable energy in the heat and transport sectors and helping reduce emissions. The National Development Plan, published in February 2018, sets out an allocation of €300m for the rollout of the Support Scheme for Renewable Heat for the period 2018 to 2027.

g) increased electricity interconnection

Electricity interconnection is strategically important to Ireland, having a potentially substantial impact on each of the three pillars of Ireland's energy policy – sustainability, security of supply and competitiveness. Interconnection also supports the energy transition and may have a variety of wide-ranging benefits to the Irish consumer, including lower long term costs of electricity through connection to a larger market and diversity of electricity supply.

The East West interconnector is a 500MW interconnector that has been in operation since 2012 and allows the trading of electricity between the island of Ireland and British wholesale electricity markets.

There are also two proposed interconnector projects. The first is the 700MW Celtic interconnector that will run to the south-west coast of France and the second is the 500MW Greenlink interconnector that will run to Pembroke in Wales.

Electricity Interconnection – National Policy Statement published⁵⁶

With a number of forthcoming interconnection proposals allied to strong national and EU policy backing, a new national policy statement on electricity interconnection in Ireland was published in July 2018. This policy statement lays out the official policy position on electricity interconnection. It outlines the many drivers and benefits of interconnection, as well as the potential impacts electricity interconnection may have on the wider energy market.

It will help to guide potential developers in better understanding the range of national policy drivers and the CRU (Ireland's energy regulator) in determining its regulatory approach to electricity interconnection, by drawing attention to key policy parameters for consideration in its evaluation of interconnection applications from project promoters. At present, the CRU is considering two interconnector applications, one from Element Power for the Greenlink Interconnector proposing a link to Wales and another from Ireland's TSO, EirGrid, for the Celtic Interconnector proposing a link to France.

h) future role of coal in power generation

As set out in the National Development plan, the Government intends that, by 2030, peat and coal will no longer have a role in electricity generation in Ireland. This is in line with Ireland's commitments under the Paris Agreement and the National Policy Position which sets out a long-term vision of an aggregate reduction in carbon dioxide emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors.

Progress will be made on Ireland's transition to a low carbon energy system, as detailed in the White Paper. As part of this, a decision will be made, probably before the end of 2018, on the future of Moneypoint, Ireland's only coal-fired electricity generating plant. In accordance with the commitment in the White Paper, a replacement low-carbon technology needs to be identified.

(i) Biofuels Obligation Scheme

⁵⁶ [https://www.dccae.gov.ie/en-
ie/energy/publications/Documents/19/National%20Policy%20Statement%20on%20Electricity%20Interconnection.pdf](https://www.dccae.gov.ie/en-ie/energy/publications/Documents/19/National%20Policy%20Statement%20on%20Electricity%20Interconnection.pdf)

The Biofuels Obligation Scheme was introduced in 2010 and requires suppliers of road transport fuels to include a certain percentage of environmentally sustainable biofuels across their general fuel mix. It is administered by the National Oil Reserves Agency. It places an obligation on suppliers of road transport fuels to ensure that specified percentages (by volume) of the motor fuel (generally gasoline and motor diesel) they place on the market in Ireland is produced from renewable sources, e.g. bioethanol and biodiesel. The scheme works by ensuring that each supplier fulfils their requirement by having the necessary number of biofuel certificates required. Certificates are awarded on the basis of 2 certificates per litre of sustainable biofuel if that biofuel is produced from wastes or residues or 1 cert for all other sustainable biofuels. All biofuels used to meet the renewable energy in transport target and the overall renewable energy target must comply with certain sustainability criteria. The level of obligation has increased over time and, since January 2017, it has been set at 8% by volume. The obligation will increase to 10% by volume from January 2019 and it is planned to further increase to 11% by volume from January 2020. The Biofuels Obligation Scheme will continue to be developed in line with the recast Renewable Energy Directive with further increases in the obligation up to 2030.

- ii. Where relevant, specific measures for regional cooperation, as well as, as an option, the estimated excess production of energy from renewable sources which could be transferred to other Member States in order to achieve the national contribution and trajectories referred to in point 2.1.2

Estimated excess production of energy from renewable sources are not known at this point in time.

North Seas Energy Cooperation

By coordinating on increased interconnection among the countries in the North Seas Energy Cooperation, an increasing amount of excess production of energy could flow across borders in a well-functioning internal energy market.

Ireland also works in the NSEC to coordinate the timing of tenders, to exchange best practices on the design for offshore wind support schemes and to identify common principles as well as possible options for alignment and concrete joint (pilot) projects. This work could contribute to the promotion of renewable sources by driving down the cost of deploying offshore wind energy production.

NSEC countries collect and regularly update each other on their respective national tender schedules with the aim to identify possible overlaps in time and to enable for a most continuous tender pipeline across the North Seas region. Ireland is ready to take into account, amongst other criteria and where possible, this overview of tender schedules in its future tender planning to avoid unnecessary overlaps and to provide a steady capacity pipeline to involved stakeholders without stop and go cycles.

Interconnection

See Section 2.4.1 re electricity interconnection

iii. Specific measures on financial support, where applicable including Union support and the use of Union funds, for the promotion of the production and use of energy from renewable sources in electricity, heating and cooling, and transport

The Support Scheme for Renewable Heat – see 3.1.2 (i) above – is considered a financial support. The measures a) to e) and measure i) in Section 3.1.2 above are financial support measures. There are no European funds involved in these measures to date.

The costs of the AER and REFIT schemes are recovered directly from electricity consumers through an annual public service obligation levy, payable by all electricity consumers. While these schemes are all now closed to new applicants, support will be provided to projects under these various schemes –each of which have different end points (2021 to 2032). Regarding the schemes being developed, the RESS, which is likely to be PSO funded, is expected to commence in 2019 with operational aid payable for up to 15 years.

The Prototype Development Fund is Exchequer funded, and will be in place to 2030 subject to Government approval. As regards the support measures for electric vehicles, a number of measures are Exchequer-funded, while others are taxation and licensing measures.

North Seas Energy Cooperation (NSEC)

In the NSEC, Ireland also contributes to the work of analysing and developing options for further mobilisation of investment capital for joint projects, for instance through EU funds such as EFSI and CEF as well as institutional investors. Such joint projects could be cross-border projects for renewable energy in accordance with the CEF proposal.

iv. Where applicable, the assessment of the support for electricity from renewable sources that Member States are to carry out pursuant to Article 6(4) of Directive (EU) 2018/...⁺

Directive to be enacted.

v. Specific measures to introduce one or more contact points, streamline administrative procedures, provide information and training, and facilitate the uptake of power purchase agreements

Consideration will be given to this in 2019.

Summary of the policies and measures under the enabling framework Member States have to put in place pursuant to Article 21(6) and Article 22(5) of Directive (EU) 2018/...⁺ to promote and facilitate the development of renewable self-consumption and renewable energy communities

Microgeneration

Ireland recognises the importance of supporting micro generation, as micro-generation not only offers customers protection from rising energy costs, but also because micro-generation could enhance broader social engagement with renewable energy projects across Ireland and enable the transition to a low carbon economy. Furthermore, micro-generation will be required given the scale of our climate and energy ambition as laid out in the National Development Plan and Project Ireland 2040.

In July, the Government launched a grant- aided pilot micro generation scheme, targeting solar PV installation and domestic customers for self-generation. The pilot scheme also supports the use of battery storage for installations over a certain size. This is in line with industry best practice where installations are sized appropriately with the maximum amount of renewable electricity generated being consumed on site by the customer.

The data gathered during the pilot scheme will inform potential future phases of support for micro-generation in Ireland that may be appropriate, as we align with the ambition of the recast Renewable Energy Directive which recognises the rights, entitlements (to generate, store and sell renewable electricity) and obligations of renewable self-consumers. This pilot scheme will deliver on ambitions and commitments made in the Energy White Paper and the Programme for Government.

⁺ OJ
⁺ OJ

Support for micro generation, including payment for electricity generated by the use of solar PV panels on domestic rooftops, was also appraised as part of the Renewable Electricity Support Scheme (RESS) economic assessment last year. The analysis identified a number of challenges that may need to be addressed before the introduction of a tariff or other financial support for exported electricity. These include amongst others, a reform of network charges, an assessment of the distributional impact of such a policy decision on the PSO (cost burden sharing), and development of a fair tariff for exported electricity taking the benefits of self-consumption into account. This approach is in line with experience from other EU member states who have attempted to introduce supports for micro-generation.

Community participation in Energy

The 2015 Energy White Paper and Programme for a Partnership Government both recognise the importance of community participation in renewable energy projects in both the national and local interest. Community ownership of, community participation in and community benefit from renewable electricity projects is a cornerstone of the new Renewable Electricity Support Scheme (RESS).

The High Level Design of the RESS scheme was approved by Government in July and is now subject to the EU State Aid approval process. The High level design was informed by international best practice, workshops with stakeholders, interviews with relevant expert groups and public consultation (which received over 1,250 submissions).

One key aim of the consultation was to identify and help to address many of the structural barriers to realising community owned renewable energy projects in Ireland. The interviews and workshops held identified the most appropriate policies and supports to increase community participation in and benefit from renewable electricity projects, in an Irish context. Government will continue to work with industry groups to ensure these policies are implemented in a fair, achievable and transparent manner.

Community policies and support measures will be put in place, including:

- Financial support for community-led projects including the delivery of key capacity building measures
- Mandatory community benefit fund and register
- Mandatory investment opportunities for communities and citizens

- Separate community category in the RESS auction process (up to 10% capacity).

vi. Assessment of the necessity to build new infrastructure for district heating and cooling produced from renewable sources

The Energy White Paper – Ireland’s Transition to a Low Carbon Energy Future 2015-2030 – set out the need to develop a policy framework to encourage the development of district heating. A Working Group, chaired by the Department of Communications, Climate Action and Environment has been established in order to develop this framework. A key output of the Working Group will be to identify the barriers to the development of district heating in Ireland and formulate recommendations focussing on the areas of policy, regulation, planning and building regulations, and financing.

vii. Where applicable, specific measures on the promotion of the use of energy from biomass, especially for new biomass mobilisation taking into account:

- biomass availability, including sustainable biomass: both domestic potential and imports from third countries
- other biomass uses by other sectors (agriculture and forest-based sectors); as well as measures for the sustainability of biomass production and use

The Support Scheme for Renewable Heat and the Biofuels Obligation Scheme (see 3.1.2(i) above) are demand-side measures that will stimulate demand for biomass and biofuels.

REFIT 3

REFIT 3⁵⁷ received State Aid clearance⁵⁸ from the European Commission in October 2011. It is designed to incentivise the addition of 310MW of renewable electricity capacity to the Irish grid composed of High efficiency Combined Heat and Power (using both Anaerobic Digestion and the thermo-chemical conversion of solid biomass), biomass combustion and biomass co-firing. The scheme opened to new applications in 2012. REFIT 2 and 3 closed for new applications on 31 December 2015.

3.1.3. Other elements of the dimension

i. Where applicable, national policies and measures affecting the EU ETS sector and assessment of the complementarity and impacts on the EU ETS

⁵⁷ For further information on REFIT 3 please see : <https://www.dccae.gov.ie/en-ie/energy/topics/Renewable-Energy/electricity/renewable-electricity-supports/refit/Pages/REFIT-3.aspx>

⁵⁸ See [https://www.dccae.gov.ie/documents/REFIT%203%20State%20Aid%2031861%20\(2011\).pdf](https://www.dccae.gov.ie/documents/REFIT%203%20State%20Aid%2031861%20(2011).pdf)

The EU Emissions Trading Scheme (ETS) includes some 11,000 stationary installations (101 currently in operation in Ireland of which approximately 70 are industrial installations) with an installed power-generation capacity of more than 20 megawatts; Irish-based ETS plants are mainly in power-generation and large-scale industrial production. The Scheme covers emissions of carbon dioxide (CO₂) from power and heat generation and a wide range of energy-intensive industry sectors including oil refineries, steel works and production of iron, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals. Nitrous oxide emissions from the production of certain acids and emissions of perfluoro-carbons from aluminium production are also included. Since the start of 2012, emissions from all flights from, to and within the European Economic Area (EEA) are included in the EU ETS. The legislation, adopted in 2008, applies to EU and non-EU airlines alike, and all Irish-based carriers above the ETS threshold must participate fully in the Scheme.

The EU ETS, now in its third phase, covers about 45% of total EU emissions, but just 29% of total emissions in Ireland, based on the latest (2016) inventories published by the Irish Environmental Protection Agency in November 2017. The relatively small share of total greenhouse gas emissions which the ETS sector in Ireland accounts for is owing to the relatively light industrial base in Ireland and the disproportionately large agricultural sector for which emissions are captured in the non-ETS inventory. Emissions from the ETS sector have been rising in recent years in Ireland; this is most likely attributable to the recession and decreased output from industry during 2009-2013 and the subsequent pent-up demand that industry is now attempting to satisfy. As the carbon price in ETS rises, the decarbonisation signal for ETS participants will become stronger, incentivising additional efficiency improvements in capital stock.

Revenues obtained from EU ETS auctioning are used by the Irish Exchequer to support green and climate-related activities and overseas climate financing (especially the Green Climate Fund), as well as administration of the Scheme. As the carbon price increases, auction revenues will also increase, affording increased opportunities for climate-related investments by Government. Since 2013, auction revenues in Ireland have amounted to between €36m and €54m per annum, and it is anticipated that this will increase to €100m by 2020 owing primarily to the forecasted increased cost of internationally traded carbon (i.e. emission unit allowances). Of the approximately 100 installations currently participating in EU ETS in Ireland, approximately 60 receive some form of free allowance allocation through the carbon leakage mechanism.

Ireland has been actively involved in shaping the final agreed text covering Phase IV of EU ETS which will commence in 2021. Of particular concern to Ireland were carbon leakage proposals which cover free allocation rules for highly trade- and energy-intensive sectors in the EU which are deemed vulnerable to the competitiveness threats posed by the Scheme. Ireland has played a part in developing the carbon leakage rules for Phase IV of ETS to include the potential for assessment of sectors, sub-sectors and products (at 6- and 8-digit NACE) through a disaggregated quantitative (i.e. Prodcom) assessment approach. This is important in order to ensure that the competitiveness impacts of EU ETS are minimised to support the development of European industry.

ii. Policies and measures to achieve other national targets, where applicable

In terms of national energy policies affecting the ETS sector, there are some measures aimed at power generation that are relevant. Ireland is currently developing a Renewable Electricity Support Scheme (RESS) to contribute to Ireland's 2020 renewable electricity targets and to deliver Ireland's renewable energy ambitions out to 2030. While RESS will incentivise the introduction of sufficient renewable generation to deliver national and EU-wide renewable energy and decarbonisation targets, there are other energy policy objectives such as broadening and diversifying the renewable technology mix, enhancing security of energy supply, promoting economic development, and supporting community and citizen participation in the transition to a low carbon economy, that must be met, while simultaneously delivering value for money for the consumer.

Under the 2009 Renewable Energy Directive, Ireland is committed to ensure that by 2020, 12% of our heating demand will come from renewable energy sources. Cleaner heat is part of Ireland's renewable energy policy objective and the introduction of a Support Scheme for Renewable Heat (SSRH) will be the primary support mechanism in the heating sector designed to meet Ireland's renewable energy obligations.

In addition, a Public Service Obligation (PSO) has operated in Ireland since 2001 to support certain conventional power-generation constructed for security of supply purposes, and for the development of renewable electricity. The levy compensates electricity suppliers for the additional costs they incur by purchasing electricity generated by these producers. This levy is vital to enable Ireland meet its target for electricity generated from renewable sources.

CORSIA

The International Civil Aviation Organisation (ICAO) has proposed a Carbon Offsetting Scheme for International Aviation (CORSIA), in which aircraft operators will be required to purchase offsets, or emission units, for the growth in CO₂ emissions covered by the scheme. CORSIA aims to address any annual increase in total CO₂ emissions from international civil aviation above 2020 levels. Ireland supports the ICAP CORSIA proposals covering international aviation emissions and sees this policy as a natural successor for EU ETS Aviation which will ensure a more level playing field for EU carriers currently operating in ETS and subject to costs associated with ETS compliance.

iii. Policies and measures to achieve low emission mobility (including electrification of transport)

As regards the private vehicle fleet, in line with Ireland's Climate Change National Mitigation Plan, Ireland plans to progressively electrify our mobility systems, moving away from polluting and carbon-intensive propulsion systems to new technologies, such as electric vehicles and introduction of electric and hybrid traction systems for public transport fleets, such that by 2040 Ireland's cities and towns will enjoy a cleaner, quieter environment free of combustion engine-driven transport systems. Ireland's National Mitigation Plan contains a commitment to maintain and build on existing tax and financial incentives for low emissions vehicles, as well as stating a further ambition that all new cars and vans sold in Ireland from 2030 will be zero emission (or zero emissions-capable), in line with the National Policy Framework: Alternative Fuels Infrastructure for Transport in Ireland: 2017-2030.

Low Emission Vehicles: There are a range of measures in place to support the uptake of low emission vehicles. The supports for electric vehicles include:

- a) Vehicle Registration Tax (VRT) relief on the purchase of newly registered electric vehicles.
- b) A purchase grant for electric vehicles.
- c) Accelerated Capital Allowances for electric vehicles and charging infrastructure.
- d) A grant to support the installation of a home charger for purchasers of new and second-hand electric vehicles.
- e) A grant to support the use of electric vehicles in the taxi/hackney/limousine sector.
- f) Relief from Benefit-in-Kind taxation for battery electric vehicles.
- g) Low motor tax for battery electric vehicles.
- h) A discount on road tolls for electric vehicles.
- i) A public awareness campaign led by the Sustainable Energy Authority of Ireland (SEAI).

There are also a number of measures in place to support the uptake of other low emission vehicles including:

- a) VRT relief on the purchase of newly registered hybrid electric vehicles.
- b) As part of the Causeway Project, Gas Network Ireland are currently rolling out 14 publicly accessible compressed natural gas (CNG) fuelling stations on the core TEN-T road network.
- c) Excise duty on compressed natural gas (CNG) is set at a significantly reduced level from the comparable levels that apply to petrol and diesel.
- d) Accelerated capital allowances for gas-propelled vehicles and refuelling equipment.

The Low Emission Vehicle Taskforce is also considering further potential policies and measures to support the uptake of low emission vehicles.

As regards electrification of transport, Ireland's recently published set of strategic overarching policy documents encompassing the National Planning Framework and the National Development Plan, Project Ireland 2040, contains a series of relevant measures. These include delivering the key rail projects set out in the Transport Strategy for the Greater Dublin Area, including Metro Link, DART expansion and the Luas green line link to Metro Link.

iv. Where applicable, national policies, timelines and measures planned to phase out energy subsidies, in particular for fossil fuels

Carbon Tax

The Irish Government's 2010 Finance Bill introduced a carbon tax which is applied to mineral oils, natural gas and solid fuels supplied for combustion in Ireland. Since 1st May 2012, the tax for natural gas has been increased from €15 to €20 per tonne of carbon dioxide (CO₂) emitted. The rate of tax on solid fuels from 1st May 2013 to 30th April 2014 was based on a rate of €10 per tonne of CO₂ emitted by the fuel. The rate increased to €20 per tonne with effect from 1st May 2014. Carbon tax imposition has been part of an environmental tax reform agenda in line with the polluter-pays principle; carbon tax has collected over €2 billion in revenue since it was introduced in 2010. Carbon tax is equivalent to 2.2 percent of income tax receipts in 2015 (€18.4bn). There is scope to increase this and use the money to reduce other taxes. Increasing the price of carbon by €5 would yield over €100m per annum. This would add about one percent to the price of diesel and petrol. Measures to increase carbon taxes will be part of an ongoing review into the medium-term.

Carbon Prices

Significant revision to the EU Emissions Trading Scheme, to commence in Phase IV in 2021, is likely to result in a strong inflationary effect on the ETS carbon price. As the EU ETS carbon price rises, it is anticipated that Irish carbon tax levels on the non-ETS sectors will also rise so as to avoid distortionary impacts resulting from different carbon prices applying to different sectors.

Indirect Carbon Costs

ETS installations in Ireland are currently not permitted to recoup indirect carbon costs associated with electricity and gas expenditures that already bear carbon tax incidence. This discretionary aspect of EU ETS is subject to review by the Irish Department of Finance.

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3.2. Dimension energy efficiency

Planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2, including planned measures and instruments (also of a financial nature) to promote the energy performance of buildings, in particular with regard to the following:

Ireland's 4th National Energy Efficiency Action Plan (2017), National Mitigation Plan (2017) and Long Term Renovation Strategy (2017) set out the policies, measures and programmes that Ireland is already undertaking, developing and considering to achieve energy efficiency and climate objectives.

Ireland's further commitment for 2030 will be to intensify effort and investment aiming for Ireland to deliver a 24.7% [39377 GWh] (NECP 2) /25.1% NECP 4 efficiency by 2030. This new indicative national energy efficiency contribution for 2030 represents a substantial intensification over and above the substantial scale of effort already in place (and projected to deliver 16% energy efficiency improvement by end 2020).

The 24.7% / 25.1% target for energy efficiency to be pursued in Ireland is based on the continuation of measures already in place, upscaling and adding to those measures based on the approach and level of investment set out in the National Development Plan approved by Government.

This level of achievement will be a significant challenge for Ireland. In the built environment it will require a doubling of the number of home upgrades as well as the deepening of the scale of those works so that home upgrades are "deep retrofits" delivering a larger efficiency impact. This would equate to an approximate quadrupling of the scale of effort on home retrofits (doubling of numbers and approximately doubling the depth of works). There will also be a renewed focus on further energy efficiency gains in the commercial and public sectors.

The scale of the challenge should not be underestimated. Achieving it will require a very significant scaling up of effort, capacity, investment and engagement including:

- Growing appetite and engagement among homeowners to undertake home upgrades on the scale and to the depth envisaged;
- The making available by Government of substantially more grant funding to leverage the effort and investment required to deliver retrofit on the scale envisaged to over the period 2021-2030.

- Galvanising more commercial decision makers to act on improving energy efficiency.

Progress monitoring will take place to manage the achievement of the target. It is envisaged that further measures may need to be identified and brought on stream to help ensure the target can be met. The groundwork for the upscaling and potential additional measures is already being laid through initiatives such as the piloting, research and capacity building initiatives. Some of these initiatives are outlined in this document and further information will be provided in the new Long Term Renovation Strategy.

(i) Energy efficiency obligation schemes and alternative policy measures under Articles 7a and 7b and Article 20(6) of Directive 2012/27/EU and to be prepared in accordance with Annex III to this Regulation

Ireland has chosen to deliver the energy savings required by Article 7 of the EED through a combination of an obligation scheme on energy suppliers and distributors and a range of Alternative measures. These range from fiscal incentives to regulatory requirements to directly funded energy efficiency programmes.

- Energy Efficiency Obligation Scheme

Since 2014, as part of the implementation of the EU Energy Efficiency Directive, energy suppliers above a certain threshold are obligated to deliver annual energy savings to consumers across the residential and commercial sectors.

Alternative Measures:

- SME programme

The SEAI provides advice and training for SMEs on energy management, particularly in areas such as lighting, heating and cooling. SEAI have developed two pilot schemes targeting SME energy efficiency, a Dairy Farm pilot and a Smart lighting pilot. The pilots together with input from stakeholder consultation will inform the development of further measures to encourage, support and deliver further energy efficiency gains in the SME sector.

- Large Industry Energy Network (LIEN)

This is a voluntary network of the largest commercial energy users, facilitated by the SEAI, through which companies share knowledge and best practice on energy management and

energy cost reduction. The network focuses on structured energy management and exploring new opportunities to improve energy efficiency including through its working groups.

- **Building Regulations**

Part L of Ireland's building regulations which deal with Conservation of Fuel and Energy in Buildings, limit the energy use and carbon dioxide emissions from a building as far as is practicable and requires an energy performance and carbon dioxide emissions performance that is 60% better than the 2005 regulations. The Energy Performance of Buildings Directive requires that all new buildings (public and private) are NZEB by 2020. It also requires that new buildings owned and occupied by public authorities are of NZEB standard after 2018.

- **Energy Efficient Boiler Replacement Regulation**
Regulation relating to the replacement of boilers to ensure energy efficiency.

- **Accelerated Capital Allowances for energy efficient equipment**

To promote the use of the most energy efficient products, equipment and technologies, an ACA scheme is in place for the purchase of energy efficient equipment in the workplace. Companies are offered a tax incentive to purchase highly energy efficient equipment thus helping to improve their energy efficiency and deliver emissions reductions.

- **Home Renovation Incentive**

The Home Renovation Incentive (HRI) is a relief from Income Tax for homeowners, landlords and local authority tenants. The HRI Tax Credit can be claimed for repairs, renovations and improvements including improvements that deliver energy efficiencies to homes and/or rental properties.

- **Carbon tax**

Outside of the ETS, a national carbon tax, currently set at €20 per tonne of CO₂ emitted, was introduced on a phased basis from 2009. A clear indication has been given in Ireland's National Mitigation Plan that Government is committed to carbon pricing as a core element of the suite of policy measures to address and reduce greenhouse gas emissions and promote further energy efficiency over time.

- Smart Meters

To facilitate improved energy efficiency by empowering consumers with more detailed, accurate and timely information regarding their energy consumption and costs – empowering them to reduce consumption, spend and emissions.

- (ii) Long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private⁵⁹, including policies, measures and actions to stimulate cost-effective deep renovation and policies and actions to target the worst performing segments of the national building stock, in accordance with Article 2a of Directive 2010/31/EU

To date Ireland has published 2 long term renovation strategies:

- Better Buildings: A National Renovation Strategy (2014)
- Ireland's 2nd Long Term Renovation Strategy (2017)⁶⁰

The 2nd Long Term Renovation Strategy consists of chapters on each of the three sectors of the Built Environment; residential, commercial and public.

The main focus of this document is on outlining the measures underway in each sector and how they fit into a forward looking, strategic, framework that is focused on 2 things:

- maximising progress to Ireland's 2020 target of an improvement in energy efficiency of 20%
- Preparing for the step change in effort, and depth of measures, required of the period 2021-30 while maximising the impacts of cost effectiveness of available government funding and regulatory action.

The next Long Term Renovation Strategy is in planning to meet the finalisation date set in the EPBD of March 2020.

⁵⁹ In accordance with Article 2a of Directive 2010/31/EU

⁶⁰ <https://www.dccae.gov.ie/documents/20170412%20LTRS.pdf>

- (iii) Description of policy and measures to promote energy services in the public sector and measures to remove regulatory and non-regulatory barriers that impede the uptake of energy performance contracting and other energy efficiency service models⁶¹

To emphasise its leadership role the Irish Government set a more ambitious energy efficiency target for the Public Sector – a 33% efficiency improvement by end 2020. In January 2017 Ireland's first Public Sector Energy Efficiency Strategy was published and public sector bodies have been mandated to implement its provisions.

The Strategy aims to support the public sector in achieving the 33% target which based on current projections would deliver c.4,446 GWh of primary energy savings by 2020.

By end 2017 the public sector had achieved a 24% energy efficiency improvement. This equates to 3,220 GWh in primary energy savings and an annual carbon emissions reduction of c.667,000 tonnes.

The new strategy puts in place a governance framework which will enable the sector to better manage the achievement of the 33% target by 2020. The strategy also identifies specific approaches to achieve the objective, including energy management and procurement. It is underpinned by guidance and supports available to public sector organisations through SEAI, and other key partners such as the Office of Public Works.

The strategy also provides that a further strategy – focusing on the period to the next milestone - 2030 will be developed during 2019 for publication in 2020. This process will entail the setting of a new efficiency target for the sector for 2030.

- (iv) Other planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2 (for example measures to promote the exemplary role of public buildings and energy-efficient public procurement, measures to promote energy audits and energy management systems⁶², consumer information and training measures⁶³, and other measures to promote energy efficiency⁶⁴)

⁶¹ In accordance with Article 18 of Directive 2012/27/EU

⁶² In accordance with Article 8 of Directive 2012/27/EU.

Ireland has a comprehensive set of measures already in place to achieve the 2020 energy efficiency target of 20%. These have been set out in Ireland's 4th National Energy Efficiency Action Plan which covers:

- The progress made by (2017) towards the 2020 targets
- The strategies and measures in place to deliver further on the 2020 target across the residential, commercial, transport and public sectors.

The additional scale of efficiency gain Ireland is now undertaking as its contribution to the EU 2030 target comprises a multi focus strategy. It will focus on new build to high standards, a quantum step up of the scale and depth of building renovation and an intensification of effort in the commercial and public sectors to deliver further energy efficiencies.

Building on the measures set out in the 2017 NEEAP this NECP adds new initiatives, scales up existing ones and further develops support measures. Key additional and expanded feature include:

- Scaling up from the current level of c.25,000 low to medium scale home retrofits to 45,000 deep retrofits per year from 2020 (informed by the Deep Renovation and Warmth & Wellbeing Pilot schemes currently underway).
- Major renovation upgrade requirement to bring the rest of a dwelling up to a minimum energy efficiency standard where a building is undergoing a major (>25% of building surface area) renovation
- Scale up efforts to improve energy efficiency in the commercial sector
 - by expanding the EXEED programme
 - Using the Article 8 Audit obligation to encourage more efficiency improvement
 - Tapping into more of the energy efficiency potential in the SME sector.
- Expanding the Energy Efficiency Obligation Scheme
- Setting a new higher energy target for the public sector and underpinning this with a further strategy.

Ireland's National Development Plan 2018-2027 sets out 3 main high level objectives for energy efficiency in the built environment. These objectives as well as the measures currently in place to achieve them are set out below:

⁶³ In accordance with Articles 12 and 17 of Directive 2012/27/EU
⁶⁴ In accordance with Article 19 of Directive 2012/27/EU.

Investment in energy efficiency, with upgrades to homes increasing to 45,000 per annum from 2021 to achieve a minimum BER Rating 'B.'

Regulatory/Enabling and support measures

The measures outlined below play important roles in supporting and enabling the achievement of energy efficiency outcomes which are captured elsewhere. For example the impact of the work of the Behavioural Economics unit will be captured in the outcomes of home renovations etc.

- Building Regulations for major renovations
- Energy Efficiency Obligation scheme – 25% of required energy savings to be delivered in residential sector (3.2.i))
- Home Renovation Incentive (3.2.i)
- Carbon Tax(3.2.i)
- Smart Meters (3.2.i)
- Behavioural Economics Unit: Recognising that individual behaviour change is fundamental to achieving our energy efficiency and climate goals and that decisions people take about energy use are influenced by emotions and perspectives as well as logic, Ireland established a new Behavioural Economics Unit (BEU) in 2017. The BEU is based in SEAI, our Energy Agency. It will contribute to the achievement of Irelands energy and climate goals by
 - providing advice on how best to frame energy & climate messages to improve uptake by key decision makers.
 - Informing future engagement with individuals and communities to encourage sustainable energy behaviour, in homes, businesses, transport and purchases.
 - Undertaking research to test the relative merits and effectiveness of different approaches in changing energy behaviours and decisions. The Unit recently published a report “Changing Energy Behaviour – What works?” looking at international approaches and pointing to options for further exploration in Ireland.

Enhanced Building Energy Rating certificate (planned)

More consumer-friendly BER documentation designed to more effectively promote improved energy efficient outcomes will be introduced not later than early 2019. BER certificates are required at the sale/purchase of a property. These reports will guide householders in understanding the results of their BER and acting on them, providing more focused and clearer tailored information on specific measures they can take in the property and likely costs. The new BER documentation will also

feature the emissions levels associated with the dwelling more prominently to help raise awareness of these emissions and how they could be managed.

- Regulation of minimum thermal efficiency for rental properties (under consideration)
- The schemes set out under v. below

Investments in energy efficiency of existing commercial and public building stock with a target of all public buildings and at least one-third of total commercial premises upgraded to BER Rating 'B'

Public Sector

Ireland's approach to energy efficiency in the public sector is set out in the Public Sector Energy Efficiency Strategy (see above.)

Commercial & Industrial Sectors

The key initiatives to achieve further energy efficiency in the commercial & industrial sectors are outlined below. They comprise a focus on large energy users, encouraging businesses to consider energy from design stage of a project, encouraging enterprises to invest in energy efficiency fabric or equipment upgrades.

- Large Industry Energy Network

This is a voluntary network of the largest commercial energy users, facilitated by the SEAI, through which companies share knowledge and best practice on energy management and energy cost reduction.

- EXEED Initiative

The Excellence in Energy Efficient Design (EXEED) initiative is a support programme funded by DCCAE and operated by SEAI. Focusing on lifecycle energy performance in the industrial, commercial and public sectors, it works by using grant offers to engage business or organisation to look at projects from the design stage so they consider the most efficient process when commissioning or designing a new project, process or asset. Energy saving impacts monitored to date show an average achievement of 28% improvement over baseline energy use. EXEED is applicable to any sector or organisation, to projects of any scale or complexity. Besides the energy and climate impacts EXEED is assisting businesses to become more efficient competitive and resilient. The EXEED programme is

being scaled up from 2018 and is expected to deliver significant energy efficiency gains in the commercial sector over the coming decade.

- Energy Audits for Large Energy Users

As part of the implementation of the EU Energy Efficiency Directive, in 2015 a requirement was placed on large energy users in the commercial and public sectors to undertake energy audits. This mandatory requirement, which applies to non SME enterprises (over certain employee and financial thresholds), is supported by advisory measures. As part of the further development of this initiative SEAI will work with key stakeholders to explore how the audit obligation can be leveraged to encourage more enterprises to improve their energy efficiency and how some of the resulting gain can be measured.

- SME support programme

The SEAI provides advice and training for SMEs on energy management, particularly in areas such as lighting, heating and cooling. Lighting upgrades for SMEs and equipment upgrades in the agricultural sector have been piloted and the sector has been consulted to inform development of measures targeting the SME sector for the period from 2020.

- Heating and Air Conditioning inspections

Supports for changing out oil-fired boilers to heat pumps, along with the provision of roof solar, in at least 170,000 homes

Regulatory/enabling measures

- Building regulations for major renovations in dwellings
- Energy Efficiency Obligation scheme – obligated parties can assist homeowners to install heat pumps or roof solar

Funding support measures

- Better Energy Homes – grant available for heat pumps and solar thermal
- Deep Retrofit pilot – funding installation of heat pumps, solar thermal and solar PV
- Better Energy Communities – funding installation of heat pumps, solar thermal and solar PV

- Solar PV scheme – funding installation of solar PV

The NDP also makes commitments in the area of transport efficiency.

- v. Where applicable, a description of policies and measures to promote the role of local energy communities in contributing to the implementation of policies and measures in points i, ii, iii and iv

Better Energy Communities grant scheme

The BEC scheme encourages and supports community based partnerships to improve the thermal and electrical efficiency of the building stock and energy poor homes and facilities, encouraging the implementation of deeper and more technically and economically challenging measures. These partnerships can be between the public and private sectors, domestic and non-domestic sectors, commercial and not-for-profit organisations and energy suppliers. The community and business supports leverage considerable additional private investment.

Sustainable Energy Communities network

The Sustainable Energy Communities network works with groups from all around Ireland to build their technical and project management skills. The starting point is energy efficiency, but the next step can be renewable energy generation within communities, which forms another link between the sectoral mitigation measures for the Built Environment sector and those for Electricity Generation sector.

- vi. Description of measures to develop measures to utilise energy efficiency potentials of gas and electricity infrastructure⁶⁵

- Energy Efficiency in Electricity Transmission and Distribution
- Energy Efficiency in Power Generation
- DS3 System Services
- Cost Effective Energy Efficiency Improvements in Electricity Infrastructure

- vii. Regional cooperation in this area, where applicable

Ireland participates actively in Concerted Action on the Energy Efficiency Directive. This facilitates improved energy efficiency outcomes by enabling enhancement of measures and approaches.

⁶⁵

In accordance with Article 15(2) of Directive 2012/27/EU

viii. Financing measures, including Union support and the use of Union funds, in the area at national level

Funding Support Measures

○ *Better Energy Homes (BEH)*

The BEH scheme provides grant aid to private homeowners who wish to improve the energy performance of their home. Fixed grants are provided towards the cost of a range of measures including attic insulation, wall insulation, heating systems upgrades, solar thermal panels and accompanying BER.

○ *Better Energy Warmer Homes (BEWH)*

The BEWH scheme funds energy efficiency improvements in the homes of the elderly and vulnerable, making the homes more comfortable, healthier and more cost-effective to run.

○ *Warmth and Wellbeing Pilot Scheme*

This pilot scheme is providing energy efficiency improvements to the homes of older people and children suffering from chronic respiratory conditions. This is a joint policy initiative between DCCAE and the Department of Health and delivered by the SEAI and the HSE.

○ *Deep Retrofit Pilot Programme*

This pilot scheme was launched by SEAI in 2017 to establish how best to support deeper levels of renovation in the residential sector, with a view to gaining practical experience of how to develop a residential energy efficiency offering post-2020.

○ *Social Housing Upgrades*

Energy efficiency upgrades are undertaken by local authorities to social housing stock funded by DHPLG.

○ *Better Energy Communities*

The BEC scheme encourages and supports community based partnerships to improve the thermal and electrical efficiency of the building stock and energy poor homes and facilities, encouraging the implementation of deeper and more technically and economically challenging measures. These partnerships can be between the public and private sectors, domestic and non-domestic sectors,

commercial and not-for-profit organisations and energy suppliers. The community and business supports leverage considerable additional private investment.

o Sustainable Energy Communities network

The Sustainable Energy Communities network works with groups from all around Ireland to build their technical and project management skills. The starting point is energy efficiency, but the next step can be renewable energy generation within communities, which forms another link between the sectoral mitigation measures for the Built Environment sector and those for Electricity Generation sector.

See also the various programmes under the Commercial and Industrial sector above. The measures detailed above which are operated by SEAI are funded by DCCAE. These include grants to homeowners and businesses for energy efficiency measures. Grants for the purchase of electric vehicles and electric vehicle charging equipment are also available. The Better Energy Warmer Homes is co-funded by ERDF funding.

3.3. Dimension energy security⁶⁶

i. Policies and measures related to the elements set out in point 2.3⁶⁷

Policies and measures for gas and electricity

The policies and measures are in line with those in Ireland's National Energy Policy Paper⁶⁸ and Programme for Government⁶⁹, and include:

- in the context of decarbonisation, maintain Ireland's resilience to a long-duration gas supply disruption,
- identify options to enhance Ireland's security of gas supply, including the potential for and gas storage,
- Support efforts to increase indigenous renewable sources in the energy mix, including wind, solar and biomass.
- Continue to examine the role that Carbon Capture and Storage technology could have, given the high level of natural gas in the energy mix, both for electricity generation and as back-up for intermittent renewables technologies
- Develop, maintain and upgrade the electricity and gas networks to ensure that our energy system remains safe, secure and ready to meet increased demand
- Facilitate infrastructure projects, including private sector commercial projects, which enhance Ireland's gas security of supply including improving import route diversity and the resilience of the network
- Actively participate in EU Project of Common Interest (PCI) process
- Facilitate the implementation of Ireland's EU designated gas and electricity PCIs

Policies and Measures – Oil Security

Ireland's oil emergency management takes place within the framework of Ireland's membership of the European Union (Directive 2009/119/EC) and the International Energy Agency (IEA). Ireland holds 90 days of a strategic oil reserve, to be used in the event of a supply disruption. The National Oil Reserves Agency (NORA) is Ireland's Central Stockholding Entity (CSE), responsible for acquiring and managing Ireland's strategic oil reserve. NORA is funded by a Government levy of 2 cents per

⁶⁶ Policies and measures shall reflect the energy efficiency first principle.

⁶⁷ Consistency shall be ensured with the preventive action and emergency plans under Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010 (OJ L 280, 28.10.2017, p. 1) as well as the risk preparedness plans under Regulation (EU) 2018/... [as proposed by COM(2016) 862 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC].

⁶⁸ Ireland's Transition to a Low Carbon Energy Future 2015-2030

⁶⁹ A Programme For A Partnership Government, May 2016

litre on oil disposals. At the end of 2017, NORA held approximately 68% of its stocks on the island of Ireland, with the remaining 32% of stocks held abroad.

In the event of an oil supply disruption, the Department will liaise with NORA and the oil industry on the evolving situation. Where a stock release is warranted, a recommendation is made to the Minister for Communications, Climate Action and Environment by Departmental officials. The Minister informs his cabinet colleagues of his decision and instructs NORA to release stocks, specifying the product categories, volumes and location from which the stocks are to be released. NORA has a Stock Drawdown Plan in place to deal with such a situation. NORA has also Memoranda of Agreement with five shipping companies that considerably strengthen the Agency's ability to ship products from storage locations at home and abroad to where it is needed in the event of a shortage of supply.

In the case of a domestic issue requiring stock drawdown, the Department would inform the EU /IEA of its actions and make arrangements with NORA on the replenishment of stocks. In the case of collective EU or IEA action, stocks would be released in accordance with agreed procedures.

The Department is currently developing the Oil Emergency Allocation Plan (OEAP) to enable the allocation of oil to ensure the continuation of societal functioning in a scenario where oil availability is limited. The Plan provides for the allocation of petroleum fuels and in combination with Ireland's strategic oil reserve, forms the basis of the Government's response to a prolonged fuel supply disruption within the state. The Plan is modular in nature, consisting of a number of schemes, which, if required, may be enacted in their entirety, depending on the extent and duration of the emergency and the fuel type(s) in short supply. Quantities of fuel allocated to various fuel users may also be varied during the lifetime of the plan, based on the level of fuel stocks at the Minister's disposal.

The Department works closely with NORA and the Irish oil industry (through IPIA – the Irish Petroleum Industry Association) on the development of oil emergency management policies and procedures. NORA updates its stock drawdown procedure at least annually. A number of cross sectoral oil emergency exercises have been held, involving the other Government Departments, NORA, and the IPIA, with the most recent being in November 2018. These are scenario based and explore the impacts of an oil emergency across all sectors, with an emphasis on a whole of government level response, taking into account the extent of the supply deficit in the market.

ii. Regional cooperation in this area

- Implement the requirements of EU regulation 2017/1938 (Measures to safeguard security of gas supply) including risk assessments, preventative action plans, emergency plans, and solidarity. The Commission for Regulation of Utilities is the designated competent authority for this regulation.
- Implement the requirements of EU regulation on Risk Preparedness in the Electricity Sector (when it comes into force). This regulation will provide for Member States cooperation on common methods for assessing risks and establish a framework for a more systematic monitoring of security of supply issues.
- Continue strong regional cooperation with the UK on emergency preparedness and response for gas and electricity including solidarity in an emergency situation
- Participate in EU fora for gas, electricity and oil security of supply
- Cooperation with the Department of the Economy in Northern Ireland on the all-island dimensions of oil security, in particular around the utilisation of import infrastructure on an island wide basis, in the event of a disruption to the capacity to move product through an oil terminal

iii. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

Connecting Europe Facility (CEF) funding

Avail of EU Connecting Europe Facility (CEF) funding and other EU funding support, without which projects would not be completed. The Connecting Europe Facility (CEF), established under Regulation (EU) No. 1316/2013, is a key EU funding instrument for targeted infrastructure investment at European level. Its aim is to accelerate investment in the field of trans-European networks, supporting the development of high performing, sustainable and efficiently interconnected networks in the fields of transport, energy and digital services. EU energy Projects of Common Interest (PCIs) are eligible to apply for CEF funding for works or studies, providing they satisfy certain criteria set out in both the PCI and CEF Regulations. While a PCI is eligible for funding under CEF, it is not guaranteed. In general, projects that are commercially viable would not receive funding under CEF. CEF funding is only allowable for a maximum of 50% of the project costs, if recommended.

European Investment Bank (EIB)

Avail of EIB funding opportunities to support projects. The European Investment Bank (EIB) offers financial support to projects through innovative financial instruments such as guarantees and project bonds. These instruments create significant leverage in their use of EU budget and act as a catalyst to attract further funding from the private sector and other public sector actors.

EU Funding – Connecting Europe Facility (Electricity)

As set out in the gas section above, Ireland has benefited significantly from the availability of CEF funding for projects. Two Electricity Projects of Common Interest have received CEF funding:

- “Greenlink” an interconnector project proposed by Element Power to run from Great Island to Pembroke in Wales initially received €809k to conduct feasibility studies but has received an additional grant allocation of €4.8m in 2018.
- “Celtic Interconnector” an electricity IC between Ireland and France being developed by EirGrid/RTÉ (Réseau de Transport, d’Électricité) received €7.9m of CEF funding to conduct feasibility studies

PCI	CEF Funding Recommended
Works – Gas Networks Ireland twinning of gas pipeline at Moffat – [project to twin the 50 km single section of onshore transmission pipe between Cluden and Brighthouse Bay, Scotland). CRU approved matched funding.	€33,764,185
Study - Gas Networks Ireland’s Physical Reverse Flow (PRF) project at Moffat	€925,000

Table 26: EU Funding – Connecting Europe Facility (gas)

3.4. Dimension internal energy market⁷⁰

3.4.1. Electricity infrastructure

i. Policies and measures to achieve the targeted level of interconnectivity as set out in point (d) of Article 4

Ireland has a 7.4% electricity interconnection level having already developed interconnectors with the UK – a north-south interconnector with Northern Ireland and an East-West Interconnector with Wales. When the UK leaves the EU, Ireland will have no direct electrical interconnection with the rest of the EU.

2015 Energy White Paper

Ireland's high level policy position on interconnection, as outlined in the Energy White Paper published in December 2015, emphasises the important role of interconnection in the transition to a low carbon energy future. For example, in its outline of "measures to maintain and enhance energy security" the White Paper commits the Department to "promoting and facilitating interconnection with other countries and regions."

Ireland's peripheral location at the north-western edge of mainland Europe presents obvious challenges to interconnection, not least in the area of costs, yet may also highlight the desirability of interconnection, particularly in the context of security and diversification of electricity supply.

Electricity Interconnection – National Policy Statement published⁷¹

With a number of forthcoming interconnection proposals allied to strong national and EU policy backing, a new national policy statement on electricity interconnection in Ireland was published in July 2018. This policy statement lays out the official policy position on electricity interconnection. It outlines the many drivers and benefits of interconnection, as well as the potential impacts electricity interconnection may have on the wider energy market. It will help to guide potential developers in better understanding the range of national policy drivers and the CRU (Ireland's energy regulator) in determining its regulatory approach to electricity interconnection, by drawing attention to key policy parameters for consideration in its evaluation of interconnection applications from project promoters. At present, the CRU is considering two interconnector applications, one from Element

⁷⁰Policies and measures shall reflect the energy efficiency first principle.

⁷¹<https://www.dccae.gov.ie/en->

[ie/energy/publications/Documents/19/National%20Policy%20Statement%20on%20Electricity%20Interconnection.pdf](https://www.dccae.gov.ie/en-energy/publications/Documents/19/National%20Policy%20Statement%20on%20Electricity%20Interconnection.pdf)

Power for the Greenlink Interconnector proposing a link to Wales and another from Ireland's TSO, EirGrid, for the Celtic Interconnector proposing a link to France.

Regulatory Policy for Electricity Interconnectors

In August 2016 the CRU commenced the process of devising a Regulatory Policy for Electricity Interconnectors with the publication of a paper "Policy for Electricity Interconnectors" (CER/16/239) requesting submissions detailing what matters should be considered in developing a regulatory policy for electricity interconnectors.

In October 2017 CRU wrote to Eirgrid⁷² directing them to process grid connection applications from Electricity Interconnector promoters with PCI status. In that note CRU reaffirmed its commitment to progress Electricity Interconnector applications.

CRU published a consultation paper on the Greenlink application and its planned approach to evaluating the application in June 2018. CRU then published a consultation on the evidence base details (regulatory and specifics) in July 2018. The next stage of the regulatory policy framework was the publication by CRU in September 2018 of its decision paper on Assessment Criteria for IC Applications. Subsequently in October 2018 CRU published its decision on Greenlink application for Cap and Floor treatment. This stage was the public interest test and has been passed.

Both the National Policy Statement and the CRU's own regulatory process are facilitating the evaluation of the two interconnector applications – Greenlink and Celtic - during 2018-2019.

ii. Regional cooperation in this area⁷³

North Seas Energy Cooperation (NSEC)

The North Seas Energy Cooperation aims to facilitate the further cost-effective deployment of offshore renewable energy with the aim of ensuring a sustainable, secure and affordable energy supply in the North Seas countries, thereby also facilitating further interconnection, further integration and increased efficiency of wholesale electricity markets in the longer term.

Ireland works together with the other North Seas Energy Cooperation countries on the possibilities for concrete cooperation projects. Besides joint offshore wind projects that would be connected to

⁷² <https://www.cru.ie/wp-content/uploads/2017/10/CRU17299-Information-Note-Direction-to-EirGrid-on-Grid-Connection-for-Electricity-IC-with-PCI-status.pdf>

⁷³ Other than the PCI Regional Groups established under Regulation (EU) No 347/2013

and supported by several Member States, this includes the work on possible 'hybrid' solutions that would use a grid connection cable for evacuating offshore wind as well as interconnection capacity between countries, and on the corresponding market arrangements.

A regional study is being developed looking at the possibilities for cooperation on hybrid projects and identifying and addressing possible legal, regulatory and commercial barriers. Further work is planned on synergies between offshore wind and offshore oil and gas installations.

By coordinating on increased interconnection among the countries in the North Seas Energy Cooperation, an increasing amount of excess production of energy could flow across borders in a well-functioning internal energy market.

The NSEC overall aims to reduce the costs of renewable energy and grid development and remove barriers to investment, thereby contributing to achieving climate goals and the EU-wide renewable energy 2030 target. Moreover, it strengthens security of supply and supports the EU's long term competitiveness and energy market integration.

The Irish-Scottish Links on Energy Study⁷⁴

Ireland was a partner in the Irish-Scottish Links on Energy Study (ISLES), a major initiative designed to enable the development of interconnected grid networks to enhance the integration of marine renewable energy between Scotland, Northern Ireland and Ireland. DCCAE is the lead administrative partner for ISLES in collaboration with the Scottish Government and the Department of the Economy in Northern Ireland.

The objective of the study was to investigate the feasibility of an offshore interconnected grid, and identify steps to reducing barriers to delivering this grid. The first phase of this project - ISLES I - was completed between 2010 and 2012 and produced a feasibility study. The second phase - ISLES II - was completed in June 2015 and comprised three research streams:

- Spatial Plan and Sustainability Appraisal
- Network Regulation and Market Alignment Study, and
- Business Plan

⁷⁴ <http://www.islesproject.eu/>

The project was part financed under the European Union's INTERREG IVA Programme for Northern Ireland, the Border Region of Ireland and Western Scotland with the partners providing the match-funding.

British Irish Council – Energy Work Sector

Ireland is a central contributor to the British-Irish Council (BIC) Energy Working Group. This Work Sector was established in 2009 and was previously divided into two sub-groups, considering Marine Energy resources and Electricity Grid issues. In 2016 these two sub-groups came together in one group with a joint focus on marine and grid issues. The role of the Energy Work Sector is to provide a forum for discussion and collaborative working on cross-border issues in relation to electricity infrastructure. In 2017 Ireland led discussions of the Work Sector in the area of electricity interconnection in particular and the Work Sector has been an important contributor to the ISLES project also. June 2016 saw Scotland host an energy Ministerial where Ministers signed off on an ambitious programme of work focused on the grid and marine areas but also extended to include some other topics for cooperation such as community energy.

iii. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

The ISLES project was part financed under the European Union's INTERREG IVA Programme for Northern Ireland, the Border Region of Ireland and Western Scotland with the partners providing the match-funding.

3.4.2. Energy transmission infrastructure

i. Policies and measures related to the elements set out in point 2.4.2, including, where applicable, specific measures to enable the delivery of Projects of Common Interest (PCIs) and other key infrastructure projects

Government Policy Statement on the Strategic Importance of Transmission and Other Energy Infrastructure⁷⁵

In July 2012, the government produced a policy statement on the Strategic Importance of Transmission and other Energy Infrastructure. This statement reaffirmed the need for the development and renewal of energy networks to meet economic and social goals.

⁷⁵

[http://www.pleanala.ie/misc/PCI/PCI1/DAF2/2.0%20Missing%20Information/3.0%20Requested%20Reference%20Docs/2.0%20DCENR%20%20\(2013\)%20Govt%20Policy%20Statement%20%20Strategic%20Importance%20of%20%20Energy%20Infrastructure.pdf](http://www.pleanala.ie/misc/PCI/PCI1/DAF2/2.0%20Missing%20Information/3.0%20Requested%20Reference%20Docs/2.0%20DCENR%20%20(2013)%20Govt%20Policy%20Statement%20%20Strategic%20Importance%20of%20%20Energy%20Infrastructure.pdf)

It stated that the planning process provides the necessary framework for ensuring that all necessary standards are met and that comprehensive statutory and non-statutory consultation is built into the process. It confirmed that Government “endorses, supports and promotes the strategic programmes of the energy infrastructure providers.”

Compliance with Trans-European Energy Infrastructure Regulation

Ireland is compliant with EU Regulation 347/2013 which promotes the development of trans-European energy infrastructure. Under Article 8 of the regulation, DCCAE has designated Ireland’s planning authority, An Bord Pleanála, as the competent authority responsible for facilitating and coordinating the permit granting process for projects of common interest.

An Bord Pleanála was designated Competent Authority for the purposes of Article 8.3(c) of Regulation 347/2013. An Bord Pleanála is carrying out this role in accordance with the requirements of 347/2013 for a streamlined permit granting procedure. The competent authority, in consultation with other consenting authorities, sets the time limits in accordance with Article 10 of the Regulation on which individual decisions shall be issued for a project of common interest.

EU Regulation 347/2013 lays down rules for the timely development and trans-European energy projects in order to achieve the energy policy objectives of the EU. The Energy Infrastructure Regulation contains guidelines for the identification of projects known as Projects of Common Interest (PCI). The PCI designation carries certain conditions and entitlements, including more streamlined planning and regulatory processes at Member State level. The regulation facilitates the timely implementation of projects of common interest by streamlining, coordinating more closely and accelerating permit granting processes and by enhancing public participation.

Ireland has been fully supportive of the EU initiative for trans-European energy infrastructure Projects of Common Interest and has successfully supported a number of gas and electricity infrastructure projects. One such gas PCI is a project currently underway by Gas Networks Ireland to twin the remaining 50km onshore pipeline in Scotland, part of the gas interconnector with Scotland. This project which is due for completion by the end of 2018 will further increase the resilience of the network.

TSO Public Engagement

In discharging its duties as operator and developer of the national transmission grid, EirGrid engages with communities and citizens on an ongoing basis.

In December 2014 it completed a comprehensive review of its existing consultation process and has been working since then to implement the commitments arising from the review. EirGrid subsequently produced a new project development and consultation roadmap. This is in the form of a six-step process with the public central to each step.

ii. Regional cooperation in this area⁷⁶

In the context of the delivery of Ireland's three main interconnector proposals – North-South and Greenlink with the UK and Celtic with France - have seen Ireland cooperating productively with authorities in the UK and France on an ongoing basis. As an example of this cooperation, the French Ministry hosted a delegation from DCCAE in April 2018 to discuss the common approach to the delivery of the Celtic Interconnector.

iii. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

Both the Celtic and Greenlink interconnector have received CEF funding for studies. Greenlink has received a grant of up to €809,000 and Celtic has received two grant awards for approx €3.75m and €4m.

3.4.3. Market integration

i. Policies and measures related to the elements set out in point 2.4.3

As stated in Section 2.4.3 of this document, new rules on the trading of electricity in the SEM were introduced on 1 October 2018. These rules, and in particular the establishment of new day-ahead, intra-day and balancing markets, were introduced to facilitate more efficient trade with other European electricity markets, and ensure Ireland's compliance with current EU energy market legislation, and with the future Clean Energy Package legislation. Legislation was amended in Ireland and Northern Ireland to allow the Regulators make the necessary changes to the electricity market rules. The legislation is contained in sections 7 and 8 of the Energy Act 2016.

As part of the revised market design the Regulatory Authorities have also introduced a new Capacity Remuneration Mechanism (CRM). Capacity Mechanisms are deemed necessary in the all-island (and other) electricity market because of the difficulties of ensuring sufficient revenues for generating plants in energy-only markets. This is especially the case for small, isolated markets with large volumes of intermittent generation, such as the Single Electricity Market.

⁷⁶

Other than the PCI Regional Groups established under Regulation (EU) No 347/2013

Under rules approved by the European Commission in November 2017, a new competitive auction determines the value of capacity in the market, and generators are penalised if they are not available when required. This replaces the previous capacity payments scheme under which all generators received an administratively determined capacity payment and suffered no penalty if not available when required. The new CRM has been developed to deliver a more competitive outcome for customers, as well as complying with State Aid rules on capacity mechanisms. The first capacity auction to take place under the new wholesale market rules was held in December 2017, and resulted in an annual cost of capacity for 2017/2018 of circa €330 million with 93 out of the 100 market units that participated in the auction successful. These results represent a saving of approximately €200 million compared to the annual capacity payment in 2017 of almost €520 million.

The benefits of these new market arrangements include more competitive wholesale electricity prices for consumers through more efficient market trading; efficient dispatch of interconnection to other markets; and increased security of supply for Ireland.

As of October 2018, the Irish wholesale market is therefore directly linked to similar markets across Europe via the rules of the EU Target Model, increasing the efficiency in trade across the two existing interconnectors between the island of Ireland and Great Britain, thereby increasing the potential for renewables penetration and reducing the need for curtailment of wind generation.

Following the successful implementation of the new market in October 2018, the attention of the Government, in cooperation with the National Regulator and TSO, will focus on monitoring the new wholesale market arrangements. This process will include taking any necessary measures to ensure the market continues to function as desired. As regards future policy, it is the objective of Ireland to participate and contribute in the continued development of the EU IEM, and remain coupled with other EU electricity markets to as great an extent as possible.

This will include implementing the *EU Clean Energy For All Europeans package* of legislative reforms when negotiations have been completed. However, it should be noted that the circumstances of the UK withdrawal from the EU may have consequences for Ireland's all-island SEM, and trade between Ireland and Great Britain, and therefore Ireland's immediate ability to remain market coupled. As of December 2018 there remains considerable uncertainty relating to Brexit, the UK's continued membership of the EU Internal Energy Market following March 2019, and how this may impact the SEM, and trade between GB and Ireland across interconnectors. While the November 2018 UK Withdrawal Agreement contains provisions to maintain SEM and trade across interconnectors under

status quo arrangements until at least the end of 2020, this agreement has yet to be ratified by either the UK or European parliaments. Until such ratification takes place, uncertainty will remain as to the impact of Brexit on the Irish electricity system.

ii. Measures to increase the flexibility of the energy system with regard to renewable energy production such as smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, re-dispatching and curtailment, real-time price signals, including the roll-out of intraday market coupling and cross-border balancing markets

Changes to electricity wholesale market trading rules, as required by EU energy legislation, including the future Clean Energy Package (when Trilogue negotiations have been completed) have been designed to facilitate the integration of significant volumes of renewable electricity into the generation mix, as well as creating a more competitive outcome for consumers.

The new market rules seek to generate maximum competition by concentrating trading in the day-ahead and intra-day markets. Those markets are directly linked to similar markets across Europe via the rules of the electricity Target Model. It is anticipated that this will provide efficient and transparent pricing in the short term markets that will also support trading in the forwards, financial markets. A new balancing market, introducing balance responsibility for all market participants, has also been introduced to comply with EU internal market rules.

In addition to the above, system adequacy and flexibility in Ireland will continue to be enhanced through ongoing implementation by the TSO, EirGrid, of the multi-year DS3 programme. The DS3 Programme is designed to ensure that the TSO can securely operate the power system with increasing amounts of variable non-synchronous renewable generation over the coming years. The DS3 Programme is made up of 11 workstreams, which fall under the three pillars of System Performance, System Policies and System Tools, and brings together many different strands, including development of financial incentives for better plant performance, and the development of new operational policies and system tools to use the portfolio to the best of its capabilities.

iii. Where applicable, measures to ensure the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets

As regards non-discriminatory participation of renewables, demand response and storage, national energy policy in Ireland will continue to be framed by adherence to EU legislation, and future implementation of the Clean Energy Package.

As stated in Section 2, under national and EU legislation, renewable generation currently receives priority dispatch in the Irish wholesale electricity market, notwithstanding that there are occasions when system security necessitates TSO curtailment of non-synchronous generation.

As regards Demand Side Units, 500 MW of Demand Side Unit capacity in Ireland cleared the first Capacity Market auction to take place under new rules held in December 2017. This represents double the capacity that had been previously available. Demand Side Units also have non-discriminatory access to wholesale electricity markets in Ireland.

iv. Policies and measures to protect consumers, especially vulnerable and, where applicable, energy poor consumers, and to improve the competitiveness and contestability of the retail energy market

- CRU Energy Engage Code
- CRU Supplier Handbook
- CRU accredited price comparison websites

v. Description of measures to enable and develop demand response including those addressing tariffs to support dynamic pricing⁷⁷

- Smart Meter programme
- TSO Market Facilitation and Capacity Market measures

3.4.4. Energy poverty

i. Where applicable, policies and measures to achieve the objectives set out in point 2.4.4

Ireland's Strategy to Combat Energy Poverty is due to be reviewed in 2019. The objectives of that Strategy expand the reach of existing energy efficiency schemes and commit the Government to developing and piloting new measures to find more effective ways to focus energy efficiency efforts on those most at risk of energy poverty.

⁷⁷ In accordance with Article 15(8) of Directive 2012/27/EU

The actions include:

- Establishing a pilot scheme to test the health benefits of energy efficiency retrofit in an Irish context (Warmth and Wellbeing pilot scheme) (established 2016 for 3 year period, possible expansion afterward)
- Expansion of the efficiency schemes to capture more people who may be at risk of energy poverty (as of 2016 ongoing review of the criteria is underway in conjunction with DEASP)
- A consultation on the implementation of minimum energy efficiency standards for rented properties (consultation 2018, implementation post 2020)
- Ensure that energy markets are working for all consumers (CRU)
- Establish an Energy poverty Advisory Group
- Ensure that all new energy policy measures developed by DCCAE are evidence-based and consider the distributional impact of these policies (ongoing)

Measures that are currently in place:

Housing upgrade measures

- Better Energy Warmer Homes Scheme
- Better Energy Communities
- Energy Efficiency Obligation Scheme
- Warmth and Wellbeing pilot scheme
- Deep Retrofit Pilot Programme
- Local Authority housing upgrade programme
- Housing Assistance for Older People
- Housing Adaptation Grant

Consumer Protection measures

- Energy Engage Code
- Energy Supplier Handbook
- CRU accredited price comparison websites

Fiscal measures

- Household Benefits Package
- Fuel Allowance

3.5. Dimension research, innovation and competitiveness

i. Policies and measures related to the elements set out in point 2.5

Ireland's Energy White Paper for the period 2015 to 2030 (Department of Communications, Climate Action & Environment, 2015) aims to position Ireland as a leading European energy innovation hub to ensure that Irish-based firms benefit from increasing investment in sustainable energy innovation. The paper states that energy research plays an integral part in Ireland's energy policy. A successful research environment will help to develop the tools required for the transition to a sustainable, low carbon environment and to ensure that Ireland is a world leader during the energy transition. The Energy White Paper recognises that Ireland's energy transition will present further opportunities for job creation and economic growth.

The **Energy Research Strategy** (Energy Research Strategy Group, 2016) published by the **Department of Communications, Climate Action & Environment (DCCAE)** states that in order to fully realise the potential of new and emerging technologies, and to develop and demonstrate clean and sustainable energy solutions, further investment into energy research and innovation in Ireland is needed. It recognises that this has major implications for economic development and high quality job growth. The strategy also refers to the importance of sustained funding in order to ensure that companies and research performing organisations invest time and resources in performance of energy RD&D, such that skilled and experienced researchers in the energy domain are developed and retained in Ireland. **Ireland's National Mitigation Plan** (Department of Communications, Climate Action & Environment, 2017) recognises that research, development and innovation will play a key role in achieving Ireland's transition to a low carbon economy and society. **Innovation 2020** (Department of Jobs, Enterprise & Innovation, 2015) recognises energy as one of six enterprise themes which are of particular importance to Ireland and calls for greater use of RDI funding to find solutions to pressing societal challenges in areas such as energy.

The **SEAI Statement of Strategy 2017 to 2021** (Sustainable Energy Authority of Ireland, 2017) outlines how SEAI will support the realisation of its vision for Ireland's energy to be sustainable, secure, affordable and clean through measures and activities focused on the transition to a smarter and more sustainable energy future. In recognition of its importance, the strategy sets energy / low-carbon technology Research & Innovation as one of the SEAI's core strategic priorities. Written in the context of International, European and National policy drivers, and at a time of significant economic and socio-political change, the SEAI Strategy outlines the requirement to address the following key high-level priorities relating to SEAI Research & Innovation activities:

- i. increase funding of R&D projects and test sites with national and international impact;
- ii. enhance Irish engagement in energy/low carbon technology related work programmes associated with Horizon 2020;
- iii. increase delivery of demonstration and innovation projects contributing to enterprise development; and
- iv. increase mapping and co-ordination of Irish energy research, leading to higher impact

There is a shared vision of continuing to develop the Irish energy research, development & demonstration community to one which is considered to be world class. In order to address the current and historic underinvestment in energy RD&D, it is intended to significantly increase the amount of public funding invested in energy RD&D, to instigate new initiatives, expand current activities, develop strategic collaborative partnerships with national & international organisations and further strengthen the capacity of the energy RD&D system in Ireland.

SEAI coordinates and funds a range of research, development & demonstration (RD&D) activities relating to the production, supply & use of energy. The overarching goals of these RD&D activities are to:

- Stimulate and accelerate the development & deployment of energy related products, processes & systems in the Irish marketplace
- Grow Ireland's national capacity to carry out internationally leading RD&D activities
- Support solutions that enable technical & other barriers to market uptake of energy related products, processes & systems to be overcome
- Provide timely guidance & support to policy makers and public bodies through results, outcomes and learning from supported projects

The National Energy RD&D Funding Programme seeks to grow national capacity in energy research such that researchers in academia and industry are well placed to compete for national non-domain specific R&D funding and are in a position to be international thought leaders and actors (through, for example, thought leadership within relevant domains, playing leadership roles in International Energy Agency activities, and leading & participating in international collaborative initiatives such as Horizon 2020). Increased and sustained investment will help to ensure that companies and research performing organisations in Ireland are encouraged and enabled to invest time and resources in

performance of energy RD&D, resulting in skilled and experienced researchers in the energy domain being developed and retained in Ireland.

SEAI's remit in respect of RD&D activities is to coordinate Irish energy research, lead and support excellent research, development, demonstration & innovation activities, to be at the forefront of knowledge generation relevant to the energy sector, and to promote its application in policy and practice. SEAI Research & Innovation funding is invested in projects at the following stages/for the following purposes: applied research, research for practice, research for policy, development, and demonstration projects in the energy domain specifically. SEAI funding is primarily invested in companies, universities, institutes of technology, research institutions, semi state bodies and public bodies.

Climate science aspects of the **Environmental Protection Agency Research Programme** aim to provide:

1. Advanced analysis of GHG emissions and removals, enabling improved policy development and decision making.
2. Research based information in support of risk and vulnerability analysis and adaptation actions in Ireland.
3. Solutions to achieve our 2020 targets and to identify and test solutions for achievement of societal and economic low carbon transformation to 2050.
4. Information on pathways for achievement of highest air quality standards in Ireland and advance integrated assessment of air pollution, short life climate forcers, and other wider environmental issues

Domain agnostic funders of research in Ireland also have an important part to play in the energy & climate research ecosystem in Ireland. Enterprise Ireland, the Irish Research Council and Science Foundation Ireland are part of a network which supports energy & climate research in Ireland - the focus of the Irish Research Council and Science Foundation Ireland is primarily on early stage research, whilst the focus of Enterprise Ireland is primarily on supporting businesses in the manufacturing and internationally traded services sectors.

Research Priority Areas 2018-2023

In March 2018 the Department of Business, Enterprise & innovation published the revised Research Priority Areas 2018-2023 report. Based on developments since 2012, including the increased urgency to address climate change and sustainability challenges, alongside the increased opportunities for enterprise within this wider context, the former Energy research priority theme has evolved to reflect these drivers and is renamed Energy, Climate Action and Sustainability, and the priority areas have been updated to Decarbonising the Energy System and Sustainable Living.

Disruptive Technologies Innovation Fund

The Department of Business, Enterprise and Innovation is spearheading the Government's new €500 million Disruptive Technologies Innovation Fund. This is one of four funds under the National Development Plan 2018-2027. Applications under this fund must align with the aforementioned research priority areas, which include the Energy, Climate Action and Sustainability theme, and "Decarbonising the Energy System" research priority area.

This Fund is about doing something additional on top of existing innovation programmes and exploiting collaborative research to deliver new technologies and new solutions.

The Future Jobs initiative:

The Future Jobs initiative is being developed jointly by the Department of Business, Enterprise and Innovation and the Department of the Taoiseach and is expected to be launched early next year.

Future Jobs will emphasise building resilience through improving productivity especially among Irish SMEs; enhancing skills levels and increasing participation in the labour force; preparedness for, and exploitation of, anticipated transformational changes arising from technological developments and the transition to a low carbon and digital economy.

A motivator for the Future Jobs Initiative is that climate change is having a pervasive impact across all sectors and on how we do business. Increased consumer awareness of environmental issues, international agreements, regulation and industry responses are driving growth in the global clean technology sector. Future Jobs will take on board the fact that development of the Irish circular bio-economy will require changes to our approach to production, consumption, processing, storage, recycling and disposal of biological resources.

- ii. Where applicable, cooperation with other Member States in this area, including, where appropriate, information on how the SET Plan objectives and policies are being translated to a national context

North Seas Energy Cooperation (NSEC)

Ireland works in the NSEC on the prioritisation for the offshore research agenda and according SET plan funds.

Investment priority identification for the National Energy RD&D Funding Programme (funded by DCCAE and run by SEAI) is achieved via a blended model of top-down and bottom-up priority setting. Top-down priority setting is completed by carrying out cross-sectoral consultations with important stakeholders. This ensures that investment priorities for the National Energy RD&D Funding Programme are specifically targeted towards producing tangible impacts which meet the energy-related innovation, practice and policy needs of a range of relevant cross-Government sectors.

In many cases, this shared investment priority setting model results in cross-governmental co-funding commitments as the negotiated investment priorities serve the needs of cross-government policy objectives. For example, the 2018 National Energy RD&D Funding Programme involved co-funding commitments from organisations in the transport, agriculture, environment, meteorological and marine sectors. Top-down priority setting is also informed via analysis of global low carbon technology/energy investment priorities such as those referred to in IEA Technology Collaboration Programmes and the SET Plan.

The National Energy RD&D Funding Programme also facilitates bottom-up priority setting by including an 'open strand' within the programme to which the energy RD&D community (companies, Universities, Institutes of Technology, Research Institutions, public bodies and semi-state bodies) can make a case for funding of RD&D projects in areas not identified as a result of the top-down prioritisation exercise.

Following in-depth evaluation, the RD&D investment opportunities from the pool of submissions made to the top-down and bottom-up strands of the National Energy RD&D Funding Programme which are judged to derive the greatest impact for Ireland are selected. This blended investment model provides an in-built system flexibility to ensure that good investment opportunities are not missed by relying solely on a top-down priority setting exercise and allows the entire energy RD&D

community to engage in priority setting – this approach is seen as particularly pertinent in the context of the current fast-moving pace of the energy transition nationally and internationally.

Ireland participates in extensive International collaboration on technology-related issues associated with the low-carbon transition via the International Energy Agency Technology Collaboration Programmes: Ireland is a signatory for eight IEA Technology Collaboration Programmes (TCPs). The scope and strategy of TCPs to which Ireland is a signatory align with national strategic objectives related to renewable energy, climate change and coordination of energy-related research.

Ireland is represented on IEA Standing Groups and Committees (e.g., the IEA Governing Board, IEA Committee on Energy Research & Technology; IEA Standing Group on Long-Term Cooperation; IEA Standing Group on Emergency Questions; IEA Standing Group on Global Energy Dialogue;) and Working Parties which, inter alia, oversee the IEA's strategy, work programme and priorities. Ireland is also represented on relevant IEA TCP Executive Committees.

Ireland is signatory to eight IEA Technology Collaboration Programmes. The scope and strategy of these TCPs aligns with our strategic objectives related to renewable energy, climate change and coordination of energy-related research. A national call for appointment of experts to TCP tasks in 2018 was undertaken, under a new structured approach for Irish engagement with IEA TCPs. Additional calls for experts, facilitated by this new structured selection process, are expected in subsequent years.

Ireland continues to be actively involved in the SET Plan Steering Committee; fora relating to Horizon 2020 and actively participates across a range of IEA Standing Groups and Committees. Ireland's international RD&D engagement is closely aligned with national research priorities. Ireland (via SEAI) currently chairs the SET Plan Ocean Energy Implementation Group.

iii. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

The National Energy RD&D and Ocean Energy Prototype Development Funding Programmes aim to stimulate and accelerate the development & deployment of energy/low-carbon technology related products, processes & systems in the Irish marketplace, to grow Ireland's national capacity to carry out internationally leading RD&D activities; and to support solutions that enable technical & other barriers to market uptake of energy/low-carbon technology related products, processes & systems

to be overcome. The programme underpins Ireland's efforts to transition to a low carbon economy, and to support the development of jobs and enterprise opportunities associated with the low carbon transition.

The **EPA Research Programme** includes a specific strand on climate science research in Ireland, recognising the need for research to inform a practical response to, and strategic engagement on, climate change. The EPA has a statutory role in coordinating environmental research in Ireland. EPA Research has a strong focus on policy and is driven by national regulations and European Directives.

Domain agnostic funders of research in Ireland also have an important part of play in the energy & climate research ecosystem in Ireland. Enterprise Ireland, the Irish Research Council and Science Foundation Ireland are part of a network which supports energy & climate research in Ireland - the focus of the Irish Research Council and Science Foundation Ireland is primarily on early stage research, whilst the focus of Enterprise Ireland is primarily on supporting businesses in the manufacturing and internationally traded services sectors.

Horizon 2020 is the EU's main instrument for funding research and development. It has a budget of nearly €80 billion over 7 years. A budget of €5.9bn has been allocated to non-nuclear energy research for the period 2014-2020. Irish industry, academia & public sector bodies participate in Horizon 2020 with SEAI fulfilling the role of National Delegate for Societal Challenge 3 (Secure, Clean and Efficient Energy). The Report of the independent High Level Group on maximising the impact of EU Research & Innovation Programmes (European Commission, 2017) calls for a prioritisation of research and innovation in EU and national budgets and for a doubling of the EU research and innovation programme budget, from €80bn in Horizon 2020 (or FP8) to €160bn in FP9. Researchers based in Ireland won approximately €40M in energy-related RD&D funding from Horizon 2020 during the first half of the programme.

The EPA fulfils the role of National Delegate and National Contact Point for Societal Challenge 5 of the Horizon 2020 Work Programme. Researchers based in Ireland won approximately €1.2M in funding from Societal Challenge 5 of the Horizon 2020 Programme, with a further potential for €0.5M under consideration for 2019 - climate action, environment, resource efficiency and raw materials. These awards are across 9 research institutions.

Ireland also participates in several energy and climate related ERA-Nets and Joint Programme Initiatives (JPI's), including the Smart Energy Systems ERA-NET; Ocean ERA-NET; the Climate JPI and the LIFE Programme.

SECTION B: ANALYTICAL BASIS⁷⁸

4. CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES^{79,80}

4.1 Projected evolution of main exogenous factors influencing energy system and GHG emission developments

Note that Ireland's draft NECP 2021-2030 is based on 4 scenarios – 2 baseline (with existing measures - WEM) scenarios and 2 advance (with additional measures - WAM) scenarios as follows:

NECP 1 - With existing measures (WEM) – high oil prices (EU *Energy Reference Scenario* (2016) Prices.(constant 2013 values)

NECP 2 - With additional measures (WAM) - high oil prices (EU *Energy Reference Scenario* (2016) Prices(constant 2013 values)

NECP 3 - With existing measures (WEM) - low oil prices (Department of Business Energy and Industrial Strategy (UK) (BEIS) 2017 low fossil fuel prices.)

NECP 4 - With additional measures (WAM) - low oil prices (BEIS 2017 low fossil fuel prices)

(i) Macroeconomic forecasts (GDP and population growth)

Projections for economic growth (GDP) and population growth are sourced from Ireland's Economic and Social Research Institute (ESRI). For a description of Ireland's COSMO macro-economic model⁸¹

	Unit	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
GDP	EUR million	199685	216578	221760	227508	233480	239713	246003	252457	259168	266243	273823	282075	327224	371914
Population growth	million	4.74	4.87	4.91	4.95	5.00	5.04	5.08	5.12	5.16	5.20	5.24	5.28	5.48	5.69

Table 27: NECP 1 (High Oil Price) Macroeconomic forecasts 2017-2040, with existing measures, high oil price

⁷⁸ See Part 2 for a detailed list of parameters and variables to be reported in Section B of the Plan.

⁷⁹ Current situation shall reflect the date of submission of the national plan (or latest available date). Existing policies and measures encompass implemented and adopted policies and measures. Adopted policies and measures are those for which an official government decision has been made by the date of submission of the national plan and there is a clear commitment to proceed with implementation. Implemented policies and measures are those for which one or more of the following applies at the date of submission of the national plan or progress report: directly applicable European legislation or national legislation is in force, one or more voluntary agreements have been established, financial resources have been allocated, human resources have been mobilised.

⁸⁰ The selection of exogenous factors may be based on the assumptions made in the EU Reference Scenario 2016 or other subsequent policy scenarios for the same variables. Besides, Member States specific results of the EU Reference Scenario 2016 as well as results of subsequent policy scenarios may also be a useful source of information when developing national projections with existing policies and measures and impact assessments.

⁸¹ see: <https://www.esri.ie/publications/cosmo-a-new-core-structural-model-for-ireland/>

Projections for GDP growth are higher for the low oil price sensitivity.

Macroeconomic forecasts	Unit	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
GDP	EUR million	199685	220389	228073	236324	244812	253529	262234	270975	279789	288769	298083	307950	362406	416253
Population growth	million	4.74	4.87	4.91	4.95	5.00	5.04	5.08	5.12	5.16	5.20	5.24	5.28	5.48	5.69

Table 28: NECP 3 (low oil price), Macroeconomic forecasts, low oil price, 2017-2040

(ii) Sectoral changes expected to impact the energy system and GHG emissions

Projections for gross value added are also sourced from the ESRI.

Sectoral Gross value added	Unit	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
Industry	EUR million	76487	81320	83706	86513	89644	92988	96467	100060	103805	107764	112005	116596	140925	164936
Market services	EUR million	101366	110695	113229	115371	117112	118802	120357	121971	123691	125536	127562	129871	140136	150350
Non-marketed services, health and education	EUR million	29967	32013	32181	32672	33160	33636	34104	34567	35029	35494	35967	36451	38960	41457
Public administration and defence	EUR million	6917	7389	7428	7541	7654	7764	7872	7979	8085	8193	8302	8414	8993	9569

Table 29: NECP 1 (With Existing Measures, High Oil Price) Sectoral Gross Value Added projections 2017-2040

The impact of the assumption of cheaper input fuel prices in the price sensitivity scenario is evident in the projections of higher sectoral gross value added (NECP3).

Sectoral Gross value added	Unit	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
Industry	EUR million	76487	83831	87484	91380	95522	99868	104359	108944	113628	118455	123499	128849	159085	188881
Market services	EUR million	101366	111337	114887	118345	121531	124597	127383	130063	132683	135278	137939	140813	155659	170404
Non-marketed services, health and education	EUR million	29967	32088	32355	32981	33633	34295	34963	35636	36310	36986	37664	38347	42058	45746
Public administration and defence	EUR million	6917	7406	7468	7612	7763	7916	8070	8225	8381	8537	8693	8851	9708	10559

Table 30: NECP 3 (With existing measures, low oil price) Sectoral Gross Value Added projections 2017-2040

(iii) Global energy trends, international fossil fuel prices, EU ETS carbon price

The high price scenarios presented (NECP 1 and 2) are based on the EU Reference Scenario (2016) prices (expressed in constant \$2013) for oil, gas and coal.

The recommended EU Reference scenario ETS price is used in all scenarios.

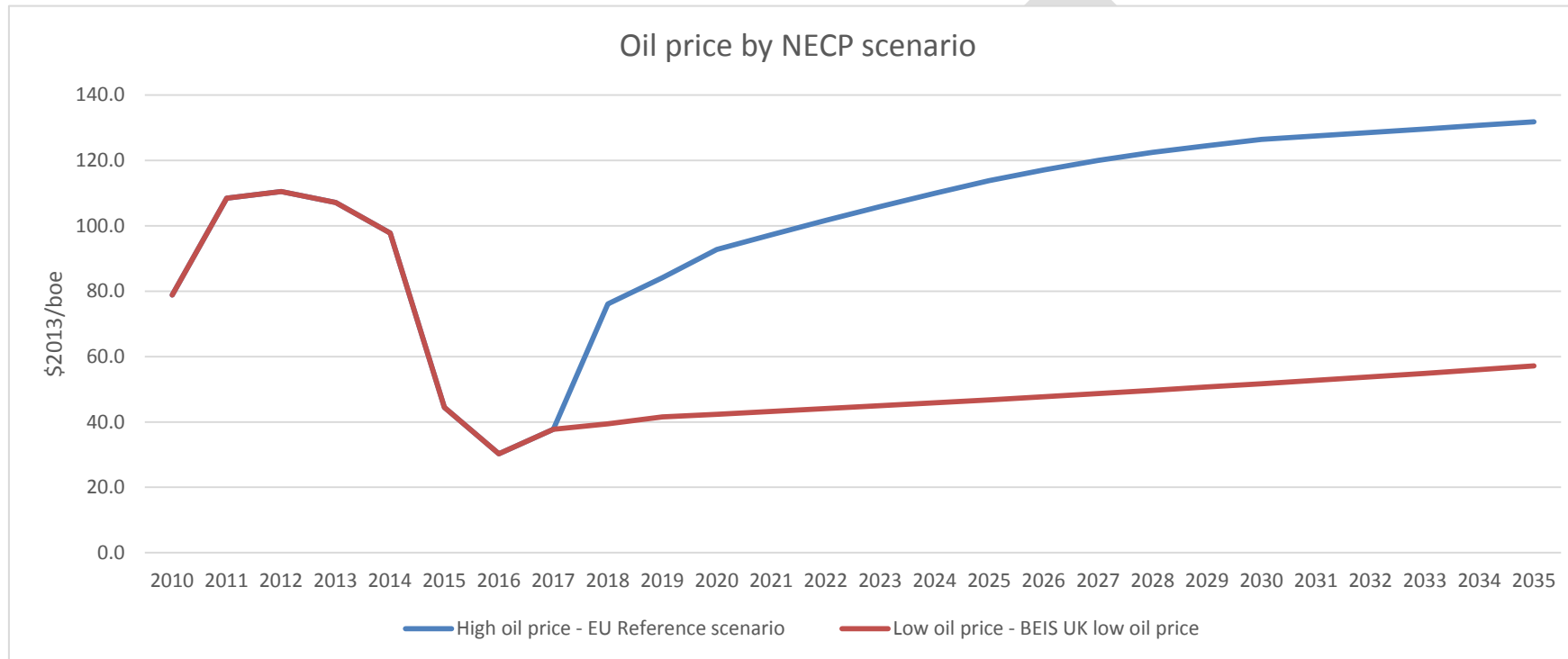


Figure 3: Oil price by NECP scenario

Global energy trends	Unit	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
International fuel prices															
Oil	EUR2013/GJ	8.26	11.29	11.92	12.55	13.19	13.85	14.52	14.82	15.11	15.41	15.71	16.00	16.69	17.37
Gas	EUR2013/GJ	5.04	6.71	7.14	7.57	8.02	8.46	8.91	9.06	9.22	9.38	9.53	9.69	10.34	10.99
Coal	EUR2013/GJ	2.05	2.59	2.65	2.71	2.77	2.84	2.92	3.03	3.15	3.27	3.38	3.50	3.70	3.91
Carbon price ETS sector	EUR2013/ ton CO2	10.50	15.00	16.50	18.00	19.50	21.00	22.50	24.70	26.90	29.10	31.30	33.50	42.00	50.50

Table 31: NECP 1 (With Existing Measures, High Oil Price) Projected global energy trends 2017-2040, with existing measures, high oil price.

The low oil price sensitivity is modeled on the basis of prices sourced from BEIS (UK),⁸² and uses their 30 November 2017 low fossil fuel price assumptions.

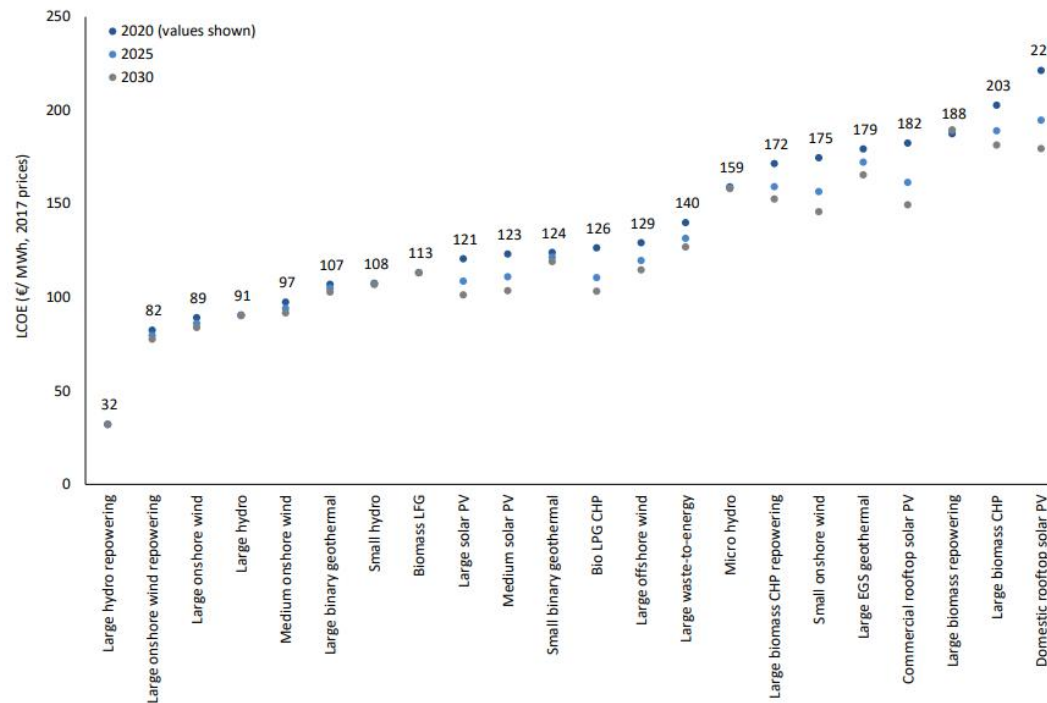
Global energy trends	Unit	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
International fuel prices															
Oil	EUR2013/GJ	8.26	8.65	8.04	7.47	6.93	6.41	5.92	5.97	6.04	6.13	6.24	6.37	7.04	7.70
Gas	EUR2013/GJ	5.04	5.11	4.71	4.32	3.93	3.56	3.20	3.21	3.14	3.17	3.12	3.16	2.96	2.75
Coal	EUR2013/GJ	2.05	2.06	1.86	1.68	1.50	1.33	1.17	1.18	1.20	1.22	1.22	1.25	1.17	1.08
Carbon price ETS sector	EUR2013/ ton CO2	10.50	15.00	16.50	18.00	19.50	21.00	22.50	24.70	26.90	29.10	31.30	33.50	42.00	50.50

Table 32: NECP 3 (With existing measures, low oil price) Projected global energy trends 2017-2040, with existing measures, low oil price.

⁸² Available here: <https://www.gov.uk/government/collections/fossil-fuel-price-assumptions>

(iv) Technology cost developments

The projected makeup of renewable electricity supply in each modelled scenario was informed in part by economic analysis conducted by Cambridge Economic Policy Associates on ⁸³behalf of DCCAE for the design of Ireland's upcoming Renewable Electricity Support Scheme (RESS). This analysis modelled several scenarios with varying levels of RES-E achievement in 2030 factoring in the capital and operating costs of an array of renewable technologies. The modelling presented in this report draws on the findings of this piece of analysis in its assessment of possible RES-E mixes in 2030 and beyond. The technology cost assessment arising from the RESS economic analysis is summarised in the figure below which compares the levelised cost of electricity (LCOE) for each generation technology deployed in Ireland.



⁸³ <https://www.dccae.gov.ie/en-ie/energy/consultations/Pages/Renewable-Electricity-Support-Scheme-Design-Consultation.aspx>

Figure 4: selected central estimates for levelised cost of electricity in 2020, 2025 and 2030, assuming 10% discount rate. Source: CEPA (2017)

The heating technology stock has been projected using an investment model which captures investors' willingness to pay for low carbon technologies given policy supports and changing fuel price dynamics. Capital and operating cost assumptions for low carbon and conventional heating technologies are presented in the table below. The opex assumptions for each technology do not include fuel costs which vary by scenario and with time as prices change and biomass supply chains adjust to growing demands.

Technology	Size (kW)	Capex (€/kW)	Opex (€/kW)
Biomass boiler	7	981	34
	30	787	28
	100	625	23
	300	478	18
	1,000	320	13
	3,000	320	13
Biomass CHP	100	3305	132
	300	3091	125
	1,000	2858	116
	3,000	2645	109
	10,000	2411	100
Ground source heat pump	3	3466	11
	30	2042	9
	100	1297	8
	300	1297	8
	1,000	1297	8
Air source heat pump	3	1408	32
	30	885	6
	100	612	3

Technology	Size (kW)	Capex (€/kW)	Opex (€/kW)
Gas boiler	7	215	6.5
	30	182	5.5
	100	155	4.7
	300	130	3.9
	1,000	103	3.1
	3,000	78	2.3
Oil boiler	7	128	3.8
	30	117	3.5
	100	107	3.2
	300	98	2.9
	1,000	89	2.7
	3,000	80	2.4
Electric heating	7	374	1
	30	334	1
	100	301	1
	300	271	1
	1,000	238	1
	3,000	208	1

	300	479	3
	1,000	479	3
Water source heat pump	3	2777	56
	30	2426	56
	100	2242	56
	300	2075	56
	1,000	1891	56
	3,000	1786	56
	10,000	1786	56
Deep geothermal	>200	2890	11
Solar thermal	3	1464	8
	10	1464	8
	30	1464	8
	100	839	8
	300	839	8
	1,000	549	8

Table 33 : Heating technology cost assumptions applied in modelling of heat sector

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4.2. Dimension Decarbonisation

4.2.1. GHG emissions and removals

i. Trends in current GHG emissions and removals in the EU ETS, effort sharing and LULUCF sectors and different energy sectors

Trends in GHG Emissions and removals	Unit	2016	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
ETS sector emissions (in ETS scope since 2013)	tCO ₂ eq	17,734,844	17,010,984	17,053,946	17,946,118	18,278,361	19,285,997	19,707,980	20,056,136	20,187,783	20,586,616	20,600,833	20,600,728	19,234,481
Effort Sharing sector GHG emissions (in scope since 2013)	tCO ₂ eq	43,810,977	44,646,914	44,818,054	44,821,817	44,706,335	44,495,847	44,262,498	44,227,226	44,201,501	44,167,036	44,100,725	44,025,235	42,752,265
LULUCF (accounted according to EU legislation requirements)	tCO ₂ eq		3,459,313	2,516,188	3,373,443	3,435,082	4,100,952	4,660,205	4,597,821	4,735,746	5,252,297	5,032,152	6,010,813	5,886,476

Table 34: NECP 1 (With existing measures, high oil price) Projected trends in GHG Emissions and Removals, with existing measures, high oil price, 2016-2040

Trends in GHG Emissions and removals	Unit	2016	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
ETS sector emissions (in ETS scope since 2013)	tCO ₂ eq	17,734,844	17,337,868	17,461,225	18,211,858	17,839,177	18,502,655	17,650,260	17,785,097	17,756,218	18,194,744	18,235,418	18,416,297	21,033,818
Effort Sharing sector GHG emissions (in scope since 2013)	tCO ₂ eq	43,810,977	46,834,156	47,309,174	47,621,849	47,831,312	47,890,708	47,912,747	48,070,496	48,222,854	48,307,082	48,352,031	48,352,752	48,155,529
LULUCF (accounted according to EU legislation requirements)	tCO ₂ eq		3,459,313	2,516,188	3,373,443	3,435,082	4,100,952	4,660,205	4,597,821	4,735,746	5,252,297	5,032,152	6,010,813	5,886,476

Table 35: NECP 3 (With existing measures, low oil price) With existing measures, high oil price) Projected trends in GHG Emissions and Removals, with existing measures, low oil price, 2016-2040

- In the last 2 years, national total emissions have increased by 7.4% or 4.23 Mt CO₂eq. In the same period, emissions in the ETS sector have increased by 11.2% or 1.78 Mt CO₂eq and in the non-ETS sector by 5.9% or 2.45 Mt CO₂eq.
- *Agriculture* emissions increased by 2.7% or 0.53 Mt CO₂eq in 2016. The most significant drivers for the increased emissions in 2016 are higher dairy cow numbers (+6.2%) with an increase in milk production of 4.0%.
- Greenhouse gas emissions from the *Transport* sector increased by 4.1% or 0.48 Mt CO₂eq in 2016. This is the fourth successive year of increases in transport emissions. In road transport in 2016, gasoline use continued to decrease by 6.7% while diesel use increased by 8.0% and biofuels use decreased by 8.0%.
- *Agriculture* and *Transport* accounted for 73.2% of total non-ETS emissions in 2016.
- Emissions in the *Energy Industries* sector show an increase of 6.0% or 0.71 Mt CO₂eq which is attributable to an increase in natural gas use for electricity generation at power plants by 27.7% and reductions of 6.5% and 15.6% respectively for electricity generated from wind and hydro renewables. This is reflected in a 3.3% increase in the emissions intensity of power generation in 2016 (480 g CO₂/kWh) compared with 2015 (465 g CO₂/kWh). Renewables now account for 25.5% of electricity generated in 2016 (down from 27.3% in 2015). Ireland exported 2.4% of electricity generated in 2016.
- Emissions from the *Manufacturing Combustion*² sector increased by 0.07 Mt CO₂eq or 1.6% in 2016. There were minor decreases in combustion emissions for all sub sectors except cement which increased by 3.5% in 2016.
- The *Industrial Processes* sector emissions increased by 7.1% or 0.14 Mt CO₂eq, mainly from increased cement production. Cement process emissions increased by 8.6% in 2016.
- Greenhouse gas emissions from the *Residential* sector remained almost unchanged with a small increase of 0.1% or 0.01 Mt CO₂eq.
- Emissions from the *Waste* sector increased by 0.9% or 0.01 Mt CO₂eq in 2016

Mt CO ₂ eq	2015	2016	% Change
Agriculture	19.324	19.851	2.7%
Energy Industries	11.845	12.557	6.0%
Transport	11.813	12.294	4.1%
Residential	6.041	6.047	0.1%
Manufacturing Combustion	4.484	4.555	1.6%
Industrial Processes	2.007	2.150	7.1%
F-Gases	1.142	1.267	11.0%
Commercial Services	0.970	0.994	2.5%
Waste	0.949	0.958	0.9%
Public Services	0.851	0.873	2.7%
Total	59.426	61.546	3.6%

Table 36: Greenhouse gas emissions for 2015 and 2016 for Ireland

Agriculture emissions increased by 2.7% or 0.53 Mt CO₂eq in 2016 following an increase in 2015 of 1.5%. The most significant drivers for the increased emissions in 2016 are higher dairy cow numbers (+6.2%) with an increase in milk production of 4.0%. In the 5-year period 2012-2016, dairy cow numbers have increased by 22% and corresponding milk production by 27%. This reflects national plans to expand milk production under Food Wise 2025 and the removal of the milk quota in 2015. In 2016, there were also increased CO₂ emissions from liming (+8.4%) and urea (+26.5%) application. Other cattle and pig numbers increased by 3.0% and 3.7% respectively. Total fossil fuel consumption in agriculture/forestry activities increased by 5.0% in 2016.

Transport emissions increased by 4.1% in 2016 or 0.48 Mt CO₂eq. This is the fourth successive year of increases in transport emissions following five consecutive years of decreases since 2007. In road transport in 2016, gasoline use continued to decrease by 6.7% while diesel use increased by 8.0% and biofuels use decreased by 8.0%. Looking at the underlying drivers, the number of passenger diesel cars increased by 11.9% in 2016 while the number of passenger petrol cars decreased by 5.7%, commercial vehicle numbers increased by 3.5% and employment continued to grow with 3.3% growth recorded between Q4 2015 and Q4 2016.

Sectoral emissions in the *Energy Industries* sector show an increase of 6.0% which is attributable to an increase in natural gas use for electricity generation by 27.7% and reductions of 6.5% and 15.6% respectively for electricity generated from wind and hydro renewables. This is reflected in a 3.3% increase in the emissions intensity of power generation in 2016 (480 g CO₂/kWh) compared with 2015 (465 g CO₂/kWh). Renewables now account for 25.6% of electricity generated in 2016 (down from 27.3% in 2015). Ireland exported 2.4% of electricity generated in 2016. In 2016, total final consumption of electricity increased by 2%.

Emissions in the *Residential* sector are almost unchanged with a small increase of 0.1% or 0.01 Mt of CO₂eq. in 2016. Within the different fuels used in household space and water heating, kerosene use increased by 5.2%, gasoil by 5.0% and natural gas by 1.4%, whereas coal and peat use continued to decline by 13.3% and 1.9% respectively in 2016.

Emissions from the *Manufacturing Combustion* sector increased by 1.6% or 0.07 Mt CO₂eq in 2016. There were minor decreases in combustion emissions for all sub sectors except cement which increased in 2016. However, increased emissions from companies within the ETS were evident in the food and drink and cement sectors, with emissions increasing by 4.5% and 3.5% respectively. These increases were offset by reductions in other sectors, most notably, a reduction of 5.1% in emissions from non-ferrous metals industry.

Emissions from the *Industrial Processes* sector continue to increase by 7.1% (0.14 Mt CO₂eq) in 2016 following a 10.3% increase in 2015, mainly from increased cement production. Total process emissions from the mineral products subsector (including cement) increased by 7.5%. These emissions are included in the ETS sector and contribute significantly to the ETS sector increase in 2016.

In 2016, total emissions (combustion and process) from the cement sector increased by 6.8% and amount to 2.72 Mt CO₂eq, or 4.4% of national total emissions. Cement sector emissions have now increased by 79% since 2011.

Emissions from *Commercial Services* and *Public Services* increased by 2.5% and 2.7% respectively, with increases of 5.2% in natural gas use in both sectors in 2016. These increases were offset somewhat by increases in biomass/biogas use of 55.4% and 26.9% respectively.

- Emissions from the *Waste* sector increased by 0.9% in 2016, with decreases in sub category; incineration and open burning (-42.8%). Overall emissions increased by 0.01 Mt CO₂eq.
- For 2016, total national greenhouse gas emissions are estimated to be 61.55 million tonnes carbon dioxide equivalent (Mt CO₂ eq) which is 3.6 % higher (or 2.12 Mt CO₂ eq) than emissions in 2015 (59.43 Mt CO₂ eq) and follows the 3.7% increase in emissions reported for 2015. Emission reductions have been recorded in 7 of the last 10 years, however the last two years have seen large increases in emissions. In the last 2 years, national total emissions have increased by 7.4% or 4.23 Mt CO₂eq. In the same period, emissions in the ETS sector have increased by 11.2% or 1.78 Mt CO₂eq and in the non-ETS sector by 5.9% or 2.45 Mt CO₂eq. We are now seeing strong evidence that emissions are once again increasing in line with economic and employment growth, particularly in the *Energy Industries*, *Agriculture* and *Transport* sectors.
- These figures indicate that Ireland exceeds its 2016 annual limit set under the EU's Effort Sharing Decision (ESD), 406/2009/EC3 by 0.3 Mt CO₂eq.

ii. Projections of sectoral developments with existing national and Union policies and measures at least until 2040 (including for the year 2030)

The greenhouse gas emissions projections prepared for this draft National Energy and Climate Plan consider projected activity data provided by a number of key data providers including:

- Updated energy projections provided by the Sustainable Energy Authority of Ireland (SEAI) in October and November 2018.
- Agricultural projections provided by Teagasc in April 2018 which considers the impact of Food Wise 2025 for the agriculture sector.

As the latest inventory (1990-2017) is not finalised at the time of writing the emissions projections that have been prepared for the draft National Energy and Climate Plan is projecting from the 2016 inventory baseline year. From an energy perspective, 2017 energy balance data is used, so 2018 is the first projected year.

The *Projections with existing policies and measures (WEM)* scenario assumes that no additional policies and measures, beyond those already in place by the end of 2017, are implemented. A fuller list of key assumptions is provided in annex xxx A comparison to With Additional Measures (WAM) scenarios are provided in section 5.

Sectoral developments in GHG emissions	Unit	2016	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Power Sector	ktCO ₂ e	12,076.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industry	ktCO ₂ e	4,554.61	3,982.79	3,962.39	3,942.55	3,911.53	3,872.94	3,833.68	3,790.11	3,745.68	3,707.05	3,671.68	3,631.75	3,799.97
Residential	ktCO ₂ e	6,046.55	6,558.84	6,481.57	6,388.99	6,297.46	6,198.39	6,080.90	5,966.53	5,858.60	5,758.09	5,665.52	5,582.04	4,753.93
Tertiary	ktCO ₂ e	1,867.77	1,380.98	1,360.03	1,339.84	1,317.17	1,293.75	1,269.28	1,245.06	1,220.85	1,197.87	1,175.91	1,155.15	1,212.68
Transport	ktCO ₂ e	12,293.95	12,914.88	13,131.87	13,216.56	13,192.46	13,104.26	13,001.88	13,082.36	13,171.74	13,257.76	13,323.63	13,352.87	12,694.51

Table 37: NECP 1 High Oil Price Projected sectoral developments in GHG Emissions, with existing measures, high oil price, 2016-2040

The greenhouse gas emissions projections prepared for the draft National Energy and Climate Plan take into account projected activity data provided by a number of key data providers including:

- Updated energy projections provided by the Sustainable Energy Authority of Ireland (SEAI) in October and November 2018.
- Agricultural projections provided by Teagasc in April 2018 which considers the impact of Food Wise 2025 for the agriculture sector.

As the latest inventory (1990-2017) is not finalised at the time of writing the emissions projections that have been prepared for the draft National Energy and Climate Plan is projecting from the 2016 inventory baseline year. The *Projections with existing policies and measures* scenario assumes that no additional policies and measures, beyond those already in place by the end of 2017, are implemented.

In terms of sectors covered by the Effort Sharing Decision (i.e. non Emissions Trading Scheme) under this scenario Ireland is projected to cumulatively exceed its compliance obligations by approximately 10.4 Mt CO₂ equivalent over the period 2013-2020. In terms of the same sectors covered under the Effort Sharing Regulation the projections indicate that Ireland will exceed the carbon budget by approximately 22 Mt CO₂ equivalent over the 2021-2030 period assuming both ETS and LULUCF flexibilities as set out in the Effort Sharing Regulation are fully utilised.

Under the *Projections with existing policies and measures* scenario total emissions (excluding LULUCF) are projected to decrease by 7% and 10.8% by 2030 and 2040 respectively compared to 2005 levels (from the 1990-2016 inventory). ETS emissions are projected to decrease by 8.2% and 14.2% by 2030 and 2040 respectively compared to 2005 levels.

Total emissions from sectors under the Effort Sharing Regulation are projected to decrease by 6.3% and 9% by 2030 and 2040 respectively compared to 2005 levels. Emissions from Energy Industries (corresponding to IPCC Sector 1.A.1.) are projected to decrease by 3% and 15.9% by 2030 and 2040 respectively compared to 2005 levels. Emissions from Industry (corresponding to IPCC Sector 1.A.2.) are projected to decrease by 38.1% and 35.2% by 2030 and 2040 respectively compared to 2005 levels. Emissions from Residential (corresponding to IPCC Sector 1.A.4.b.) are projected to decrease by 23.2% and 34.6% by 2030 and 2040 respectively compared to 2005 levels. Emissions from Tertiary (corresponding to IPCC Sector 1.A.4.a.) are projected to decrease by 52.4% and 50% by 2030 and 2040 respectively compared to 2005 levels. Emissions from Transport (corresponding to IPCC Sector 1.A.3.) are projected to increase by 1.7% by 2030 and decrease by 3.2% by 2040 compared to 2005 levels. Emissions from Agriculture (corresponding to IPCC Sector 3.) are projected to increase by 9.3% and 9.8% by 2030 and 2040 respectively compared to 2005 levels. Emissions from LULUCF are projected to increase by 21.5% and 19% by 2030 and 2040 respectively compared to 2016 levels.

Sectoral developments in GHG emissions	Unit	2016	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
Power Sector	ktCO ₂ e	12,076.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Industry	ktCO ₂ e	4,554.61	4,706.26	4,765.28	4,806.38	4,868.79	4,897.10	4,953.57	4,976.23	5,027.78	5,044.58	5,085.81	5,090.77	5,781.95
Residential	ktCO ₂ e	6,046.55	6,497.60	6,468.23	6,419.10	6,378.55	6,320.37	6,246.80	6,165.48	6,095.48	6,021.36	5,960.88	5,898.40	5,499.79
Tertiary	ktCO ₂ e	1,867.77	1,775.95	1,778.59	1,779.68	1,782.34	1,779.58	1,777.81	1,770.36	1,764.28	1,751.57	1,740.38	1,725.66	1,859.49
Transport	ktCO ₂ e	12,293.95	14,476.43	14,899.20	15,207.04	15,404.28	15,503.97	15,559.53	15,762.96	15,947.08	16,099.14	16,212.88	16,282.60	16,082.80

Table 38: NECP 3 Low Oil Price - Projected sectoral developments in GHG Emissions, with existing measures, low oil price, 2016-2040

The greenhouse gas emissions projections prepared for the draft National Energy and Climate Plan take into account projected activity data provided by a number of key data providers including:

- Updated energy projections provided by the Sustainable Energy Authority of Ireland (SEAI) in October and November 2018.
- Agricultural projections provided by Teagasc in April 2018 which considers the impact of Food Wise 2025 for the agriculture sector.

As the latest inventory (1990-2017) is not finalised at the time of writing the emissions projections that have been prepared for the draft National Energy and Climate Plan is projecting from the 2016 inventory baseline year.

The *Projections with existing policies and measures* scenario assumes that no additional policies and measures, beyond those already in place by the end of 2017, are implemented.

In terms of sectors covered by the Effort Sharing Decision (i.e. non Emissions Trading Scheme) under this scenario Ireland is projected to cumulatively exceed its compliance obligations by approximately 15.8 Mt CO₂ equivalent over the period 2013-2020. In terms of the same sectors covered under the Effort Sharing Regulation the projections indicate that Ireland will exceed the carbon budget by approximately 55.8 Mt CO₂ equivalent over the 2021-2030 period assuming both ETS and LULUCF flexibilities as set out in the Effort Sharing Regulation are fully utilised. Under the *Projections with existing policies and measures* scenario total emissions (excluding LULUCF) are projected to decrease by 3.9% and 0.4% by 2030 and 2040 respectively compared to 2005 levels (from the 1990-2016 inventory).

ETS emissions are projected to decrease by 17.9% and 6.2% by 2030 and 2040 respectively compared to 2005 levels. Total emissions from sectors under the Effort Sharing Regulation are projected to increase by 2.8% and 2.4% by 2030 and 2040 respectively compared to 2005 levels. Emissions from Energy Industries (corresponding to IPCC Sector 1.A.1.) are projected to decrease by 24% and 13.9% by 2030 and 2040 respectively compared to 2005 levels. Emissions from Industry (corresponding to IPCC Sector 1.A.2.) are projected to decrease by 13.2% and 1.5% by 2030 and 2040 respectively compared to 2005 levels. Emissions from

Residential (corresponding to IPCC Sector 1.A.4.b.) are projected to decrease by 18.8% and 24.3% by 2030 and 2040 respectively compared to 2005 levels. Emissions from Tertiary (corresponding to IPCC Sector 1.A.4.a.) are projected to decrease by 28.9% and 23.4% by 2030 and 2040 respectively compared to 2005 levels. Emissions from Transport (corresponding to IPCC Sector 1.A.3.) are projected to increase by 24% and 22.5% by 2030 and 2040 respectively compared to 2005 levels. Emissions from Agriculture (corresponding to IPCC Sector 3.) are projected to increase by 9.3% and 9.8% by 2030 and 2040 respectively compared to 2005 levels. Emissions from LULUCF are projected to increase by 21.5% and 19% by 2030 and 2040 respectively compared to 2016 levels.

4.2.2. Renewable energy

i. Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors

Renewable Energy Shares 2017	Renewables (Total)	Of which:						
		Hydro	Wind	Biomass	Biogases	Bioliquids	Solar	Heat Pumps/Geothermal
Primary Energy	9.3%	0.4%	4.4%	2.6%	0.4%	1.1%	0.1%	0.3%
Share of gross final consumption - Renewable Directive (RES)	10.6%	0.5%	5.5%	2.5%	0.2%	1.4%	0.1%	0.4%
Share of Electricity final consumption - (RES-E)	30.1%	2.4%	25.2%	1.8%	0.7%		0.04%	
Share of heat final consumption - (RES-H)	6.9%			5.4%	0.2%		0.3%	0.9%
Share of transport final consumption - (RES-T)	7.4%					7.3%		

Table 39: Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors

Overall and modal shares of renewable energy

The contribution from renewables in 2005 was 2.8%, rising to 10.6% of GFC in 2017. Figure 5 illustrates where the various renewable targets fit within overall energy use in Ireland and the progress towards those targets in 2017. Towards the right of the figure the 2017 percentages of renewables are shown relative to the amount of final energy that they refer to.

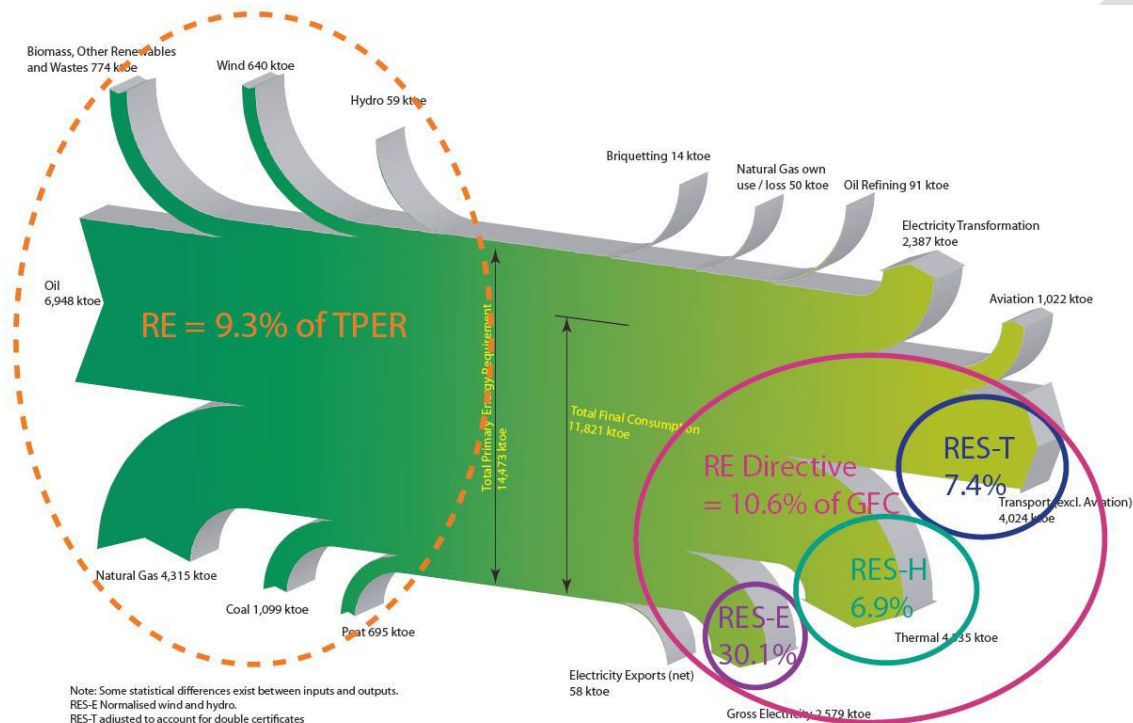
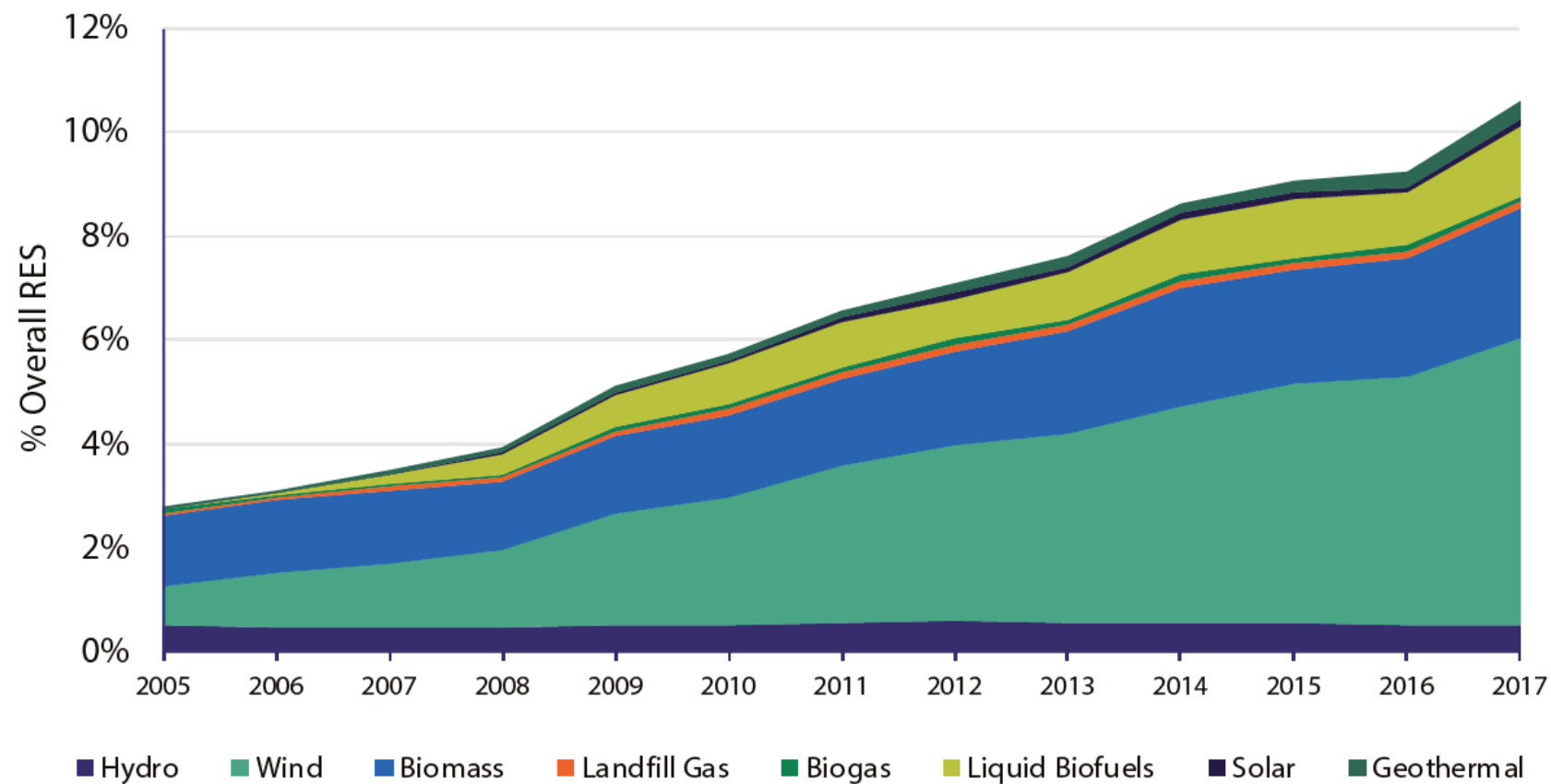


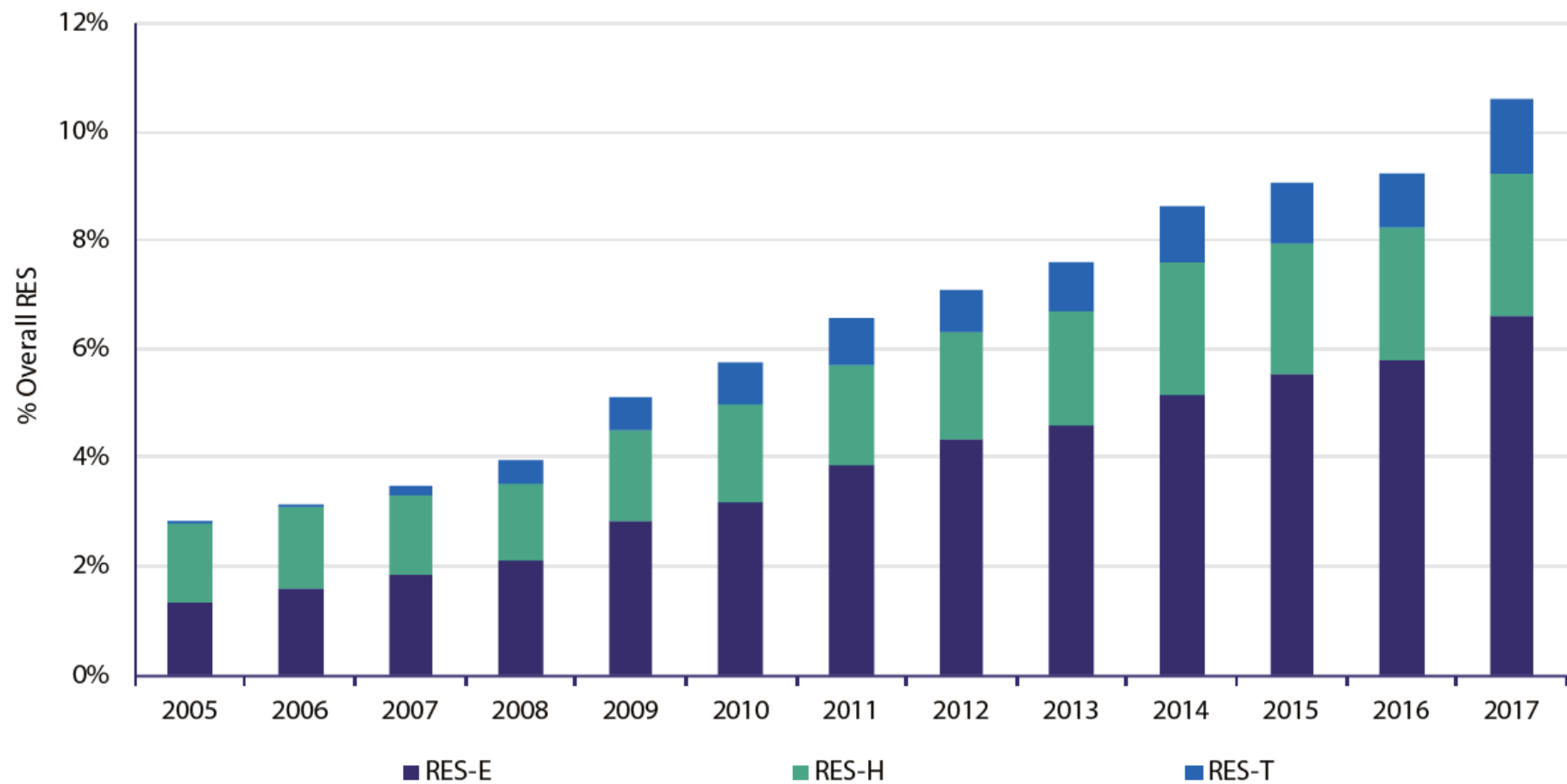
Figure 5 : Progress to renewable energy targets 2017



Source: SEAI

Figure 6: Renewable energy (%) to gross final consumption (Directive 2009/28/EC)

Figure 6 shows the contribution as per the Directive methodology from 2005 to 2017 while Figure 7 below shows the renewable energy percentage contributions to GFC by mode with RES-E normalised.



Source: SEAI



Figure 7: Renewable energy (%) contribution to gross final energy consumption by mode

Renewable Electricity

The total contribution from renewable energy to gross electricity consumption in 2017 was 30.1% normalised (compared with 26.8% in 2016). The share of electricity from renewable energy has increased fourfold between 2005 and 2017 – from 7.2% to 30.1% – an increase of 23 percentage points over 12 years. In absolute terms there has been a fivefold increase in the volume of renewable electricity generated from 1,873 GWh in 2005 to 8,877 GWh in 2017.

Electricity production from wind energy has increased to the point that it accounted for 84% of the renewable electricity generated in 2017. Electricity generated from biomass accounted for 8% of renewable electricity in 2017. Biomass consists of contributions from solid biomass, landfill gas, the renewable portion of waste and other biogas.

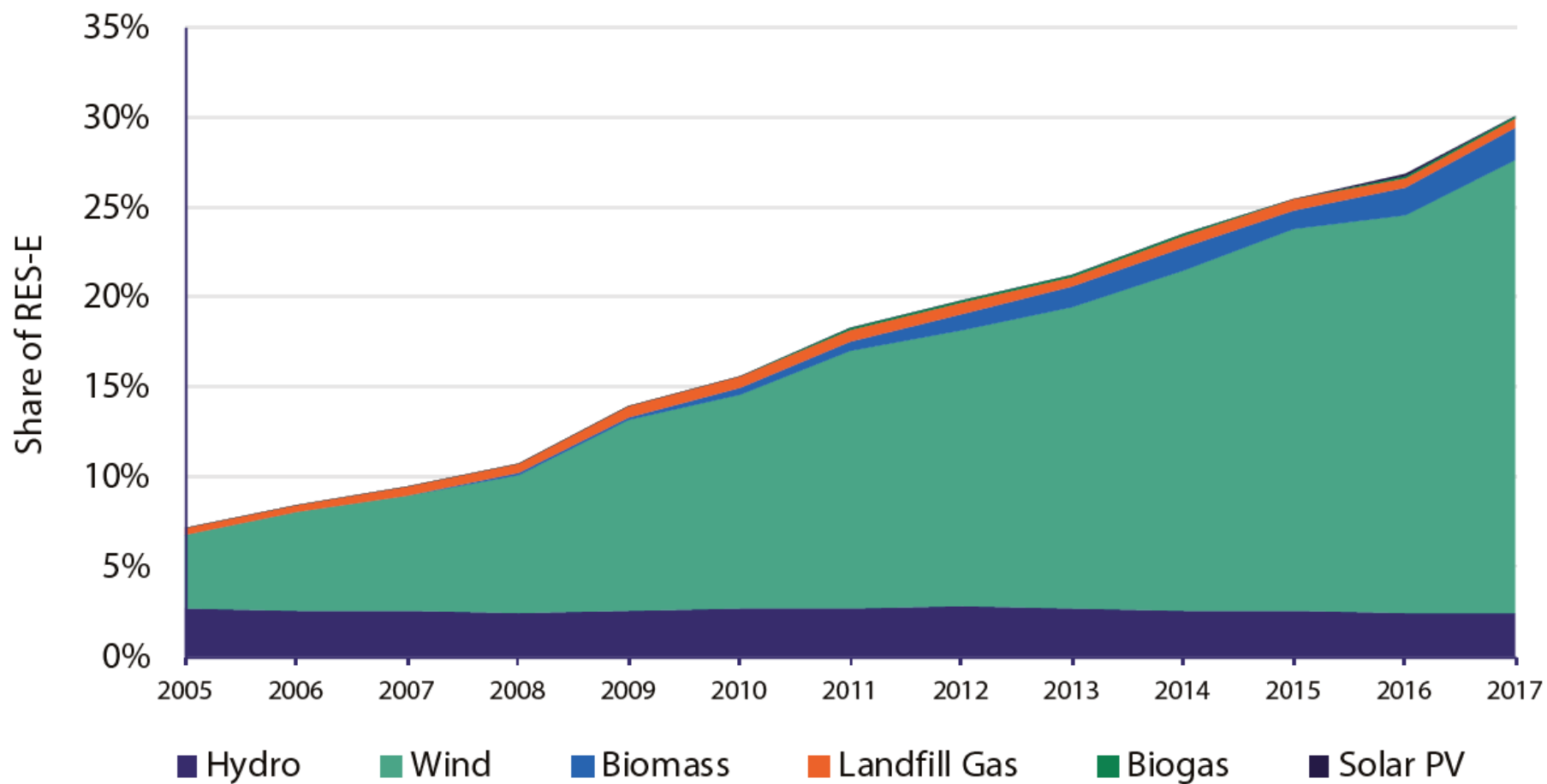


Figure 8: Renewable energy (%) contribution to gross electricity consumption by technology (RES-E normalised)

Renewable Heat

Figure 9 shows the contribution from renewable energy to heat or thermal energy uses. The increasing activity in specific sub-sectors of industry, as well as some incentives and regulations for renewable systems in residential dwellings, has led to renewable energy use rising from 187 ktoe in 2005 to 312 ktoe in 2017 (a growth of 67%). In 2017 renewable thermal energy increased by 9.8% in absolute terms relative to 2016. The renewable share of thermal energy increased by 0.6 percentage points to 6.9% in 2017.

Following a decline in the contribution from renewables to thermal energy in the early 1990s (from 2.6% in 1990 to 2.1% in 1995), RES-H grew between 2000 and 2014, from 2.4 % to 6.3%, and fell in 2015 to 6.2% and increasing again in 2016 and 2017 to 6.9%. This growth, dominated by solid biomass³¹, is mostly due to the increased use of wood waste as an energy source in the wood products and food sub-sectors of industry. In addition, recent growth in renewable energy use in the residential and services sectors can be attributed to the support of grant schemes and revisions to building regulations requiring a share of the energy demand in new dwellings to come from renewable sources.

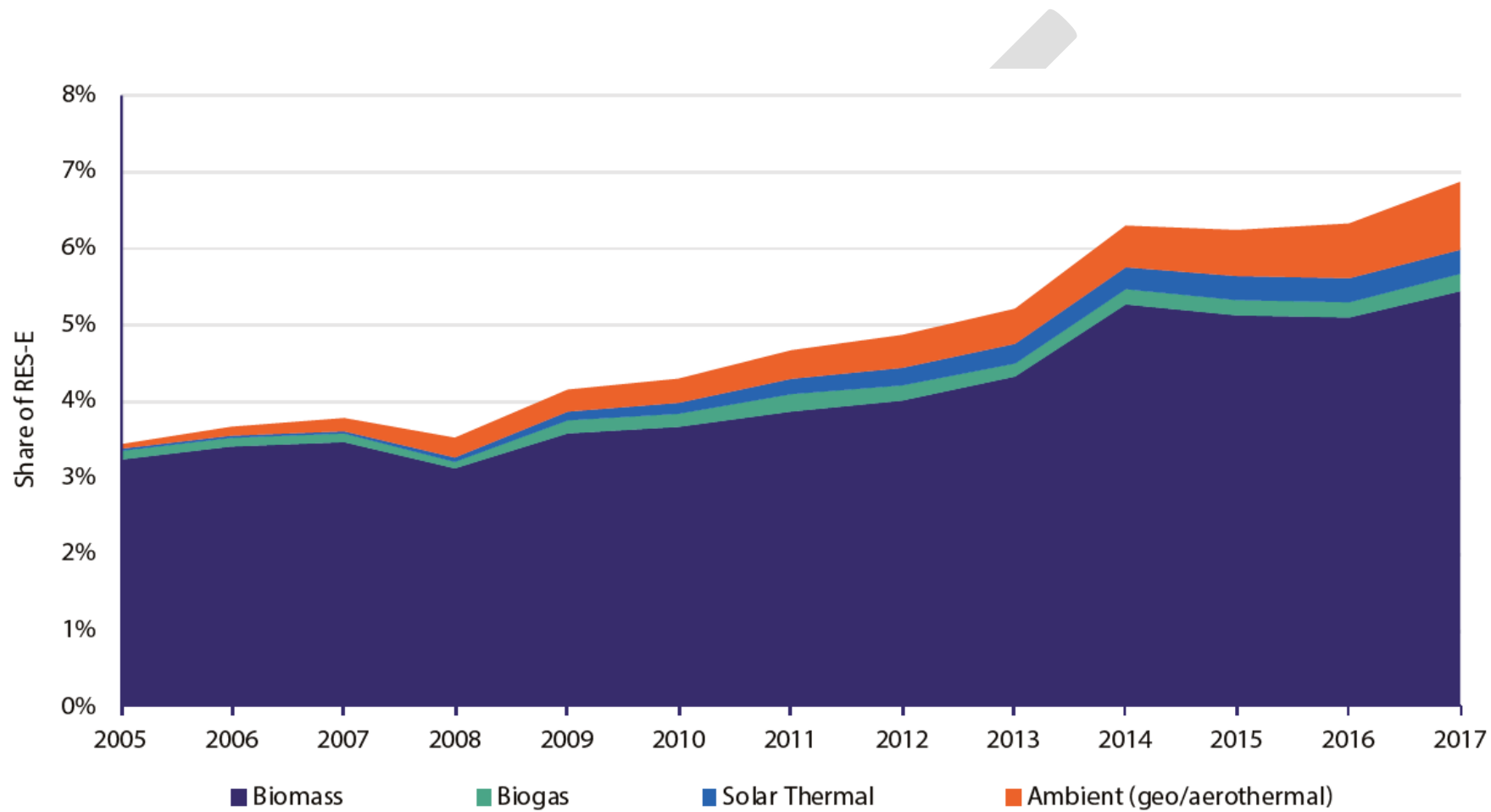


Figure 9: Renewable energy (%) contribution to thermal energy (RES-H) by technology

Renewable Transport

The figure for renewables in transport energy (RES-T) in 2017 was 4.1%, or 7.4% when the weightings for biofuels and renewable electricity are applied in accordance with the Directive. These are up on the respective 2016 figures of 3.0% and 5.2% resulting from the increase in the obligation to 8%. 15% of the required certificates for 2017 were carried forward from 2015 and 2016 as allowed for under the Biofuel Obligation Scheme.

In absolute terms, biofuels in transport increased from 1 ktoe in 2005 (0.03%) to 98 ktoe in 2011 (2.6% of transport energy). The quantity fell in 2012 to 85 ktoe mainly as a result of the majority of biodiesel qualifying for double certificates, thereby allowing the obligation to be met with certificates but causing the actual volume of biofuel to fall. Actual volumes increased again after 2013 to reach 128 ktoe (3.3% of transport energy) in 2015 but fell to 119 ktoe in 2016 (3.0% of transport energy) before increasing again in 2017 by 36% to 161 ktoe. In 2017, all the biodiesel and 1% of bioethanol used for road transport were eligible for double certificates

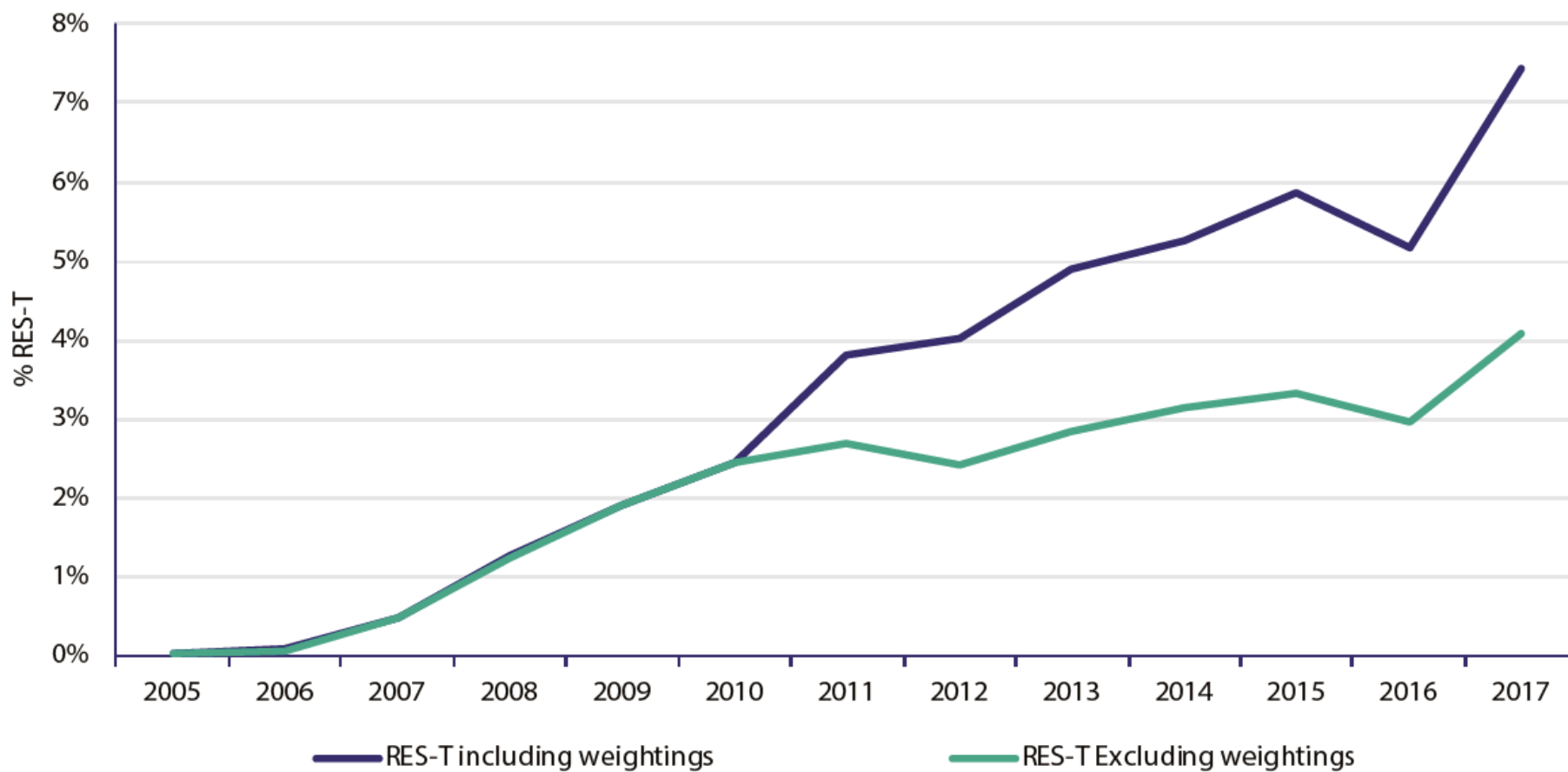


Figure 10: Renewable energy as a proportion of (petrol and diesel) transport (RES-T)

ii. Indicative projections of development with existing policies for the year 2030 (with an outlook to the year 2040)

Overall renewable energy share in gross final consumption is anticipated to be in the order of 13.3% by 2020 in the NECP 1 (WEM – high oil price) scenario. These projections do not include the anticipated impact of policies and measures announced after the end of 2017. For the price sensitivity (NECP 3) due to lower energy prices and higher energy demand, the modelled result is lower compared to NECP 1 at 12.3%.

The outlook to 2040 for these WEM (baseline) scenarios suggest an outturn of between 15.8% and 19.2% for the low and high oil price sensitivity respectively. As for 2030, these are baseline scenarios only and do not include the impact of more recently announced policies and measures. Refer to Part 5 for a comparison with the With Additional Measures (WAM) scenarios.

Overall Renewable Energy Share (RES) in Gross Final Consumption

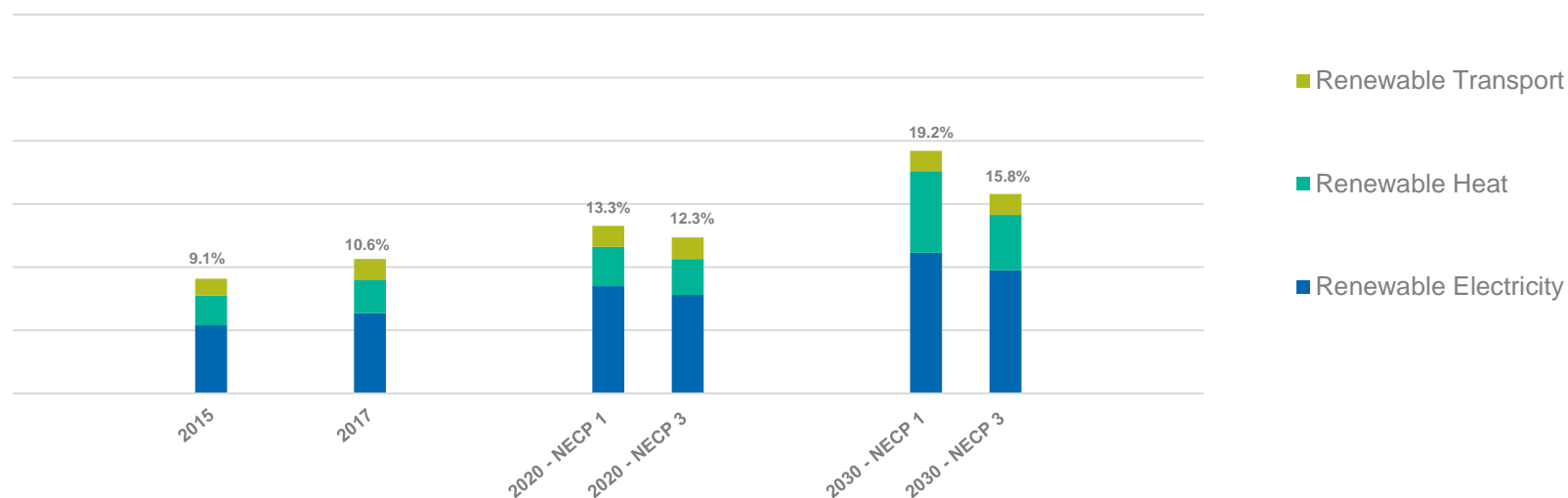


Figure 11: Overall renewable energy share in gross final consumption

The following tables below illustrate the annual trajectories for the given set of WEM scenario assumptions. It is evident that there is shortfall on the deployment trajectory set out in Article 4(a)(2).

Renewable Trajectories	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
RES-H&C (%)	6.8%	8.8%	9.5%	10.4%	11.3%	12.4%	13.5%	14.6%	15.8%	16.9%	18.0%	19.2%	23.3%
RES-E (%)	30.1%	38.5%	39.7%	37.4%	37.0%	36.7%	36.7%	36.9%	37.1%	38.3%	39.9%	41.2%	40.7%
RES-T (%)	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.0%	4.0%	3.7%
Overall RES share (%)	10.6%	13.3%	13.9%	14.1%	14.6%	15.1%	15.6%	16.1%	16.7%	17.4%	18.3%	19.2%	21.7%
Article 4(a)(2) target for RES increase				18.0%			43.0%		65.0%			100.0%	
RES min trajectory (%)		16.0%		16.6%			17.4%		18.1%			19.2%	
RES projected trajectory (%)		13.3%		14.1%			15.6%		16.7%			19.2%	
Shortfall (%)		2.7%		2.4%			1.8%		1.4%			0.0%	

Table 40: Scenario: NECP 1 (With Existing Measures, high oil price) Modelled trajectories for renewable energy by sector, with existing measures, high oil price, 2017-2040

A lower outturn on RES penetration is anticipated in price sensitivity (low price) scenario. This is a result of higher energy demand due to lower energy prices, combined with the same input assumptions in terms of renewable energy technology deployed across heat, electricity and transport.

Renewable Trajectories	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
RES-H&C (%)	6.8%	8.0%	8.3%	8.7%	9.2%	9.7%	10.2%	10.7%	11.2%	11.7%	12.3%	12.9%	15.2%
RES-E (%)	30.1%	38.2%	39.2%	36.8%	36.3%	35.8%	35.6%	35.8%	35.9%	36.9%	38.4%	39.6%	39.1%
RES-T (%)	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.1%	4.0%	4.0%	4.0%	3.7%
Overall RES share (%)	10.6%	12.3%	12.7%	12.8%	13.0%	13.2%	13.5%	13.7%	14.0%	14.5%	15.2%	15.8%	17.7%
Article 4(a)(2) target for RES increase				18.0%			43.0%		65.0%			100.0%	
RES min trajectory (%)		16.0%		16.0%			15.9%		15.9%			15.8%	
RES projected trajectory (%)		12.3%		12.8%			13.5%		14.0%			15.8%	
Shortfall (%)		3.7%		3.2%			2.4%		1.9%			0.0%	

Table 41: Scenario: NECP 3 (With Existing Measures, low oil price) Modelled trajectories for renewable energy by sector 2017-2040, with existing measures, low oil price.

4.3. Dimension Energy efficiency

i. Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)

Primary energy requirement

With the exception of the residential sector, all other sectors' energy use grew in 2017, which can be directly attributed to the growth in the economy. Energy use in the residential is mainly for space heating and 2017 was a warmer year than 2016.

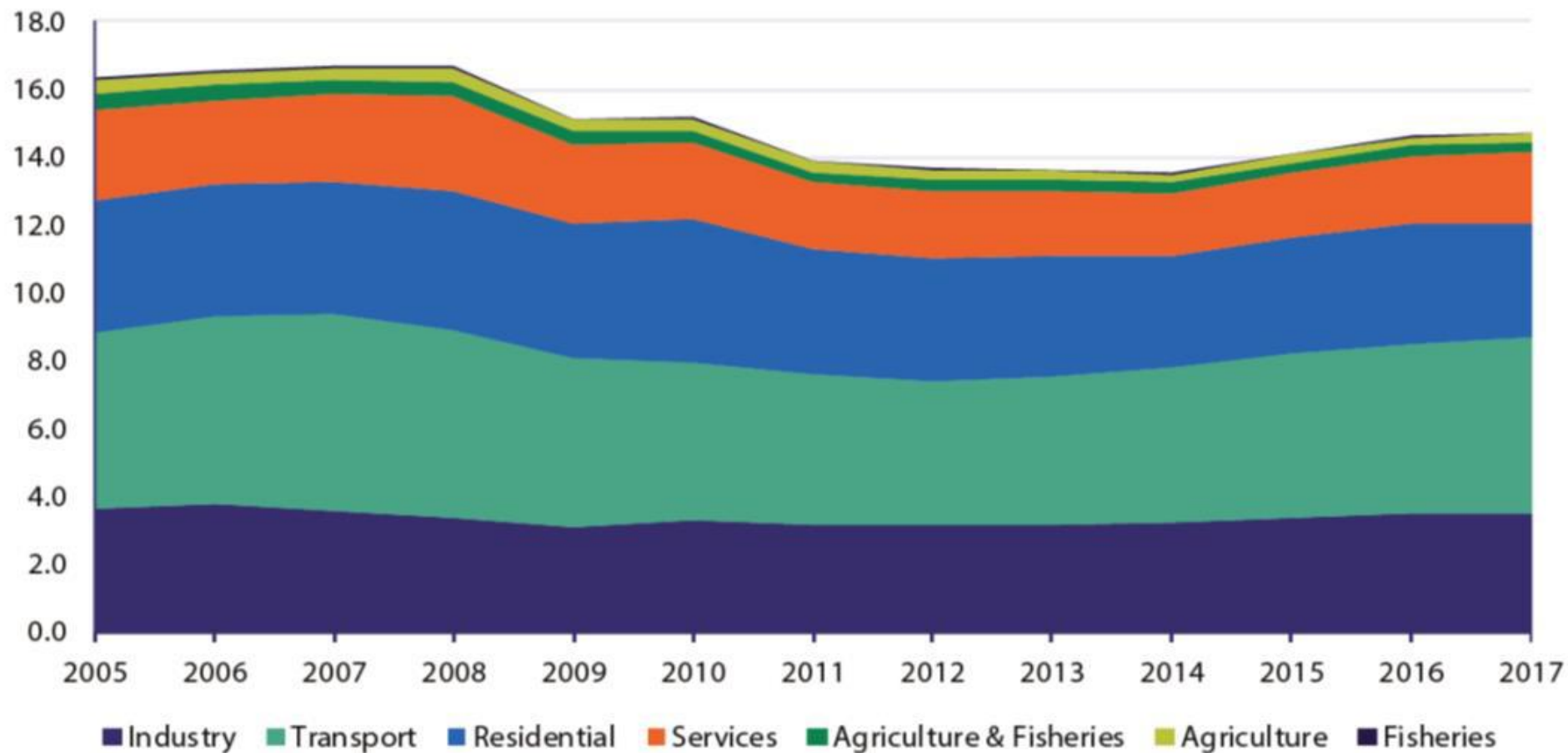


Figure 12: Total Primary Energy Requirement by Sector

Changes in sectoral primary energy consumption presented in *Figure 12* are as follows:

- Transport experienced an increase in primary energy use in 2017 of 2% to 5,138 ktoe. Transport primary energy use fell by 28% between 2007 and 2012 but has increased by 22% since then. Transport remains the largest energy consuming sector with a 36% share of primary energy in 2017.
- In 2017, primary energy use in households fell by 2.9% to 3,398 ktoe. 2017 was warmer than 2016 with 2.9% fewer heating degree days. Residential share of

primary energy was 24% in 2017.

- Industry primary energy increased by 1.5% in 2017 to 3,523 ktoe. Industry's share of primary energy was 24% in 2017.
- Use of primary energy in the commercial and public services sector increased by 1.8% in 2017 to 2,079 ktoe. Services' share of primary energy was 14% in 2017.
- Primary energy use in the residential sector and services sector can be considered collectively as energy in buildings as most of the energy use is associated with heating/cooling and lighting the buildings. In 2017, primary energy in buildings accounted for 38% of primary energy supply. Overall, primary energy use in buildings has fallen by 17% since 2005 (1.5% per annum) and in 2017 it fell by 1.1% to 5,477 ktoe.
- Agriculture/fisheries' primary energy use increased by 2.6% in 2017 to 292 ktoe and accounted for 2% of primary energy.

	Overall Growth %	Average annual growth %					Quantity (ktoe)		Shares %	
	2005 – 2017	'05 – '17	'05 – '10	'10 – '15	'15 – '17	2017	2005	2017	2005	2017
Industry	-3.1	-0.3	-2.1	0.4	2.9	1.5	3,635	3,523	22.9	24.4
Transport	-0.8	-0.1	-2.1	0.8	2.8	2.0	5,181	5,138	32.7	35.6
Residential	-13.5	-1.2	1.5	-4.1	-0.5	-2.9	3,928	3,398	24.8	23.6
Services	-21.5	-2.0	-3.0	-3.2	3.7	1.8	2,647	2,079	16.7	14.4
Agriculture / Fisheries	-37.8	-3.9	-5.2	-5.1	2.9	2.6	468	292	3.0	2.0

Table 42: Growth Rates, Quantities and Shares of TPER by Sector

Energy use can be categorised by its mode of application: whether it is used for mobility (transport), power applications (electricity) or for thermal uses (space, water or process heating). These modes also represent three distinct energy markets. Where thermal or transport energy is provided by electricity (e.g. electric heaters and electric vehicles) this energy is considered under electricity, and not under thermal or transport, so that double counting is avoided.

In 2005, thermal uses for energy (5,683 ktoe) accounted for the highest share of primary energy at 36% while transport and electricity were equal at 32% In 2017 the transport share had risen to 35% (5,063 ktoe), the thermal share had fallen to 32% (4,689 ktoe) and the share of energy use for electricity generation was 33% (4,696 ktoe).



Figure 13: Primary Energy by Mode of Application

Final energy demand

The effect of the economic downturn is evident from 2008 to 2012. It is also evident from *Figure 14* that transport continues to dominate as the largest energy consuming sector (on a final energy basis) with a share of 43% in 2017. The shares of the industry and residential sectors have decreased since 1990. In 2017 industry accounted for 21% of final energy use and the residential sector for 22%.

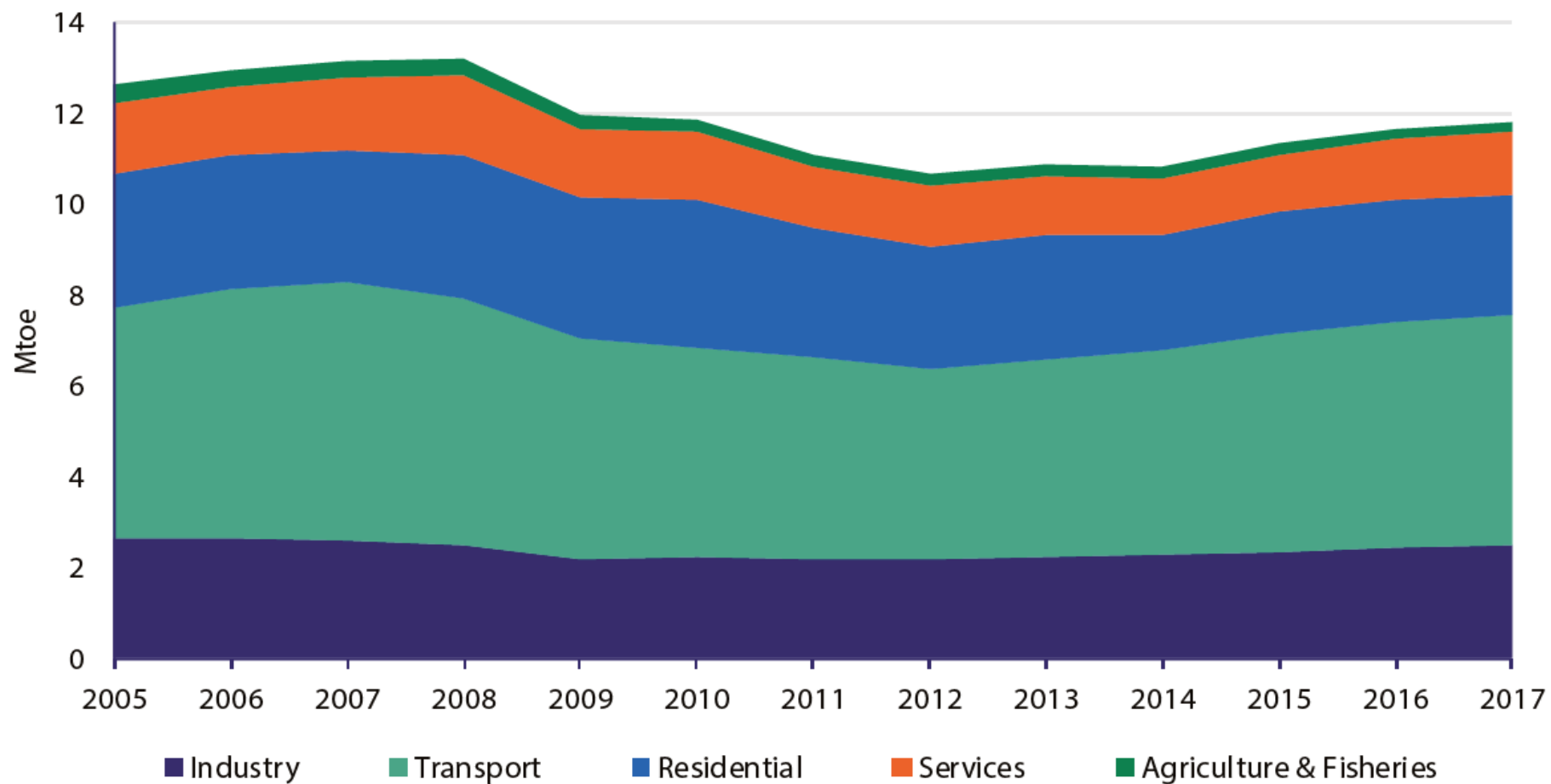


Figure 14: Total Final Energy Consumption by Sector

The changes in growth rates, quantities and shares are shown in [Table 43](#) and summarised as follows:

- Overall final energy consumption grew by 1.4% in 2017 – an increase of 169 ktoe to 11,821 ktoe – with all sectors showing growth except the residential sector.
- There was a 4.2% increase (57 ktoe) in final energy use in the services sector in 2017 to 1,392 ktoe. Correcting for weather the increase was 9.8%.
- In 2017, final energy use in industry grew by 3.4% – 82 ktoe in absolute terms – to 2,516 ktoe. Over the 2005 – 2017 period, the average growth rate in final

energy use in industry was -0.4% per annum (or 4.4% decrease in absolute terms) and its share of TFC remained steady at 21%.

- Energy use in transport grew in 2017 by 2% to 5,067 ktoe but in absolute terms it experienced the highest increase in 2017 of 98 ktoe.
- Final energy use in the residential sector fell by 77 ktoe or 2.9% in 2017 to 2,609 ktoe. Correcting for weather, residential energy use increased by 2.6%.
- The agricultural and fisheries sectors' relative share fell from 3.0% in 2005 to 2.0% in 2017. Agriculture energy consumption increased in 2017 by 4.1% (9 ktoe) to 236 ktoe.

	Overall Growth %	Average annual growth %					Quantity (ktoe)		Shares %	
	2005 – 2017	'05 – '17	'05 – '10	'10 – '15	'15 – '17	2017	2005	2017	2005	2017
Industry	-4.4	-0.4	-3.1	1.0	3.1	3.4	2,633	2,516	20.9	21.3
Transport	-0.3	0.0	-2.0	0.8	2.9	2.0	5,084	5,067	40.3	42.9
Residential	-11.1	-1.0	2.1	-4.0	-0.9	-2.9	2,937	2,609	23.3	22.1
Services	-11.3	-1.0	-1.3	-2.7	4.2	4.2	1,569	1,392	12.4	11.8
Agriculture / Fisheries	-38.4	-4.0	-5.1	-5.6	3.4	4.1	383	236	3.0	2.0
Total	-6.2	-0.5	-1.2	-1.0	2.2	1.4	12,606	11,821		

Table 43: Growth Rates, Quantities and Shared of TFC by Sector

- ii. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling⁸⁴

The heat demand in Ireland is generally low density in nature. The heat mapping and analysis of linear heat density demonstrates that around 90% of the heat demand is at densities too low to make DH a viable proposition. The potential for heat networks at 3,000 MWh / km and 5,000 MWh / km linear heat densities is negligible at less than 0.1% of the country's heat demand. At 10,000 MWh / km linear heat density, an economic potential of around 300 GWh per year (roughly 30,000 dwellings) is identified with a cost benefit of around €33million NPV, largely based on a large zone in Dublin. This is equivalent to around 1.5% of Ireland's heat demand, and therefore whilst small, still an appreciable potential. If the heat density was lowered, the technical potential may increase, but the proportion which is uneconomic is likely to increase. The relatively small potential for heat networks will mean that CO₂ and primary energy savings at a national

⁸⁴

In accordance with Article 14(1) of Directive 2012/27/EU.

level will not be significant. The analysis shows that the most likely potential appears to be based around two types of district heating schemes:

Large scale schemes (in Dublin) which have a small cost benefit over the counterfactual technology options, and which are reliant on a source of waste heat from power stations for economic viability, although other heat sources are only marginally non cost effective. Small scale schemes (potentially outside of Dublin), where there is a much larger cost benefit in terms of levelised cost, but the overall heat provision potential is very limited. These types of scheme are likely to be located where more expensive existing heating sources prevail (potentially off the gas network). The predominant heat network heat source is boilers due to the small scale of the schemes. Whilst the economic potential for heat networks is identified as relatively low, appropriate programmes and support mechanisms will need to be put in place at a national or local level if specific opportunities are to be realised. It will be important for the public sector to take a lead if any of the schemes are likely to succeed. In particular it is recommended that a detailed energy master planning assessment of Dublin is commenced making use of information from this study, and Dublin specific studies, with a view to identifying heat network areas for further feasibility testing . In virtually all areas, alternative low carbon technology options at a building scale, such as heat pumps, can provide a more cost effective heat source than heat networks. This suggests that future priorities for Ireland should be generally concentrated around the deployment and incentivising of building scale technologies including building scale CHP.

Linear heat density can be expressed as MWh heat demand per km road length and is a useful proxy for heat network costs and viability. Codema have conducted studies in areas of Dublin ⁸⁵to identify where district heating may be suitable.

iii. Projections considering existing energy efficiency policies, measures and programmes as described in point 1.2.(ii) for primary and final energy consumption for each sector at least until 2040 (including for the year 2030)⁸⁶

The results for energy savings from energy efficiency policies and measures below represent demand side savings only. Primary energy savings include the primary energy equivalent of electricity savings in the end-use sectors. Autonomous savings are not accounted for in these tables.

Most national energy efficiency programmes assumed to continue delivering their 2017 achieved level of savings until the end of 2021. No further activity under these schemes assumed from 2022 onwards. Achieved 2017 savings under EEOS are assumed to be maintained until 2030. No further savings are included after 2030 in the WEM scenarios.

*Note that these are Demand side savings (primary energy equivalent) only.

⁸⁵ <http://www.codema.ie/media/news/most-areas-suitable-for-district-heating-in-dublin-city/>

⁸⁶This reference business as usual projection shall be the basis for the 2030 final and primary energy consumption target which is described in 2.3 and conversion factors

Table 44: NECP Scenario 1 (Estimated primary and final energy savings and consumption 2017-2040, high oil)

Primary Energy Savings (GWh)	2017	2020	2030	2040
Household	6,467	8,032	9,900	10,017
Services	5,460	7,681	13,266	13,266
Industry	2,713	3,015	3,115	3,115
Transport	1,515	1,514	2,252	4,298
Cross-Sectoral	1,293	1,433	1,298	1,199
Total	17,448	21,674	29,832	31,895
Total Primary Energy Consumption (GWh)				
Household	39,414	45,115	47,558	48,069
Services	24,213	27,147	37,414	37,599
Industry	40,961	38,558	44,089	45,441
Transport	60,819	65,475	70,268	70,819
Other	3,380	2,928	3,336	3,655
Total	168,787	179,223	202,665	205,582

Final Energy Savings (GWh)	2017	2020	2030	2040
Household	6,213	7,700	9,373	9,557
Services	4,663	6,533	11,583	11,861
Industry	2,244	2,485	2,603	2,688
Transport	1,515	1,514	2,252	4,298
Cross-Sectoral	1,293	1,433	1,298	1,199
Total	15,927	19,664	27,111	29,603

Total Final Energy Consumption (GWh)				
Household	30,327	35,443	35,761	36,939
Services	16,190	16,517	21,415	23,730
Industry	29,254	26,726	29,727	32,716
Transport	58,066	62,777	66,569	66,045
Other	2,743	2,263	2,536	2,918
Total	136,579	143,726	156,008	162,348

The savings modelled by policy and measure are largely (currently) modelled independent of any price effects on decisions to invest in energy efficiency. Impacts are modelled based on government expenditure on energy efficiency support programmes and the anticipated impact of regulations and tax incentives driving energy efficient investments.

For the lower oil price scenarios, demand for energy is higher. This leads to some variation in energy savings estimates for the different scenarios. E.g.

- Carbon tax: Increased savings impact from carbon tax modelled for low price scenarios given higher energy demand.
- Smart meters: lower prices lead to higher electricity demand and higher savings given the savings estimate is based on a percentage reduction of demand caused by smart meter plus in-home display.
- Heat pumps: Heat pump uptake is modelled using SEAI's BioHeat model. That model includes a technology uptake simulation based on price signals and other barriers to uptake. Hence savings from heat pump uptake are lower in low price scenarios given the reduced impact of fossil fuel price signals on (particularly business) consumers.

Table: 45 NECP Scenario 3 (With Existing Measures, low oil price) (Estimated primary and final energy savings and consumption 2017-2040, low oil)

Primary Energy Savings (GWh)	2017	2020	2030	2040
Household	6,467	8,032	9,911	10,030
Services	5,460	7,681	13,266	13,266
Industry	2,713	3,015	3,115	3,115
Transport	1,515	1,514	2,252	4,298
Cross-Sectoral	1,293	1,643	1,674	1,546
Total	17,448	21,885	30,219	32,256
Total Primary Energy Consumption (GWh)				
Household	39,414	44,822	46,734	51,954
Services	24,213	28,691	37,983	42,940
Industry	40,961	41,826	46,363	53,019
Transport	60,819	70,430	80,110	82,683
Other	3,380	3,291	3,589	3,979
Total	168,787	189,060	214,779	234,576

Final Energy Savings (GWh)	2017	2020	2030	2040
Household	6,213	7,702	9,423	9,567
Services	4,663	6,539	11,719	11,864
Industry	2,244	2,488	2,645	2,689
Transport	1,515	1,514	2,252	4,298
Cross-Sectoral	1,293	1,643	1,674	1,546

Total	15,927	19,885	27,713	29,963
Total Final Energy Consumption (GWh)				
Household	30,327	35,446	37,848	41,651
Services	16,190	18,255	25,020	28,944
Industry	29,254	30,289	35,577	41,520
Transport	58,066	67,735	76,715	78,230
Other	2,743	2,655	3,022	3,365
Total	136,579	154,379	178,182	193,709

- iv. Cost-optimal levels of minimum energy performance requirements resulting from national calculations, in accordance with Article 5 of Directive 2010/31/EU

A 2018 report has been completed by the Department of Housing, Planning and Local Government on the development of cost-optimal calculations for Gap Analysis for residential Buildings in Ireland, under Directive 2010/31/EU on Energy Performance of Buildings. See:

https://www.housing.gov.ie/sites/default/files/publications/files/cost_optimal_residential_report_ireland_2018.pdf

The non-residential cost-optimal report is in preparation and is due to be completed shortly.

4.4. Dimension energy security

- i. Current energy mix, domestic energy resources, import dependency, including relevant risks

Current energy mix

Ireland's current energy mix is illustrated below in terms of primary energy requirement by fuel. Primary energy consumption in Ireland in 2017 was 14,473 ktoe, a 0.5% increase on the previous year. Over the period 2005 – 2017 Ireland's annual TPER fell in absolute terms by 8.7% (0.8% per annum on average).

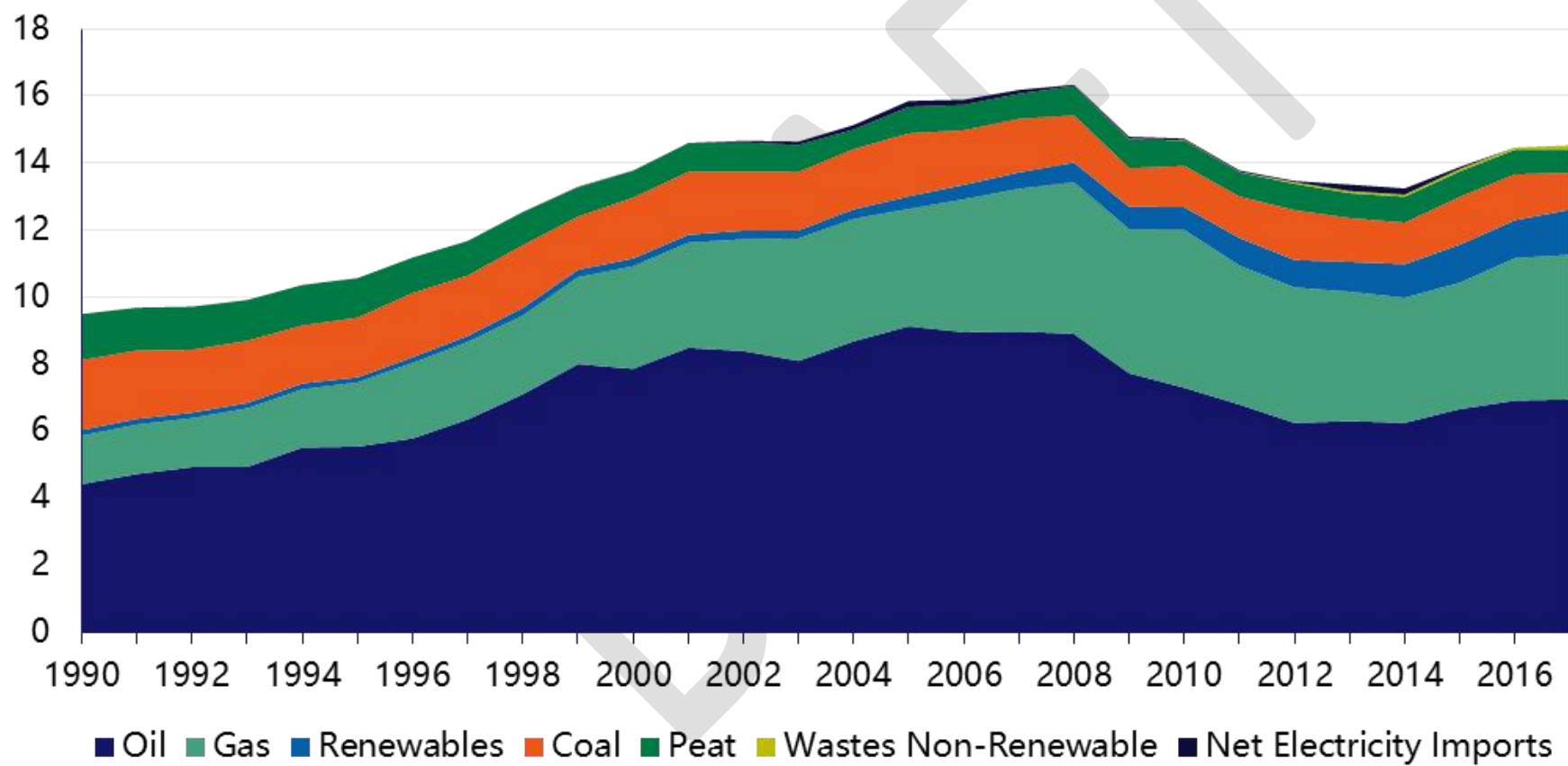


Figure 15: Total primary energy requirement by fuel

The following are the main trends in national fuel share:

- Overall primary energy use grew by 0.5% in 2017.
- Fossil fuels accounted for 90% of all energy used in Ireland in 2017. Demand for fossil fuels fell by 1.6% in 2017 to 13,058 ktoe but was 15% lower than in 2005.
- Coal use decreased by 20% in 2017 and its share of TPER fell to 7.6% down from 10.3% in 2015. Since 2005, coal demand has fallen by 42% (4.4% per annum).
- Peat use fell by 5.3% in 2017 and its share of overall energy use was 4.8%.
- Oil continues to be the dominant energy source and maintained a 48% share of TPER in 2017. The share of oil in overall energy use peaked in 1999 at 60%. Consumption of oil, in absolute terms, increased by 0.5% in 2017 to 6,948 ktoe but compared with 2005, oil demand in 2017 was 24% lower.
- Natural gas use increased in 2017 by 1.5% to 4,315 ktoe and its share of TPER increased to 30%. Natural gas use was 23% higher than in 2005.
- Total renewable energy increased by 19% during 2017 to 1,347 ktoe in 2017. Hydro and wind increased by 1.6% and 21% respectively. Biomass use increased by 13.2% in 2017 to 378 ktoe and other renewables increased by 27% to 270 ktoe. The overall share of renewables in primary energy stood at 9.3% in 2017 up from 7.9% in 2016.
- Energy from non-renewable wastes increased by 90% in 2017 to 126 ktoe and accounted for 0.9% of primary energy.
- Ireland continued to be a net exporter of electricity in 2017, exporting 58 ktoe, 4.7% less than in 2016.

	Overall Growth %	Average annual growth %					Quantity (ktoe)		Shares %	
	2005 – 2017	'05 – '17	'05 – '10	'10 – '15	'15 – '17	2017	2005	2017	2005	2017
Fossil Fuels (Total)	-14.7	-1.3	-1.8	-2.1	1.7	-1.6	15,306	13,058	96.6	90.2
Coal	-41.6	-4.4	-8.1	3.0	-12.2	-19.8	1,882	1,099	11.9	7.6
Peat	-12.2	-1.1	-0.7	0.0	-4.8	-5.3	791	695	5.0	4.8
Oil	-23.9	-2.2	-4.4	-1.8	2.2	0.5	9,130	6,948	57.6	48.0
Natural Gas	23.2	1.8	6.1	-4.4	7.0	1.5	3,503	4,315	22.1	29.8
Renewables (Total)	263.8	11.4	12.9	10.9	8.9	18.9	370	1,347	2.3	9.3
Hydro	9.6	0.8	-1.0	6.1	-7.4	1.6	54	59	0.3	0.4
Wind	569.5	17.2	20.4	18.5	6.4	21.1	96	640	0.6	4.4
Biomass	109.6	6.4	3.1	6.2	15.2	13.2	180	378	1.1	2.6
Other Renewables	572.8	17.2	34.2	4.5	11.4	27.1	40	270	0.3	1.9
Wastes (Non-Renewable)	-	-	-	51.7	35.5	89.6	-	126	-	0.9
Electricity Imports (net)	-133.2	-	-25.5	7.4	-	-4.7	176	-58	1.1	-0.4
Total	-8.7	-0.8	-1.5	-1.2	2.1	0.5	15,852	14,473		

Table 46: Growth rates, Quantities and Shares of TPER fuels

Domestic energy resources

Figure 16 shows the indigenous energy fuel mix for Ireland over the period. The reduction in indigenous supply of natural gas (until 2016) is clearly evident from the graph as is the switch away from peat. Production of indigenous gas decreased by 94% over the period between 1990 and 2015 to 106 ktoe but then increased dramatically in 2016 to 2,473 ktoe. It increased again in 2017 to 2,854 ktoe. This is the highest natural gas production level ever recorded in Ireland. This high level of production from the Corrib field is expected to taper off significantly in the next couple of years.

Indigenous renewable energy production increased by 220% between 2005 and 2017 to 1,185 ktoe.

Indigenous production of all energy in Ireland reached the highest level ever with a new peak in 2017 of 4,909 ktoe, up from the previous peak in 2016 at 4,242 ktoe.

Peat production was down since 2013 following significant production during that summer which provided favourable harvesting conditions for peat. In 2017 peat production was up 9.5% to 744 ktoe compared with the previous year.

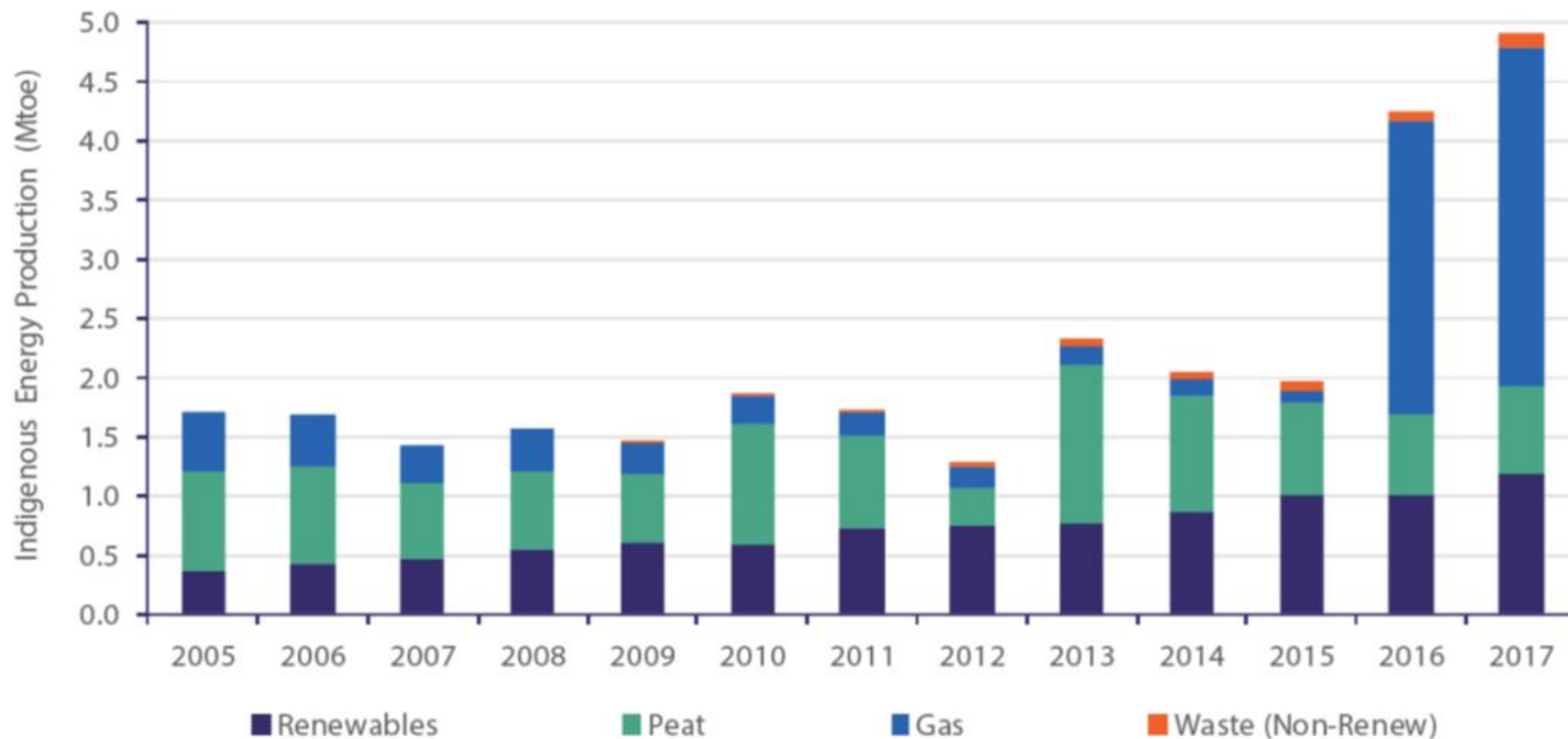


Figure 16: Indigenous Energy Production (Mtoe)

Import dependency

Figure 17 illustrates the trend in import dependency since 1990, comparing it with that for the EU as a whole and shows the dramatic change in Ireland's import dependency in 2016 resulting from the start of natural gas production from the Corrib gas field. Indigenous production accounted for 32% of Ireland's energy requirements in 1990. However, since the mid-1990s import dependency had grown significantly, due to the increase in energy use together with the decline in indigenous natural gas production at Kinsale since 1995 and decreasing peat production. Ireland's overall import dependency reached 90% in 2006. It varied

between 85% and 90% until 2016 when it fell to 69% and further to 66% in 2017. It is estimated that in 2015 the cost of all energy imports to Ireland was approximately €4.6 billion, this fell to €3.4 billion in 2016 due mainly to reduced gas imports but increased again in 2017 to €4 billion. This trend reflects the fact that Ireland is not endowed with significant indigenous fossil fuel resources and has only in recent years begun to harness significant quantities of renewable resources and more recently natural gas from the Corrib field.

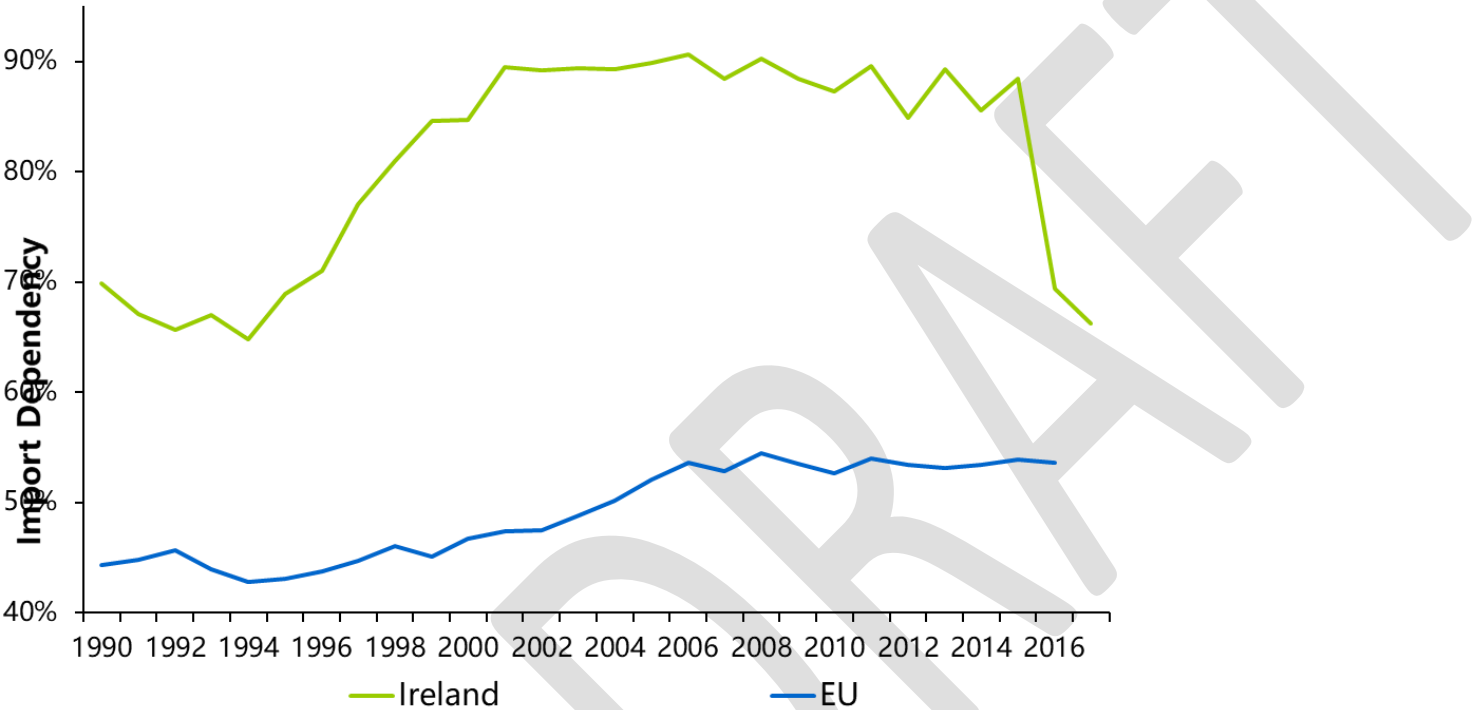


Figure 17: EU and Ireland Import Dependency

Figure 18 shows the trend for net fuel imports (imports minus exports) over the period 2005 – 2017. The dependence on oil, due largely to energy use in transport, is the most striking feature up until 2008. Between 2008 and 2017 net imports have fallen by 35% with oil imports falling 23%. In 2017 net imports fell by 4.3% and were 33% below 2005 levels while oil imports were 26% below 2005. In 2016 gas imports fell by 53% due to new indigenous production from the Corrib gas field. Gas imports fell by a further 17% in 2017.

Coal imports have remained stable over the period, reflecting the base load operation of Moneypoint (coal) electricity generating plant. In 2016, oil, gas and coal accounted for 72%, 14% and 12% of net imports respectively.

Contributions to the decrease in import dependency in 2017 were:

- Natural gas imports were down 17% to 1,409 ktoe;
- Net oil imports were down 3.3% to 7,125 ktoe;

Countering these were;

- Coal imports were up 6.5% to 1,220 ktoe;
- An 14.5% increase in renewable energy imports (biomass and biofuels) to 159 ktoe.

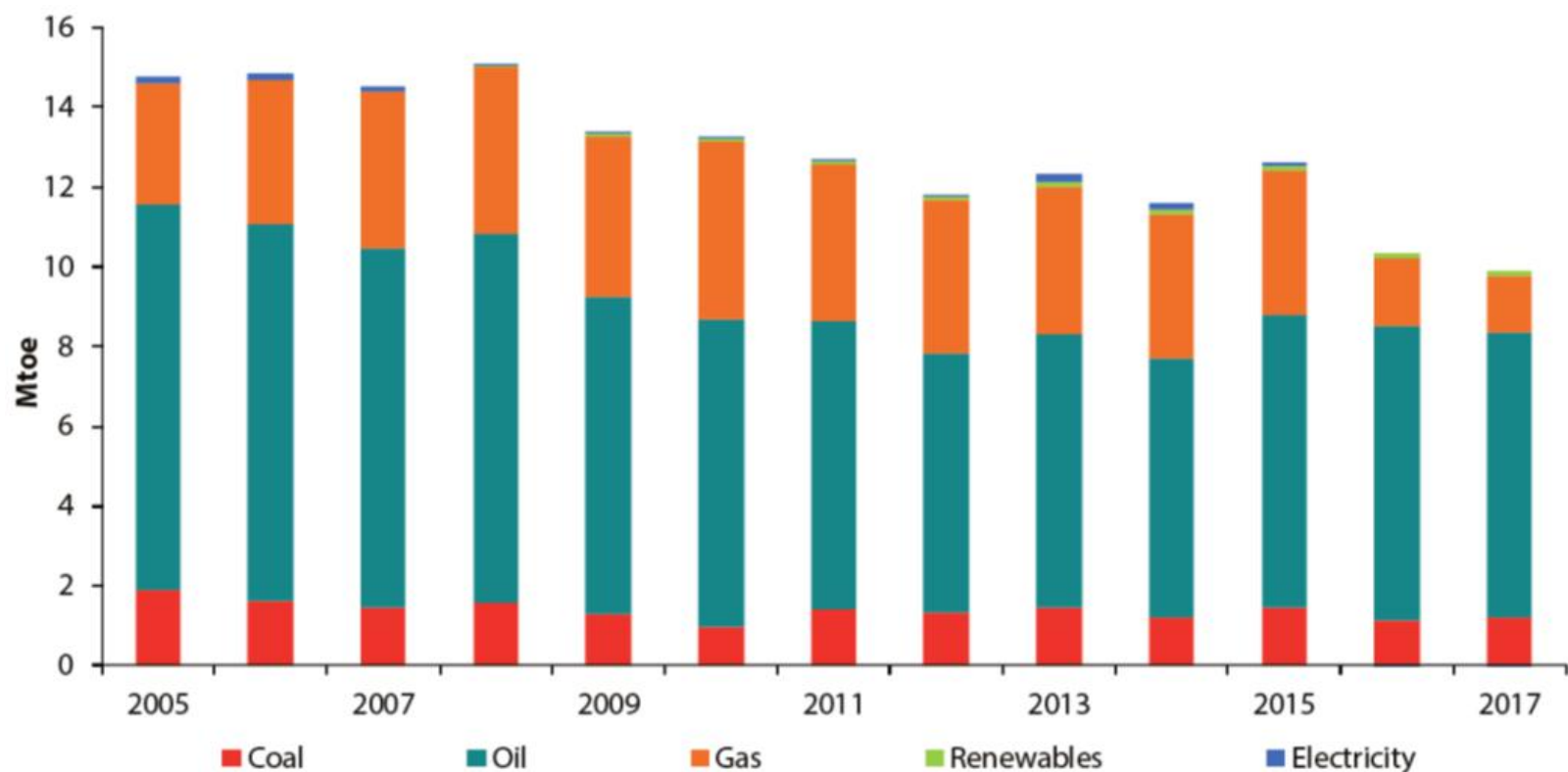


Figure 18: Imported energy by fuel

Relevant Risks -Petroleum Product Availability

Petroleum products will remain part of Ireland's energy mix in the medium term. Ireland, given its import dependency and its geographical position is vulnerable to both domestic supply constraints (for example caused by severe weather) and international oil emergencies (caused by geopolitical or other factors). These risks are mitigated by the State's stockholding of 90 days of petroleum product and by the OEAP, which may be utilised in the event of a prolonged supply constraint.

In the event of a disorderly (no agreement) UK withdrawal from the EU, the British Standards Institute (BSI) is likely to continue to be a member of CEN. As a result, the UK refining industry, due to its domestic use of the relevant aligned BSI standards, is likely to continue to produce product suitable for the Irish market, and for export to the EU as a whole.

ii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

Increase in renewable energy in line with scenarios in the draft NECP. Potential development of ocean energy technologies, depending on technology developments.

Further electricity interconnection to France and Britain in line with scenarios in the draft NECP.

Commercial peat harvesting to end 2028 with generation from peat to end by 2030.

100% oil import dependency unless there is a commercial oil find.

Corrib – expected lifetime of 15 years to 2030. Declining production from the Corrib gas field: <https://www.gasnetworks.ie/corporate/gas-regulation/system-operator/publications/GNI-Network-Development-Plan-2017.pdf>

	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26
Corrib (TWh/y)	35.84	31.61	31.94	30.66	24.49	20.26	17.19	14.45	15.26
Inch (TWh/y)*	5.44	2.96	1.97	1.46	0	0	0	0	0

*The anticipated decline in domestic gas production
implies Ireland's dependence on imports in the medium term.*

* Inch refers to Kinsale Fields: Kinsale Head, Ballycotton, Southwest Kinsale and Seven Heads gas fields

Note: The forecast is based on 'gas year', which starts on 1st of October and ends on 30th of September of the following calendar year. The terawatt (TW) is equal to one trillion (10¹²) watts. Power used worldwide is commonly measured in terawatts.

Source: Gas Networks Ireland (2017), *Network Development Plan 2017*⁸⁷

Table 47 Ireland's gas production outlook (maximum annual supply)

⁸⁷ <https://www.gasnetworks.ie/corporate/gas-regulation/system-operator/publications/GNI-Network-Development-Plan-2017.pdf>

Dimension energy security	Unit	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
Gross inland consumption															
Solids	ktoe	1802	2183	2149	2187	2197	2144	2104	2144	2090	2048	2030	2003	373	328
Oil	ktoe	7003	7110	7186	7206	7188	7160	7108	7116	7137	7133	7140	7141	7027	6916
Natural gas	ktoe	4227	4156	4185	4442	4514	4951	5132	5151	5228	5427	5403	5389	6905	7264
Nuclear	ktoe	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity	ktoe	-58	-159	-118	-52	-12	-191	-263	-273	-273	-402	-389	-361	-403	-437
Renewable energy forms	ktoe	1355	1963	2023	2101	2174	2253	2323	2438	2521	2644	2766	2894	2911	3169
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Domestic energy sources															
Solids	ktoe	684	566	561	567	557	546	546	543	530	527	529	519	235	218
Oil	ktoe	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	ktoe	3248	2746	2636	2106	1742	1478	1243	1312	950	741	533	324	0	0
Nuclear	ktoe	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Renewable energy sources	ktoe	1355	1963	2023	2101	2174	2253	2323	2438	2521	2644	2766	2894	2911	3169
Import dependency	%	#N/A	65%	66%	70%	72%	73%	74%	73%	75%	75%	76%	76%	79%	78%
Relevant risks															

Table 48: NECP 1 (With Existing Measures, high oil price) Gross inland consumption, domestic energy sources and import dependency 2017-2040, with existing measures, high oil price

Dimension energy security	Unit	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
Gross inland consumption															
Solids	ktoe	1802	2082	2015	1971	1756	1582	1076	1016	893	837	797	835	358	316
Oil	ktoe	7003	7661	7807	7915	7981	8037	8062	8116	8175	8201	8236	8250	8217	8190
Natural gas	ktoe	4227	4533	4672	5018	5188	5682	6092	6210	6348	6599	6635	6606	7900	8527
Nuclear	ktoe	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity	ktoe	-58	-124	-96	-5	113	-9	1	9	41	-79	-57	-20	-170	-154
Renewable energy forms	ktoe	1355	1979	2037	2104	2169	2232	2287	2386	2452	2558	2665	2777	2830	3136
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Domestic energy sources															
Solids	ktoe	684	565	560	565	556	543	543	530	533	529	519	510	234	217
Oil	ktoe	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural gas	ktoe	3248	2746	2636	2106	1742	1478	1243	1312	950	741	533	324	0	0
Nuclear	ktoe	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Renewable energy sources	ktoe	1355	1979	2037	2104	2169	2232	2287	2386	2452	2558	2665	2777	2830	3136
Import dependency	%	#N/A	67%	68%	72%	75%	76%	77%	76%	78%	79%	79%	80%	83%	83%

Table 49: NECP 3 (With Existing Measures, low oil price), Gross inland consumption, domestic energy sources and import dependency 2017-2040, with existing measures, low oil price

4.5. Dimension internal energy market

4.5.1. Electricity interconnectivity

i. Current interconnection level and main interconnectors⁸⁸

East West Interconnector (EWIC) – Ireland to Great Britain – 500MW

North South – Ireland to Northern Ireland – 300MW

ii. Projections of interconnector expansion requirements (including for the year 2030)⁸⁹

Electricity interconnectivity	Unit	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
Northern-Ireland and Republic of Ireland	MW	450	450	450	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Republic of Ireland and England	MW	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Republic of Ireland and France	MW	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 50: NECP Scenario 1 (With Existing Measures, high oil price) Estimated levels of interconnection with existing measures and a high oil price, 2017-2040

Electricity interconnectivity	Unit	2017	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
Northern-Ireland and Republic of Ireland	MW	450	450	450	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Republic of Ireland and England	MW	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Republic of Ireland and France	MW	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 51: NECP Scenario 3 NECP 3: (With Existing Measures, low oil price) Estimated levels of interconnection with existing measures and a low oil price, 2017-

⁸⁸ With reference to overviews of existing transmission infrastructure by Transmission System Operators (TSOs).

⁸⁹ With reference to national network development plans and regional investment plans of TSOs.

4.5.2. Energy transmission infrastructure

i. Key characteristics of the existing transmission infrastructure for electricity and gas⁹⁰

Gas Networks

Gas Networks Ireland (GNI) operates both the transmission (2,427 km) and distribution networks (11,527 km) in Ireland. The transmission network transports gas from the entry points at Moffat, Inch and Bellanaboy to the distribution networks and connected loads (e.g. gas-fired power generators). GNI's transmission network also supplies gas to Northern Ireland and the Isle of Man, both parts of the United Kingdom.

The Moffat entry point connects GNI's network to the national grid gas network in the United Kingdom and allows for gas imports to Ireland via two subsea interconnectors (IC1 and IC2). The existing interconnectors do not allow Ireland to export gas to the United Kingdom as they are unidirectional. The landfall installations for the interconnectors entering Ireland are located close to Loughshinny for IC1 and Gormanston for IC2 in the East of Ireland. The Inch entry point connects Kinsale and Seven Heads gas fields to the onshore GNI network; the Bellanaboy entry point connects the Corrib gas field to the onshore GNI network. The Northern Ireland gas network connects to GNI's network at Twynholm in Scotland and delivers gas to Northern Ireland via the Scotland Northern Ireland Pipeline (SNIP). The South North Pipeline (SNP) is an onshore gas transmission pipeline from Gormanston to Northern Ireland.

The distribution network currently delivers gas to over 680,000 customers across Ireland and the network has been extended to Nenagh and Wexford towns. GNI has completed work to extend distribution to Listowel in the South West of Ireland and the town has been connected to the network. Work has also commenced on the 29km extension to the CenterParcs leisure development in Co. Longford.

⁹⁰

With reference to overviews of existing transmission infrastructure by TSOs.



Figure 19: Map of natural gas infrastructure

Infrastructure	Function	Capacity
Moffat Entry Point (Scotland, UK)	Entry point to GNI system serving Ireland via the onshore system in Scotland and sub-sea interconnectors, IC1 & IC2. It also serves Northern Ireland via Twynholm installation and SNIP pipeline. Physically unidirectional.	342 GWh/d
South North CSEP* (Ireland)	Exit point to Northern Ireland, supplied from IC2	66.3 GWh/d
Corrib gas field (Ireland)	Domestic production facility that began commercial operation in December 2015	103.5 GWh/d
Southwest Kinsale storage (Ireland)	Underground storage facility (depleted gas field), due to be decommissioned in 2021	27.3 GWh/d

* CSEP means connected system exit point

Table: 52 Major gas network infrastructure in Ireland

Ireland has no LNG terminal yet, although there are a number of commercial proposals, one of which was included in the EU's third list of PCIs. The Southwest Kinsale storage facility was a gas production and seasonal storage facility located off the Southern coast of Ireland with a working volume of 230 million standard cubic meters (mscm), about 5% of Ireland's annual gas consumption in 2016/17. After it was depleted, the Southwest Kinsale field became Ireland's first offshore gas storage facility and operated from 2001 to 2017. Since then, gas injection ceased and current production of cushion gas is also expected to cease in 2020; the field will be decommissioned in 2021. As of 2018, there is no other gas storage facility in operation in Ireland. The decision to stop gas storage operation in the Kinsale reservoirs was a commercial decision.

Electricity Transmission

The transmission system comprises approximately 6,400 kilo-metres (km) of high voltage (HV) overhead lines and underground cables and over 200 substations. Electricity generated in power plants is transformed to higher voltage levels – 110kV; 220 kV; 275 kV and 400 kV – and fed into the transmission system. The Dublin area is an exception as the 100kV lines and cables and some of the 220/110kV transformer stations belong to the distribution system.

Ireland's geographical location brings challenges in terms of interconnection with neighbouring countries. Ireland is exclusively connected to the United Kingdom through two electricity interconnectors: The 300 MW North-South interconnector, linking the electricity systems of Ireland and Northern Ireland, and the 500 MW East-West Interconnector connecting Ireland and Wales (United Kingdom). EirGrid owns and operates both interconnectors. Ireland is currently not meeting the indicative EU electricity interconnection target of at least 10% of installed capacity by 2020; its current level of interconnection is 7.4%. When the UK leaves the EU, Ireland will have no direct electrical interconnection with the rest of the EU.

Ireland's current transmission network can safely absorb a level of renewable production generation of up to 42% of total electricity generated without affecting security of supply. Higher penetration levels, foreseen as part of the NECP, will be necessitate further interconnection.



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

Figure 20: Map of Ireland's electricity infrastructure

ii. Projections of network expansion requirements at least until 2040 (including for the year 2030)⁹¹

Project	Project promoter	Aim	Status
Twinning of South West Scotland Onshore System (SWSOS) 1st PCI list	GNI UK Ltd	Twinning of unparalleled section of pipeline. Moffat capacity increase to 375 GWh/d.	To be completed in 2018. Funding provided by Connecting Europe Facility (30%) and regulatory capital allowance.
Physical reverse flow at Moffat 3rd PCI list	GNI UK Ltd	Making Moffat entry point bi-directional.	Feasibility study ongoing. Funding provided by Connecting Europe Facility (50%).
Shannon LNG 3rd PCI list	Shannon LNG	Construction of LNG process tanks, and re-gasification facilities with a maximum export capacity of 191.1 GWh/d.	Planning permission received. Earliest commissioning in 2021, if a final investment decision is taken by the end of 2018.

Table 53 : Irish gas infrastructure development projects

Although not as part of the PCI, another project under consideration is the physical reverse flow (bi-directional) of the South-North pipeline led by GNI UK Ltd. In addition to the twinning of the SWSOS between Cluden and Brighthouse, work is ongoing to build independent compressor systems for IC1 and IC2. The project is due for completion in 2020.

Gas Network Ireland does an annual 10 year network development plan⁹², which can be found online.

⁹¹ With reference to national network development plans and regional investment plans of TSOs.

Electricity

EirGrid is currently working on two major extensions to the transmission system both related to expected strong demand increase in the greater Dublin area. The West Dublin Project includes the installation of a 220/110kV gas insulation switchgear substation that will connect to an existing 220kV double circuit line. The project responding to a significant increase in demand associated with the growth of major multinational companies in a business park in western Dublin. This project is scheduled for completion in 2019 and is sized to accommodate potential future demand growth.

The Kilkenny-Laois reinforcement project will address security of supply problems resulting from strongly growing demand and projected further growth. The project comprises a new 400/110 kV substation near Portlaoise which will be connected to the existing 400 kV and 110 kV lines, a new 110kV/38kV substation in Kilkenny and new 110kV overhead lines that links with the new substation near Portlaoise. The project is scheduled for completion in 2021.

Proposed infrastructure	Capacity (MW)	Countries	Project promoter	Expected start date
Second North-South interconnector	1500	Connecting Ireland and the UK (Northern Ireland)	EirGrid	2023 (planning permission received)
Greenlink interconnector; (EU project of common interest)	500	Connecting Ireland and the UK (Wales)	Greenlink	2023
Celtic interconnector (EU project of common interest)	700	Connecting Ireland and France	EirGrid	2025

Table 54: Electricity interconnector projects

Ireland is pursuing three new projects for interconnectors. A second North-South interconnector, the Greenlink interconnector and the Celtic interconnector. These last two projects are on the third list of the EU projects of common interest (PCI). Only the Celtic interconnector would however, ensure continuous market coupling with the European Union once the United Kingdom has exited the EU.

The existing North-South interconnector is running at full capacity and creates a market bottleneck. The construction of a new 400 kV AC/ 1500 MW overhead line North-South interconnector is currently planned to improve the security of electricity supply across the island of Ireland, and improve the capacity and reliability of

⁹² here: <https://www.gasnetworks.ie/corporate/company/investor-relations/GNI-Network-Development-Plan-2017.pdf>

both grids. The increased capacity will also facilitate the connection of additional renewable capacity to the grid and help reduce curtailment.

The Celtic interconnector is a proposed 700 MW connection between the south coast of Ireland and the north-west coast of France. EirGrid is developing this project in partnership with the French Transmission System Operator, RTE. The length of the Celtic interconnector would be approximately 600 km; about three times longer than the existing East-West interconnector. The two TSOs submitted an investment request to the Irish and French regulatory authorities in September 2018. If built, following the UK's exit from the EU, this project will be the only direct electricity connection between Ireland and the EU's electricity market.

The Greenlink project is a proposed 500 MW interconnector between Ireland and the United Kingdom. The proposed route is running from the Great Island substation, in Ireland, to the Pembroke substation, in Wales. Element Power, a private investor, is promoting the project. The construction is planned to start in 2020 with the interconnector becoming operational in 2023. The CRU has made an initial assessment on the Greenlink project in October 2018 and determined that it is in the public interest. Following the submission of sufficiently detailed financial and technical information from the Greenlink developer, the CRU expects to undertake further consultation in 2019 on the proposed regulatory regime to support Greenlink. CRU is also closely liaising with the regulator for gas and electricity markets in Great Britain to explore the potential for a final project assessment process.

EirGrid's all-island generation capacity statement 2018-2027⁹³ provides further data on potential demand increases which will have network implications. EirGrid assumes that due to the expected growth in demand from large energy users, the electricity demand in Ireland could grow by up to 57% in the next 10 years. To be prudent, in the generation capacity statement, there is also a scenario where this growth is much lower, at 20%.

4.5.3. Electricity and gas markets, energy prices

i. Current situation of electricity and gas markets, including energy prices

The Sustainable Energy Authority of Ireland (SEAI), acting on behalf of EU statistics agency, Eurostat, is responsible for collecting and evaluating statistics on Irish electricity and gas prices, on which it publishes a regular six monthly report, including analysis of recent trends and a comparison between Ireland with EU and Euro Area averages. As of November 2018, the most recent SEAI report covered the period July-December 2017. Key highlights of this latest report were the following:

⁹³ http://www.eirgridgroup.com/site-files/library/EirGrid/Generation_Capacity_Statement_2018.pdf

Key Highlights

There are a number of factors that influence energy prices in Ireland. These include, but are not limited to, imported fuel prices, energy infrastructure investment costs, electricity generating fuel mix and non-energy costs that affect energy prices (for example, taxes levied, employment costs, raw material and shipping costs).

Business Electricity

The weighted average price of electricity to business consumers in Ireland has been above both the Europe¹ and Euro Area² average³ since the second half of 2011. In the current semester (July to December 2017) the weighted average price in Ireland increased by 2.1% and was 11% and 7% above the EU and Euro Area respectively.

[Table 1](#) summarises the key changes for the electricity consumption bands for business in Ireland for the period July to December 2017 and compares with the changes across the EU and Euro Area.

Table 1: Business Electricity Prices (ex-VAT) – 2nd Semester 2017

Band (GWh)	Share of business electricity in Ireland	% change since last semester			Ireland's ranking* for electricity price in Europe
		Ireland	Europe	Euro Area	
IA (<0.02)	7.5%	4.5%	-1.4%	-2.7%	7 th
IB (0.02 – 0.5)	27.4%	0.6%	-2.6%	-3.2%	8 th
IC (0.5 – 2.0)	14.0%	0.3%	-1.7%	-2.1%	6 th
ID (2.0 – 20)	24.4%	-2.5%	-1.1%	-1.5%	9 th
IE (20 – 70)	8.9%	4.8%	-3.7%	-4.8%	7 th
IF & IG (>70)	17.7%	4.9%	-5.8%	-7.6%	6 th

Source: Eurostat and SEAI

* A ranking of 1 means most expensive

Since the last semester (January to June 2017), all consumption bands except ID experienced increases in the price of electricity to business in Ireland ranging from a decrease of 0.6% in band IB to 4.9% in band IF. Price fell in band ID in Ireland by 2.5%. Price fell in all consumption bands in both the EU and Euro Area.

In terms of ranking, the consumption band ID was the lowest ranking, at ninth most expensive in the EU and bands IC and IF were the highest at sixth.

Business Gas

Since 2013, the weighted average price of gas to business consumers in Ireland has fluctuated between the EU and Euro Area average. In the current semester it increased by 0.7% and was 10% above the EU and 5% above Euro Area.

[Table 2](#) summarises the key changes for the consumption bands in Ireland for the period July to December 2017 and compares with the changes across the Europe and EU Area.

Table 2: Business Gas Prices (ex-VAT) – 2nd Semester 2017

Band (GWh)	Share of business gas in Ireland	% change since last semester			Ireland's ranking* for electricity price in Europe
		Ireland	Europe	Euro Area	
I1 (<0.28)	9.8%	7.5%	-4.4%	-5.7%	5 th
I2 (0.28 – 2.8)	17.7%	5.0%	-2.7%	-1.3%	5 th
I3 (2.8 – 28)	20.0%	-2.7%	-5.4%	-5.5%	7 th
I4 (28 – 280)	36.3%	0.0%	-4.1%	-4.8%	10 th
I5 (280 – 1,100)	16.2%	–	-1.4%	-1.4%	–

Source: Eurostat and SEAI

* A ranking of 1 means most expensive

Prices increased in the consumption bands I1 and I2 in Ireland by 7.5% and 5% respectively while prices fell in all consumption bands in the EU and Euro Area. Price fell in band I4 in Ireland by 2.7% and remained the same in band I5. Ireland was ranked fifth most expensive in bands I1 and I2, seventh most expensive in band I3 and tenth in band I4.

Table 55 : Business Electricity and Gas Prices (Source : SEAI)

Households Electricity

Between 2011 and the end of 2015, the weighted average price of electricity to household consumers has been above the EU average. In the first semester of 2016 it dropped below the EU average until the second semester of 2017 when it increased to 1% above. The weighted average price of electricity to households in Ireland increased by 5.9% in the second half of 2017.

Table 3 summarises the key changes for the electricity consumption bands for households in Ireland for the period July to December 2017 and compares with the changes across the EU and EU Area.

Table 3: Household Electricity Prices (all taxes included) – 2nd Semester 2017

Band (MWh)	Share of household electricity in Ireland	% change since last semester			Ireland's ranking* for electricity price in Europe
		Ireland	Europe	Euro Area	
DA (<1.0)	2.6%	0.6%	-4.7%	-7.0%	4 th
DB (1.0 – 2.5)	12.0%	1.2%	0.0%	-1.1%	4 th
DC (2.5 – 5.0)	38.8%	2.2%	0.3%	-0.7%	4 th
DD (5.0 – 15)	39.0%	4.8%	1.7%	0.7%	7 th
DE (>15)	7.6%	3.1%	2.5%	2.1%	10 th

Source: Eurostat and SEAI

* A ranking of 1 means most expensive

The price increased in all bands in Ireland ranging from 0.6% increase in band DA to 4.8% in band DD. Price increased generally in Europe with the exception of band DA where it fell by 4.7%. In the Euro Area, price fell in bands DA, DB and DC but increased in DD and DE. Ireland was 15% and 5% above the EU average in DC and DD respectively and was fourth and seventh most expensive respectively in the EU in both bands.

Households Gas

The weighted average price of gas to household consumers in Ireland was below both the EU and Euro Area since 2009. In the current semester it was 9.2% and 21% below the EU and Euro Area respectively. The weighted average price of gas to households in Ireland increased by 3.2% in the second half of 2017.

Table 4 summarises the key changes for the consumption bands in Ireland for the period July to December 2017 and compares with the changes across the EU and EU Area.

Table 4: Household Gas Prices (all taxes included) – 2nd Semester 2017

Band (MWh)	Share of household gas in Ireland	% change since last semester			Ireland's ranking* for electricity price in Europe
		Ireland	Europe	Euro Area	
D1 (<5.6)	6.2%	12.9%	16.8%	18.2%	12 th
D2 (5.6 – 56)	92.1%	2.7%	8.6%	10.4%	9 th
D3 (>56)	1.8%	-2.5%	-1.1%	0.0%	7 th

Source: Eurostat and SEAI

* A ranking of 1 means most expensive

In the main gas band, D2, the price increased in Ireland but at a lower rate than the EU and the Euro Area. Price decreased by 2.7% in Ireland compared with increases of 8.6% and 10.4% in the EU and the Euro Area respectively. Ireland's ranking remained at 9th most expensive in the EU and was 3% above the EU average but 10% below the Euro Area.

Table 56 : Household electricity and gas prices (Source: SEAI)

Key Data

Business Electricity Prices (ex-VAT) – 2nd Semester 2017

Business Electricity	Band Share	Ireland c/kWh	Ireland relative to:		Ranking* In:		Semester price change:		
			EU	Euro Area	EU	Euro Area	Ireland	EU	Euro Area
Band IA	7.5%	19.9	111%	104%	7	7	4.5%	-1.4%	-2.7%
Band IB	27.4%	15.1	110%	104%	8	8	0.6%	-2.6%	-3.2%
Band IC	14.0%	12.4	111%	105%	6	5	0.3%	-1.7%	-2.1%
Band ID	24.4%	10.1	103%	99%	9	7	-2.5%	-1.1%	-1.5%
Band IE	8.9%	9.3	114%	115%	7	5	4.8%	-3.7%	-4.8%
Band IF	17.7%	8.4	112%	115%	6	5	4.9%	-5.8%	-7.6%
Weighted Average	-	12.6	111%	107%	-	-	2.1%	-	-

Source: Eurostat and SEAI

Business Gas Prices (ex-VAT) – 2nd Semester 2017

Business Gas	Band Share	Ireland c/kWh	Ireland relative to:		Ranking In:		Semester price change:		
			EU	Euro Area	EU	Euro Area	Ireland	EU	Euro Area
Band I1	9.8%	5.2	120%	116%	5	3	7.5%	-4.4%	-5.7%
Band I2	17.7%	4.2	118%	109%	5	3	5.0%	-2.7%	-1.3%
Band I3	20.0%	3.2	115%	110%	7	4	-2.7%	-5.4%	-5.5%
Band I4	36.3%	2.4	105%	102%	10	6	0.0%	-4.1%	-4.8%
Band I5	16.2%	-	-	-	-	-	-	-1.4%	-1.4%
Weighted Average	-	3.3	110%	105%	-	-	0.7%	-	-

Source: Eurostat and SEAI

Residential Electricity Prices (all taxes included) – 2nd Semester 2017

Household Electricity	Band Share	Ireland c/kWh	Ireland relative to:		Ranking In:		Semester price change:		
			EU	Euro Area	EU	Euro Area	Ireland	EU	Euro Area
Band DA	2.6%	41.8	126%	115%	4	4	0.6%	-4.7%	-7.0%
Band DB	12.0%	30.2	133%	125%	4	3	1.2%	0.0%	-1.1%
Band DC	38.8%	23.6	115%	108%	4	3	2.2%	0.3%	-0.7%
Band DD	39.0%	20.1	105%	97%	7	6	4.8%	1.7%	0.7%
Band DE	7.6%	16.4	91%	83%	10	9	3.1%	2.5%	2.1%
Weighted Average	-	22.9	101%	93%	-	-	5.9%	-	-

Source: Eurostat and SEAI

Residential Gas Prices (all taxes included) – 2nd Semester 2017

Household Gas	Band Share	Ireland c/kWh	Ireland relative to:		Ranking In:		Semester price change:		
			EU	Euro Area	EU	Euro Area	Ireland	EU	Euro Area
Band D1	6.2%	8.1	80%	68%	12	9	12.9%	16.8%	18.2%
Band D2	92.1%	6.5	103%	90%	9	7	2.7%	8.6%	10.4%
Band D3	1.8%	5.8	108%	96%	7	5	-2.5%	-1.1%	0.0%
Weighted Average	-	6.6	91%	79%	-	-	3.2%	-	-

Source: Eurostat and SEAI

*Note: A ranking of 1 denotes most expensive.

EU here includes all the European Union 28 countries plus Norway and Turkey.

The Euro Area consists of those European Union countries which have adopted the euro as their currency, currently 18 member states.

Bands mentioned in the table refer to consumption bands defined in the Transparency of Gas and Electricity Prices Regulation. The consumption levels for each band is shown at the start of sections [E.1](#), [E.2](#), [E.3](#) and in [Appendix 1 – Electricity and Gas Prices in Ireland](#).

Table 57 : Key Electricity and Gas price Data (Source : SEAI)

- ii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

Market design will continue to evolve in line with EU and national policy objectives to facilitate increased levels of energy system decarbonisation, consistent with security of supply and price competitiveness.

Projections of market prices are not used explicitly in the modelling exercise. The high price scenarios presented (NECP 1 and 2) are based on the EU Reference Scenario (2016) prices (expressed in constant \$2013) for oil, gas and coal.

The low oil price sensitivity is modeled on the basis of prices sourced from BEIS (UK), and uses their 30 November 2017 low fossil fuel price assumptions. Available here: <https://www.gov.uk/government/collections/fossil-fuel-price-assumptions>.

These trajectories are illustrated in 4.1 (ii). 2017 market prices are shown below.

	Unit	2017
Electricity price		
residential	euro/MWh	191
industry	euro/MWh	126
tertiary		
Gas price		
Industry	euro/ktoe	197984
Households	euro/ktoe	415946

Table 58: NECP Scenario 1 (With Existing Measures, high oil price) 2017 Electricity and Gas market prices, with a high oil price

	Unit	2017
Electricity price		
residential	euro/MWh	186
industry	euro/MWh	123
tertiary		
Gas price		
Industry	euro/ktoe	197984
Households	euro/ktoe	415946

Table 59: NECP Scenario 3: (With Existing Measures, low oil price) 2017 Electricity and Gas market prices, with a low oil price

4.6. Dimension research, innovation and competitiveness

i. Current situation of the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis is to be carried out at Union or global level)

The SEAI Low Carbon Technologies team provides energy/low carbon technology sector market support and technology-related policy support to DCCAE. It covers areas such as wind & electricity, heat & bioenergy, solar, ocean and smart grids. The group develops technology roadmaps (informed by SEAI modelling), promotes the growth of relevant supply chains, represents Ireland in technology fora, develops guidance relevant to technology sub-sectors for suppliers, installers, manufacturers and consumers, and supports critical supply chain development, often in collaboration with partner state agencies such as the Industrial Development Authority of Ireland (IDA Ireland) and Enterprise Ireland.

SEAI, in partnership with Irish enterprise state agencies the Industrial Development Authority of Ireland (IDA Ireland) and Enterprise Ireland performed an analysis of Ireland's Energy Supply Chain Opportunity in 2014. The analysis estimated that the total average annual investment required in sustainable energy technologies and services in Ireland up to 2020 in Ireland would be between €2.2 billion and €2.9 billion. Between €1 billion and €1.2 billion of total annual expenditure was expected to be in the energy efficiency construction sector, €865 million to €1.2 billion in renewable energy technologies and €335 million to €420 million in development of the electricity grid infrastructure. The analysis found that over 70% of the total anticipated expenditure in the energy supply chain up to 2020 was estimated to be within areas of the supply chain where Irish organisations are very well positioned or well positioned to capture investment in goods and services markets. The existing Irish supply chains in these areas did not foresee any significant barriers to expanding their business as the market grows. However, the report found that some support may be needed to help them maintain competitive advantage; for example, continued RD&D supports, financial supports, investment in training, and support for export market development.

The Irish Government is continuing to expand policies and measures aimed at increasing development and deployment of sustainable energy technologies and services. During 2019 and 2020, SEAI intends to carry out updated analyses of the situation of the low carbon technologies sector in Ireland, and its position in the global market (from either an EU or global perspective). It is anticipated that this significant piece of analysis work will directly inform Ireland's (end of 2019) NECP and subsequent updates to the NECP.

ii. Current level of public and, where available, private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers

A key metric for the assessment of innovative activity is R&D intensity (R&D expenditure as a percentage of GNP) which reflects the extent of research and innovation activities undertaken in a country in terms of resources input. Ireland's intensity rate in 2016 was 1.84% of GNI*. The *Europe 2020* strategy (a 10-year strategy developed by the European Commission in 2010) sets a 3% objective for R&D intensity. The Irish Government has adopted an R&D intensity target for

Ireland of 2.5% of GNP to be achieved by 2020.

A three-year average (2013 to 2015), equal to approximately €40M reflects Ireland's approximate level of public investment in energy RD&D. There is a shared vision of continuing to develop the Irish energy research, development & demonstration community to one which is considered to be world class. It is intended to significantly increase the amount of public funding invested in energy RD&D, to instigate new initiatives, expand current activities, develop strategic collaborative partnerships with national & international organisations and further strengthen the capacity of the energy RD&D system in Ireland.

The Environmental Protection Agency funded research report 196: Climate Technology - Realising the Potential Authors: Fionn Rogan, Paul Bolger and Brian Ó Gallachóir, consider the potential for climate technology in Ireland. Analysis was based on a broad survey of current and recent climate technology research in Irish tertiary education organisations and institutes, and of climate innovation and technology use in the private sector. A technology innovation system framework was employed to explore strengths and weaknesses in climate innovation across sectors. The report groups climate technology opportunity areas into the following categories: agriculture and land use; climate services; water and wastewater; smart buildings; marine sector; and transport and air quality. It focuses on the opportunities such as reduced emissions and energy consumption, value chain economic opportunities and co-benefits.

The Department of Agriculture, Food and the Marine (DAFM) operates three competitive research funding programmes through periodic National Research Calls for proposals that include topics relevant to climate change. The three funding programmes are:

1. **Food** – Food Institutional Research Measure (FIRM),
2. **Agriculture** – Research Stimulus Fund (RSF) and
3. **Forestry** – Competitive Forestry programme for Research and Development (CoFoRD)

DAFM also funds a number of strategically aligned European Research Area Networks and EU Joint Programme Initiatives that include climate change related thematic areas in their scope.

- Most recent ERA-NETS supported by DAFM that have particular reference to climate change thematic areas are ERA-GAS (ERA-NET for Monitoring & Mitigation of Greenhouse Gases from Agri- and Silvi-culture), and the ERA-NET SUSAN (ERA-NET for Sustainable Animal Production). While expenditure by DAFM on these ERA-NETS is outside of the scope period of this analysis, they decision by DAFM to pledge a combined c. €1.5 million to facilitate Irish participation for both Calls was taken in 2015. Expenditure on successful Irish partnered project funded through these mechanism is anticipated in Q2/Q3 2017.
- The Global Research Alliance on Agricultural Greenhouse Gases was launched in December 2009 and now has 47 member countries from all regions of the world, including Ireland. The Alliance is focused on research, development and extension of technologies and practices that will help deliver ways to grow

more food (and more climate-resilient food systems) without growing greenhouse gas emissions. DAFM has a representative on the GRA governing council.

- The Joint Programming Initiative on Agriculture, Food Security and Climate change (FACCE -JPI) brings together 22 countries that are committed to building an integrated European Research Area addressing the interconnected challenges of sustainable agriculture, food security and impacts of climate change. DAFM is a member of the Governing Board of the FACCE-JPI.
- DAFM chairs a national steering group which provides a forum to help guide Ireland's involvement in the FACCE JPI and the GRA. This group assists in identifying climate change research priorities relevant to the FACCE-JPI including participation in relevant Co-fund ERA-Nets under the Horizon 2020 programme thus ensuring that national research priorities identified in the relevant national strategic research agendas align well with the strategic research agenda of FACCE-JPI.

iii. Breakdown of current price elements that make up the main three price components (energy, network, taxes/levies)

According to SEAI data covering the period July-December 2017, the breakdown of current electricity prices in Ireland for the main consumption band for households and businesses is as follows:

Business (Band IB (27.4% share of business electricity))

- Energy and Supply – 54%
- Network – 36%
- Taxes and Levies – 10%

Households (Band DD (39% share of household electricity))

- Energy and Supply – 55%
- Network – 28%
- Taxes and Levies – 17%

The tables below provide details on the electricity and gas price components for household and non-household consumers for 2017 based on data from the

Eurostat databank. Price components are broken down into those associated with energy & supply; network costs; taxes, fees, levies & charges; value added tax; renewable taxes; capacity taxes; environmental taxes; nuclear taxes and other costs.

Gas Price Components - Ireland, 2017	Energy and supply	Network costs	Taxes, fees, levies and charges	Value added tax (VAT)	Renewable taxes	Capacity taxes	Environmental taxes	Other
Household consumers - all bands (€/kWh)	0.0252	0.0281	0.0114	0.0077	0	0	0.0037	0
Non-household consumers - all bands (€/kWh)	0.0186	0.0107	0.0059	0.0035	0	0	0.0024	0

Table 60 :
Gas price
Components

Electricity Price Components - Ireland, 2017	Energy and supply	Network costs	Taxes, fees, levies and charges	Value added tax (VAT)	Renewable taxes	Capacity taxes	Environmental taxes	Nuclear taxes	Other
Household consumers - all bands (€/kWh)	0.0999	0.0692	0.0423	0.0253	0.0117	0.0047	0	0	0.0006
Non-household consumers - all bands (€/kWh)	0.0708	0.0355	0.0310	0.0149	0.0097	0.0035	0.0005	0	0.0024

Table 61: Electricity Price Components

SEAI publishes a report titled 'Electricity & Gas Prices in Ireland' on a six-monthly basis. The aforementioned SEAI Prices reports provide a detailed analysis of factors affecting electricity & gas prices in Ireland; details of average prices of electricity & gas to business and household consumers; detailed analyses of the prices associated with the various consumption bands and a comparison to prices in other EU and Euro Area countries. The report relating to the second half of 2017

(published in July 2018)⁹⁴ is available online.

iv. Description of energy subsidies, including for fossil fuels

Ireland's proposed new **Renewable Electricity Support Scheme (RESS)** will provide support to renewable electricity projects in Ireland. With a primary focus on cost effectiveness, the RESS will deliver a broader range of policy objectives, including:

- An Enabling Framework for Community Participation through the provision of pathways and supports for communities to participate in renewable energy projects
- Increasing Technology Diversity by broadening the renewable electricity technology mix (the diversity of technologies)
- Delivering an ambitious renewable electricity policy to 2030
- Increasing energy security, energy sustainability and ensuring the cost effectiveness of energy policy

RESS **auctions** will be held at frequent intervals throughout the lifetime of the scheme. This will allow Ireland to take advantage of falling technology costs and by not auctioning all the required capacity at once; Ireland will not be 'locking in' higher costs for consumers for the entirety of the scheme.

The Scheme will provide for a renewable electricity (RES-E) ambition of up to a maximum of 55% by 2030 subject to determining the cost effective level. RESS auctions will be designed in line with trajectory targets identified in Ireland's NECP. In addition, the first RESS auction in 2019 will deliver 'shovel ready' projects, reducing the gap to 2020 targets and assisting in the early delivery for Ireland's trajectory towards 2030 targets.

Ireland's recently launched **Support Scheme for Renewable Heat (SSRH)** is a government funded initiative designed to increase the energy generated from renewable sources in the heat sector. The scheme is open to commercial, industrial, agricultural, district heating, public sector and other non-domestic heat users.

The primary objective of the support scheme for renewable heat is to increase the level of renewable energy in the heat sector. This will contribute to meeting Ireland's 2020 renewable energy targets whilst also reducing greenhouse gas emissions. The government funded scheme will support the adoption of renewable heating systems by **commercial, industrial, agricultural, district heating, public sector and other non-domestic heat users** not covered by the emissions trading system. The scheme aims to bridge the gap between the installation and operating costs of renewable heating systems and the conventional fossil fuel alternatives; and incentivise the development and supply of renewable heat.

The scheme opened for applications relating to installation grants for air source heat pumps, ground source heat pumps and water source heat pumps in September 2018. It is anticipated that the operational support component of the scheme, including support for biomass boiler/biomass HE CHP heating systems and biogas

⁹⁴ <https://www.seai.ie/resources/publications/Electricity-and-Gas-Prices-in-Ireland-Price-July-Dec-2017-.pdf>

(anaerobic digestion) boiler/biogas HE CHP heating systems will open in late 2018/early 2019 subject to receipt of state aid approval from the European Commission.

Ireland's Central Statistics Office (CSO) published a statistical release on 'Details of Environmental Subsidies and Similar Transfers' in Ireland in April 2018. The statistical release indicates that in 2016, €772 million was paid in environmental subsidies and similar transfers to Irish corporations, households and public bodies, as well as to international environmental organisations under Irish government commitments. This was 20% higher than the amount paid in 2015 but 37% lower than the €1.2 billion provided in 2008.

Environmental protection activities were subsidised to a value of €409 million, or 53% of the total, while €362 million, or 47%, was used to support resource management activities. In 2016, 35% of environmental transfers went to renewable energy production, 27% to wastewater management, 18% to biodiversity protection and 11% to heat and energy saving measures. Other activities, such as climate change mitigation and waste management, accounted for the remaining 8%. There was a large increase in subsidies to renewable energy generation from funds collected through the PSO (Public Service Obligation) Levy on electricity consumers in 2016. This was behind the increase in the proportion of subsidies to renewable energy sources from 27% in 2015 to 35% in 2016.

The statistical release referred to above also provides provisional data on 'Potentially Environmentally Damaging Subsidies (PEDS)' subsidies or other Government support measures that have social or economic objectives which may also incentivise behaviour that could be damaging to the environment. For example, transport fuel tax rebates encourage the consumption of fossil fuels.

Programme	€ ('000)
Agricultural product subsidies: cattle	55,900
PSO Levy: electricity generation from peat	115,400
Petroleum Infrastructure Support Group	191
Haulier's diesel rebate scheme	1,300
Total Potentially Environmentally Damaging Subsidies (2016)	172,791

Table 62: Potentially Environmentally Damaging Subsidies

Agricultural Product Subsidies - Agricultural subsidies on products are paid per unit of a good produced, e.g. per head of cattle. Many agricultural product subsidies have been phased out and have been replaced by direct payments to farmers such as the Single Payment Scheme.

PSO (Public Service Obligation) Levy: The PSO Levy is charged to electricity consumers in Ireland and is used to subsidise electricity generation from peat (for security of supply) and renewable sources. The statistical release includes the portions that go towards electricity generation from peat and security of supply as PEDS while the portion that supports electricity generation from renewable sources is included as an environmental subsidy.

Petroleum Infrastructure Support Group: The Petroleum Infrastructure Programme is funded through contributions from oil companies with licences for hydrocarbon exploration and development activities off the Irish coast. The fund is administered by the Department of Communications, Climate Action and the Environment and its aims are to promote offshore exploration and development and to fund government and industry petroleum research.

Haulier's Diesel Rebate Scheme: This is a repayment to road transport operators of part of the tax that they pay on diesel purchased for use in the course of business.

5. IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES⁹⁵

5.1. Impacts of planned policies and measures described in section 3 on energy system and GHG emissions and removals including comparison to projections with existing policies and measures (as described in section 4).

i. Projections of the development of the energy system and GHG emissions and removals as well as, where relevant of emissions of air pollutants in accordance with Directive (EU) 2016/2284 under the planned policies and measures at least until ten years after the period covered by the plan (including for the last year of the period covered by the plan), including relevant Union policies and measures.

Note that Ireland's draft NECP 2021-2030 is based on 4 scenarios – 2 baseline (with existing measures) scenarios and 2 advance (with additional measures) scenarios as follows:

NECP 1 - With existing measures (WEM) – high oil prices (EU *Energy Reference Scenario* (2016) Prices.(constant 2013 values)

NECP 2 - With additional measures (WAM) - high oil prices (EU *Energy Reference Scenario* (2016) Prices.(constant 2013 values)

NECP 3 - With existing measures (WEM) - low oil prices (Department of Business Energy and Industrial Strategy (UK) (BEIS) 2017 low fossil fuel prices.)

NECP 4 - With additional measures (WAM) - low oil prices (BEIS 2017 low fossil fuel prices)

Total Primary Energy

Projections for the development of total primary energy demand in each of the four scenarios are presented in the figure below. The impacts of planned policies and measures in the case of high fossil fuel prices can be observed by comparing the trajectory for NECP2 with that of NECP1. Some notable observations when comparing these two trajectories:

- Primary energy demands are comparable up until 2025 with additional effort in energy efficiency measures in NECP2 reducing primary energy demand by around 1%
- Moneypoint coal-fired power station is assumed to shut in 2026 in NECP2 which delivers a notable reduction in primary energy requirements compared with NECP1 (where the Moneypoint coal-fired power plant is assumed to shut in 2031). In both scenarios all three peat stations, which all co-fire with biomass from 2020, are assumed to shut in 2031 delivering further reductions in primary energy requirements.
- In 2030 primary energy demand is almost 7% lower in NECP2 compared with NECP1. Apart from the impact of Moneypoint coal-fired power plant closing, this is explained by a higher level of RES-E achievement (55% compared with 40%), higher penetration of heat pumps (supported through the SSRH and

⁹⁵

Planned policies and measures are options under discussion and having a realistic chance of being adopted and implemented after the date of submission of the national plan. The resulting projections under section 5.1.i shall therefore include not only implemented and adopted policies and measures (projections with existing policies and measures), but also planned policies and measures.

domestic heat pump grant), 250,000 more electric vehicles on the road (supported by measures outlined in Ireland's NDP), and greater ambition in national energy efficiency programmes.

- Primary energy demand is assumed to continue to grow after 2031 based on the underlying macroeconomic projections. Energy efficiency programmes are assumed to continue to deliver savings in NECP2 after 2030 so primary energy demand grows at a lower rate than in NECP1.
- In the case that lower fossil fuel prices transpire the effect of planned policies and measures can be seen by comparing NECP4 with NECP3. Most of the differences noted above still hold, with some notable differences, in particular:
- Overall primary energy demand is higher in the case of low fossil fuel prices due to higher economic growth and price elasticity effects.
- While Moneypoint coal-fired power plant still closes in 2026 in NECP4 the difference is not as stark compared with NECP3. This is because in NECP3 Moneypoint's contribution gradually declines because the lower gas prices mean it is less competitive than it would have been in a high fossil fuel price future (see NECP1).
- The impact of the peat station closures in 2031 is less pronounced in NECP4 because gas generation is still competitive and as a result makes up a larger share of the shortfall than in NECP2 where renewable generation plays a greater role. As a consequence, primary energy demand does not drop in 2031 in NECP4.

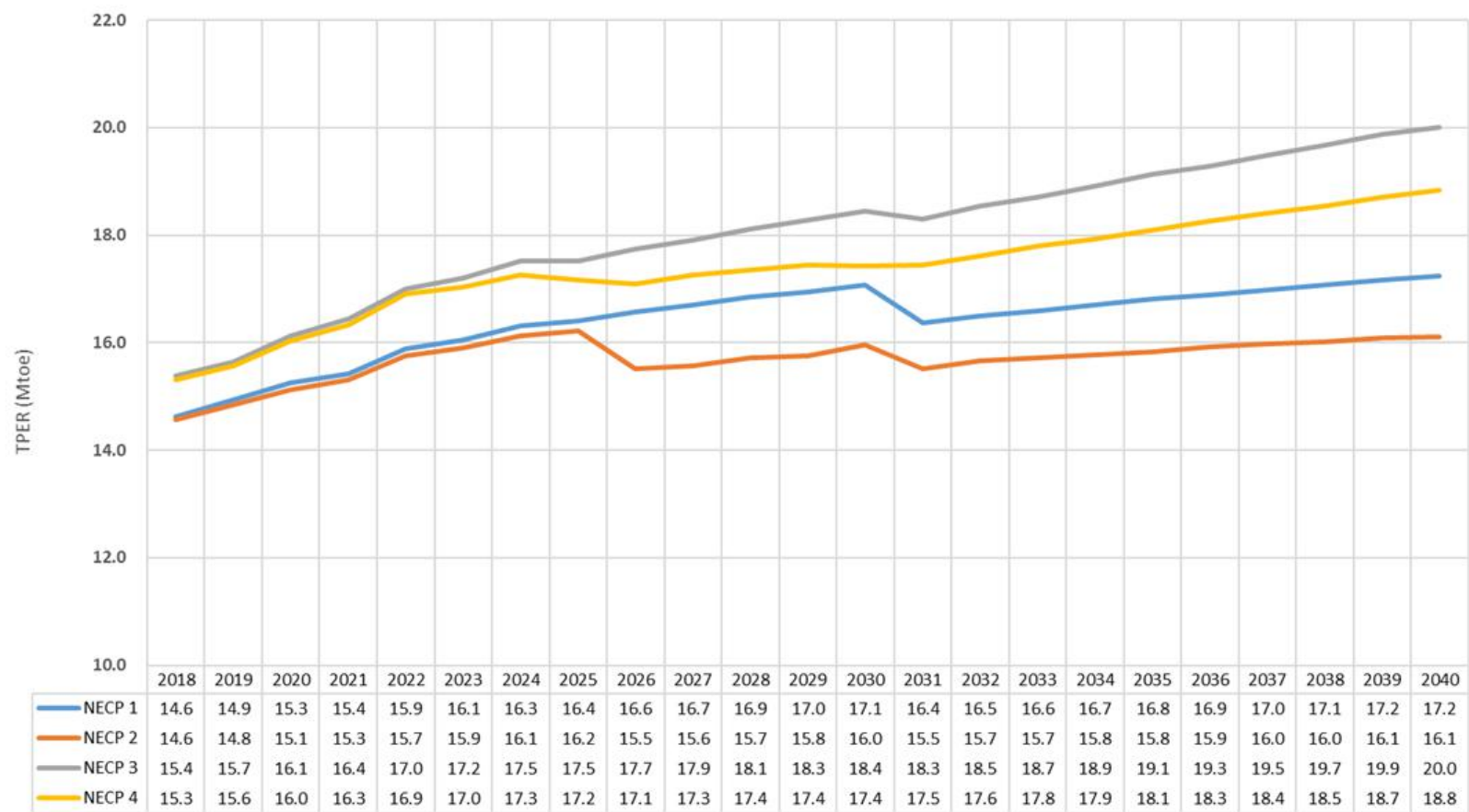


Figure 21: Primary Energy by Fuel

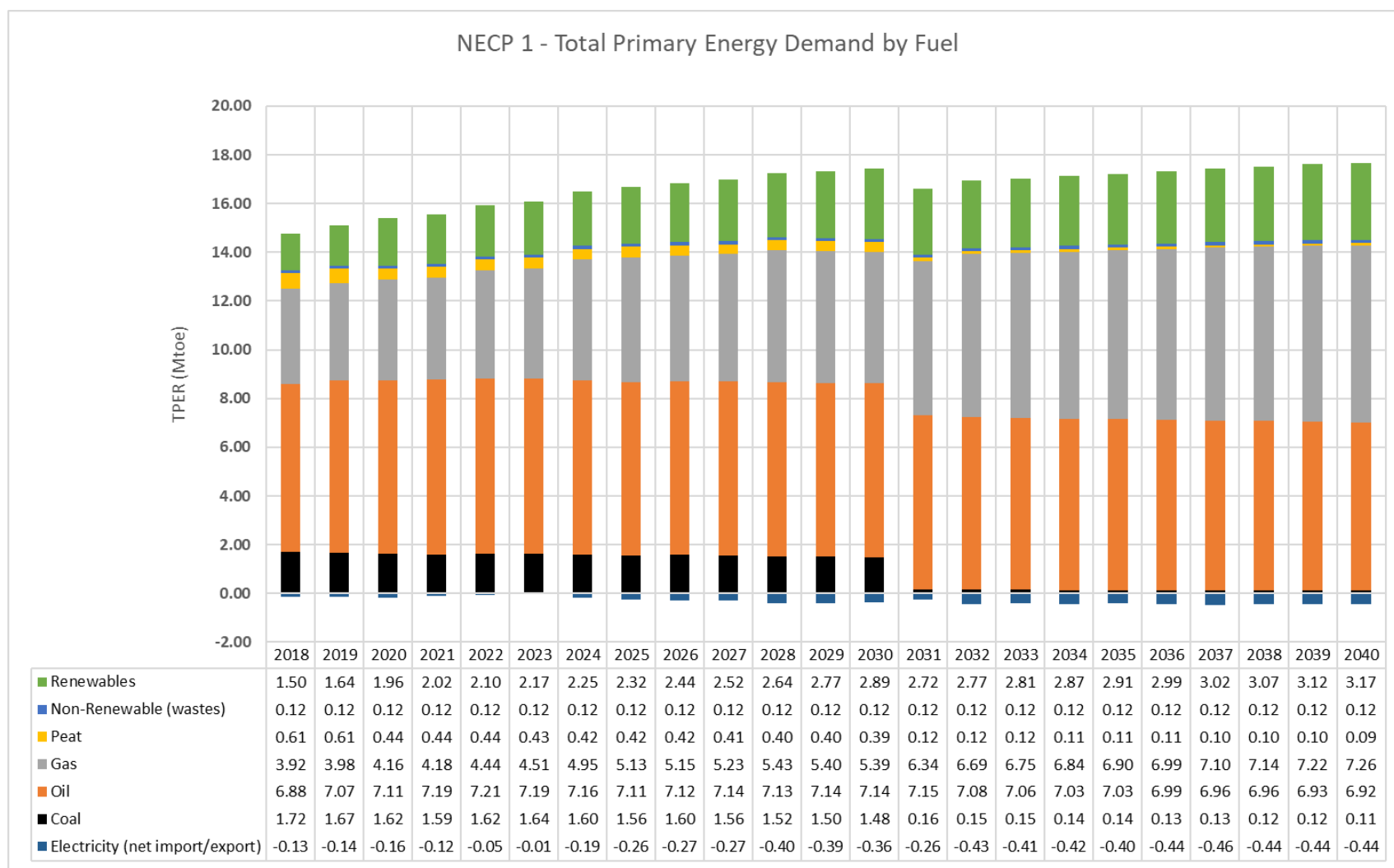


Figure 22: NECP 1 – Total Primary Energy Demand by Fuel

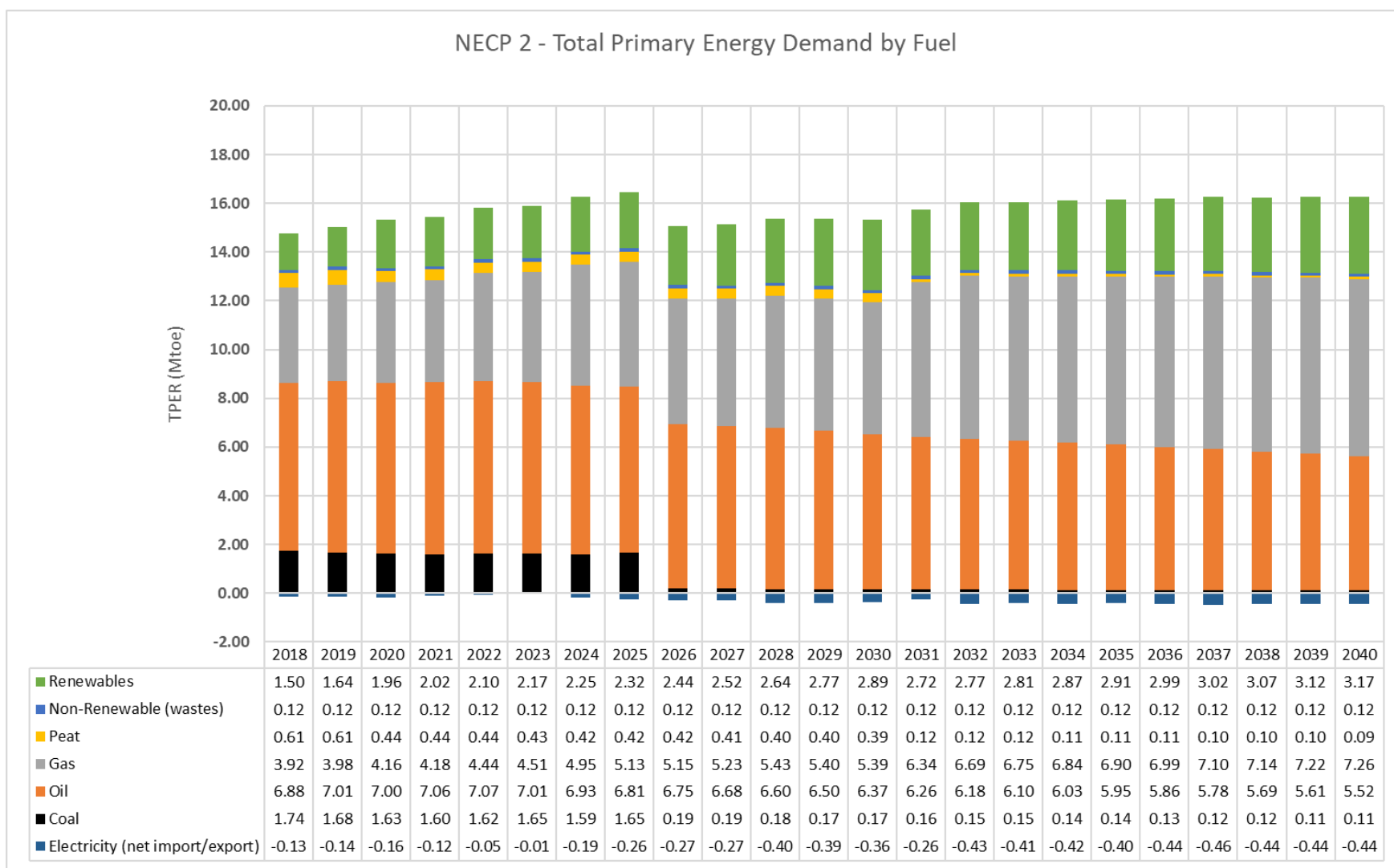


Figure 23: NECP 2 – Total Primary Energy Demand by Fuel

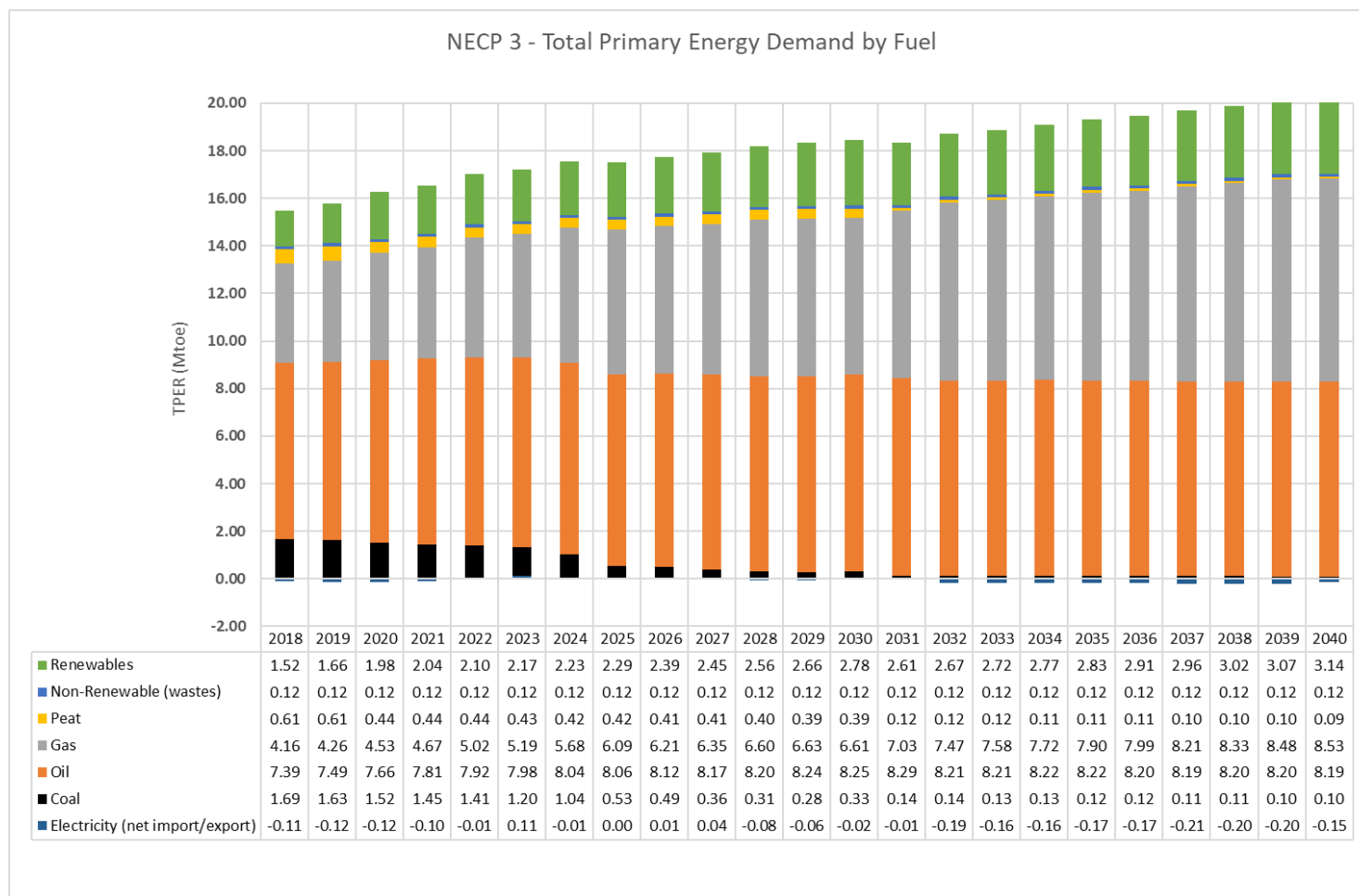


Figure 24: NECP 3 – Total Primary Energy Demand by Fuel

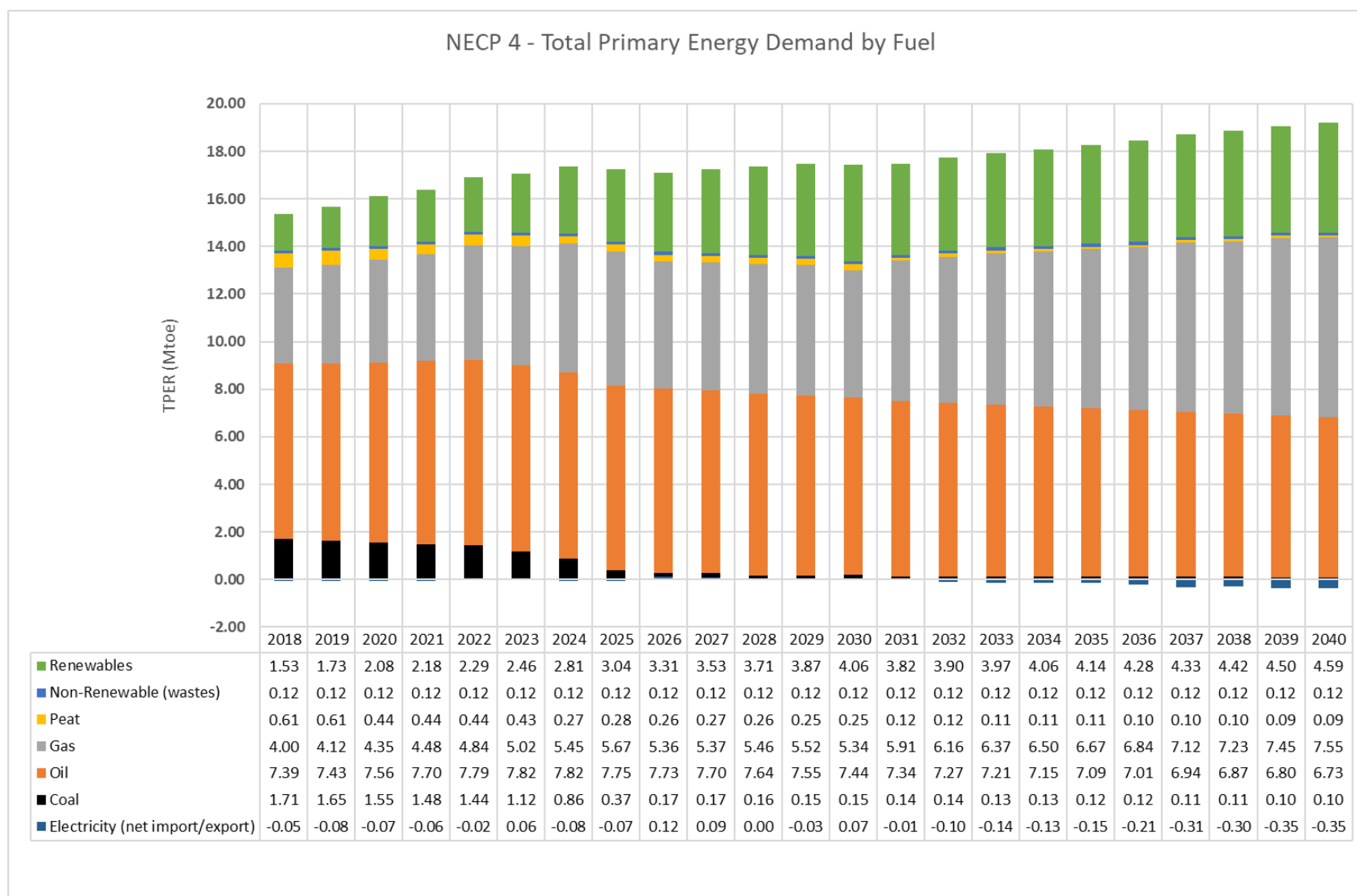


Figure 25: NECP 4 – Total Primary Energy Demand by Fuel

Total Primary Energy Demand by Fuel

In terms of primary energy demand by fuel, oil is expected to continue to dominate in all scenarios, accounting for a minimum of 40% of TPER by 2030. The demand for oil is dominated by transport sector trends, which show strong growth in line with the strong economic growth projected to 2030. Additional oil is used for space-heating predominately in the residential sector, but a declining demand is projected for this end use in all scenarios. Oil demand peaks in 2030 for the scenarios without the impacts of planned policy measures (NECP 1 – high oil price and NECP 3 – low oil price) but in the scenarios including planned policies and measures facilitates a peak two years earlier, in 2028.

The second most dominant primary energy fuel is natural gas. Together oil and natural gas account for almost two thirds of total primary energy requirement. In the high oil prices scenario which includes the impacts of planned policy measure the dependency on oil and natural gas drops to a minimum of 70% by 2030.

More than half of natural gas is used for electricity generation, and that share is expected to rise post-2020, in line with growth in absolute natural gas demand in electricity generation throughout the period for all scenarios. Further, the overall total primary energy requirement of natural gas is projected to grow throughout the period projected (to 2040) in all scenarios. This is despite the impact of planned policy measures resulting in a peak in final energy natural gas demand in 2022 for the high oil price scenario (NECP 2) and in 2025 for the low oil price scenario (NECP4).

Coal and peat use are mainly in electricity generation and, in the absence of policy measures will continue to represent more than 10% of TPER to 2030. Anticipated coal plant closure and additional biomass co-firing with peat in the planned policy measures scenario results in declining influence of those fuels from 2025. Use of small amounts of both coal and peat are assumed to continue to be used for residential space heating in all scenarios, albeit with ever diminishing absolute consumption.

The overall dependency on fossil fuels does not fall below 85% of TPER demand in the scenarios without additional planned policy measures (NECP 1 & 3). The impact of planned policies and measures reduces that dependency to approximately two thirds of TPER.

In terms of import dependency, all crude oil and oil products are imported in Ireland. It is unlikely that there will be a significant change in that imported oil dependency in the period projected. The majority of biofuels for transport are also imported – a trend that is also likely to continue. Similarly, all coal used in Ireland is imported.

Ireland currently produces approximately 76% of natural gas TPER, but in the absence of another gas field coming on stream that rate will decline annually to 2030, and with increasing gas demand only a quarter of all gas is projected to be indigenous by 2025. While peat is an indigenous energy source, its usage is projected to

fall.

Ireland has significant resources of variable renewable energy sources – such as wind, ocean energy and to a lesser extent, solar. Indigenous combustible renewables include some sources of biomass, biogas, the renewable portion of municipal solid wastes and solid recovered wastes, landfill gas and sewage sludge gas. The current share of biomass resources for energy that are imported is around 34% and this is expected to drop slightly to around 31% in NECP2 with the assumption that domestic forestry, agricultural residues and waste resources are harnessed for growing demands in electricity, heat and transport. Despite this projected growth in indigenous biomass consumption through co-firing, heat supply and biofuel blending, the overall energy import dependency is likely to lie between 72% - 85% over the period projected, where the former relates to scenarios with planned policy measures.

An interesting recent trend is that Ireland is now a net exporter of electricity. This trend is likely to continue throughout the period projected with greater exports in the scenarios including planned policy measures - which have greater renewable electricity generation and interconnection.

Total Final Energy Demand

The impacts of planned policies and measures on total final energy demand can be noted in the figure below by comparing the trajectories for NECP2 and NECP1. Some notable observations when comparing the aggregate impacts of policies and measures:

- Total final consumption in NECP2 begins to diverge from NECP1 from 2022 onwards, the point at which most of the national energy efficiency programmes are assumed to expire in NECP1 (whilst continuing in NECP2).
- The trend of divergence continues due to a variety of policies across all sectors (see bullets below on sectoral breakdown). By 2030 total final consumption in NECP2 is around 3% lower than NECP1, and around 6% lower by 2040.

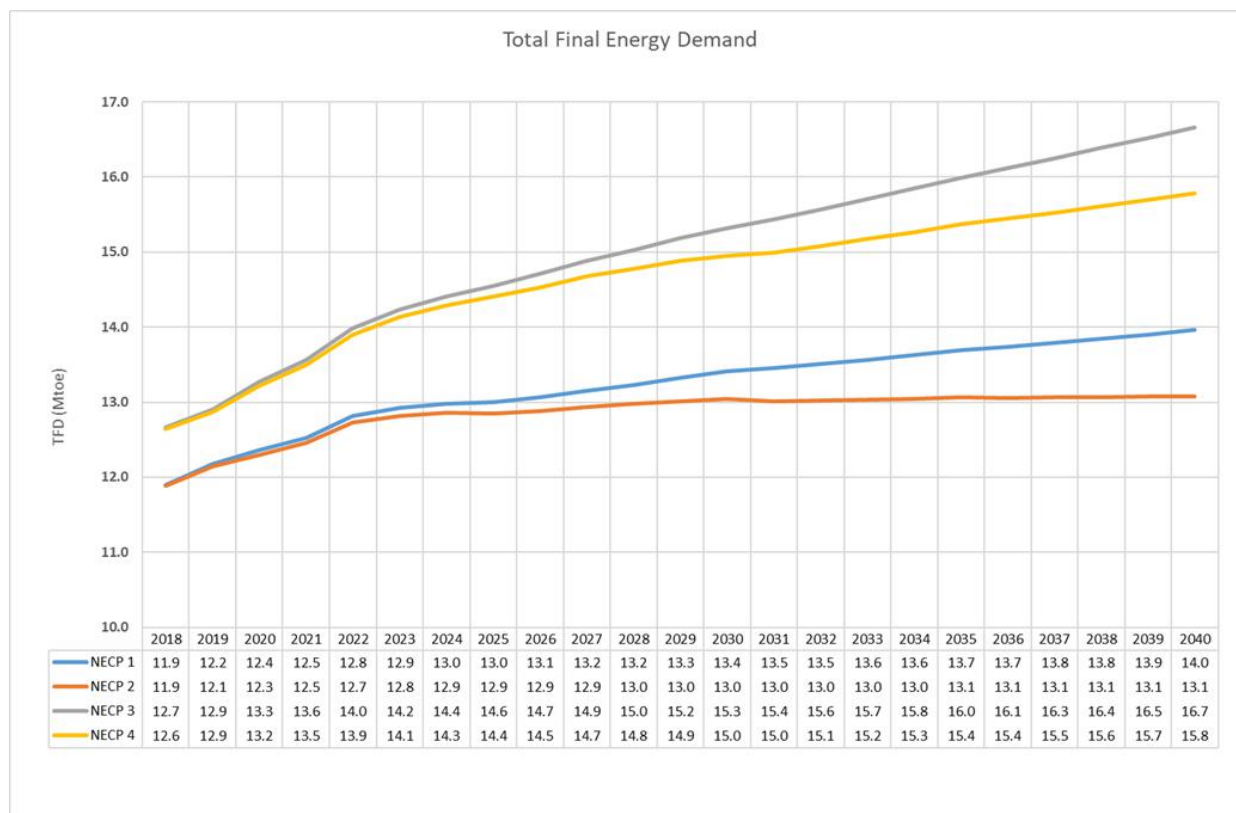


Figure 26: Total Final Energy Demand

Total Final Energy Consumption by Sector

The impacts of planned policies and measures can be observed at a sectoral level by comparing the scenarios in figures 27-30 below. The impacts of measures in a high fossil fuel price future can be observed by comparing the charts for NECP2 and NECP1. Some notable observations when comparing the impacts in each sector:

- In NECP2 total final consumption is lower in all sectors (apart from agriculture where it is the same) with an overall reduction in total final consumption of 3% by 2030.
- Final consumption is around 5% lower in 2030 in the household sector due primarily to the additional supports set out in Ireland's National Development Plan. In

particular, NECP2 includes additional ambition to deliver energy efficiency retrofits in 45,000 homes per year.

- In industry and services final energy consumption is reduced by 1% and 3% respectively in NECP2. This is achieved through additional ambition in national energy efficiency programmes, including a goal set out in Ireland's NDP to significantly improve the energy efficiency of existing commercial and public building stock.
- In transport total final consumption is 3% lower in NECP2 as this scenario assumes 250,000 additional electric vehicles are supported via the measures set out in Ireland's NDP, displacing less efficient diesel and petrol vehicles.
- Beyond 2030 total final consumption in NECP2 remains relatively constant whilst it continues to grow in NECP1. This is due to the EV stock remaining higher in NECP2 as well the continuation of national energy efficiency programmes throughout the decade in this scenario.

In the case that lower fossil fuel prices transpire the effect of planned policies and measures can be seen by comparing NECP4 with NECP3. All of the relative impacts of the various policies and measures described above hold when comparing these two scenarios. Total final consumption in 2030 is around 15% higher in NECP4 compared with NECP2 due to the higher levels of economic growth and effects of price elasticities. The higher levels of economic activity mean that total final consumption in NECP4 continues to grow after 2030 despite the counteracting effect of EV deployment and energy efficiency measures.

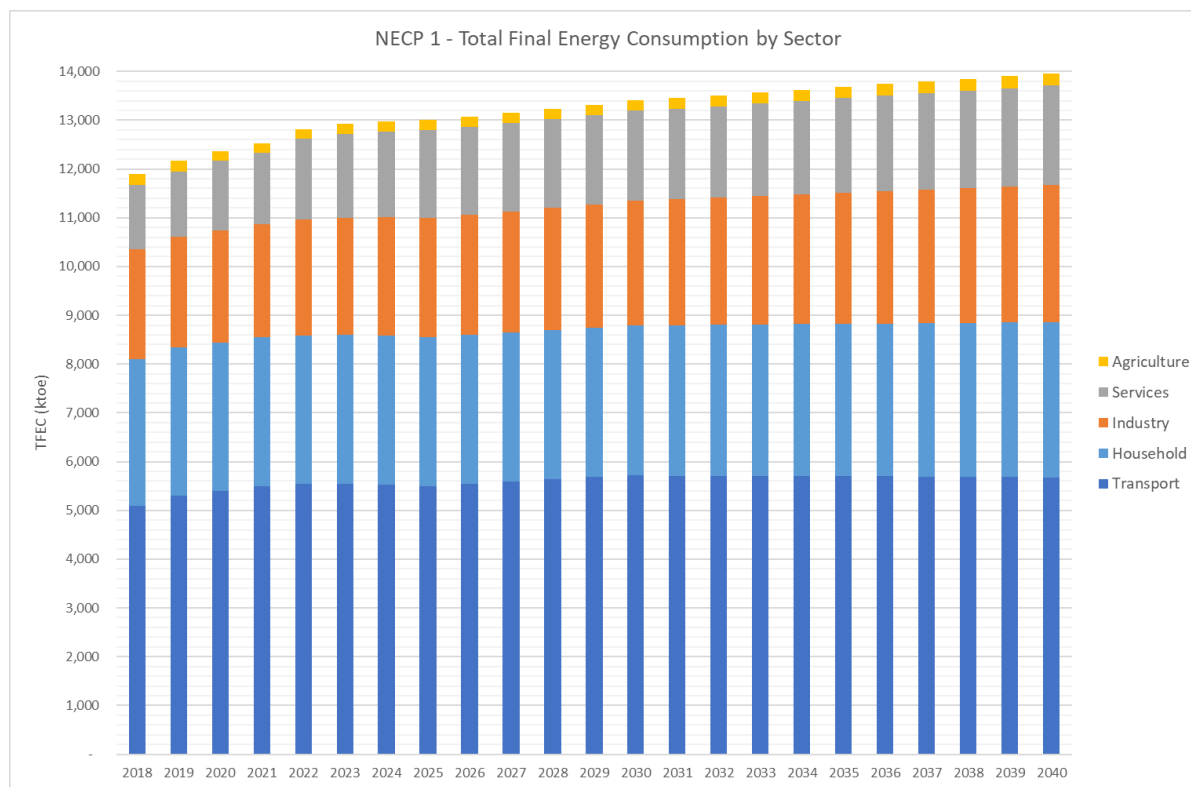


Figure 27 : NECP 1 – Total Final Energy Consumption by Sector

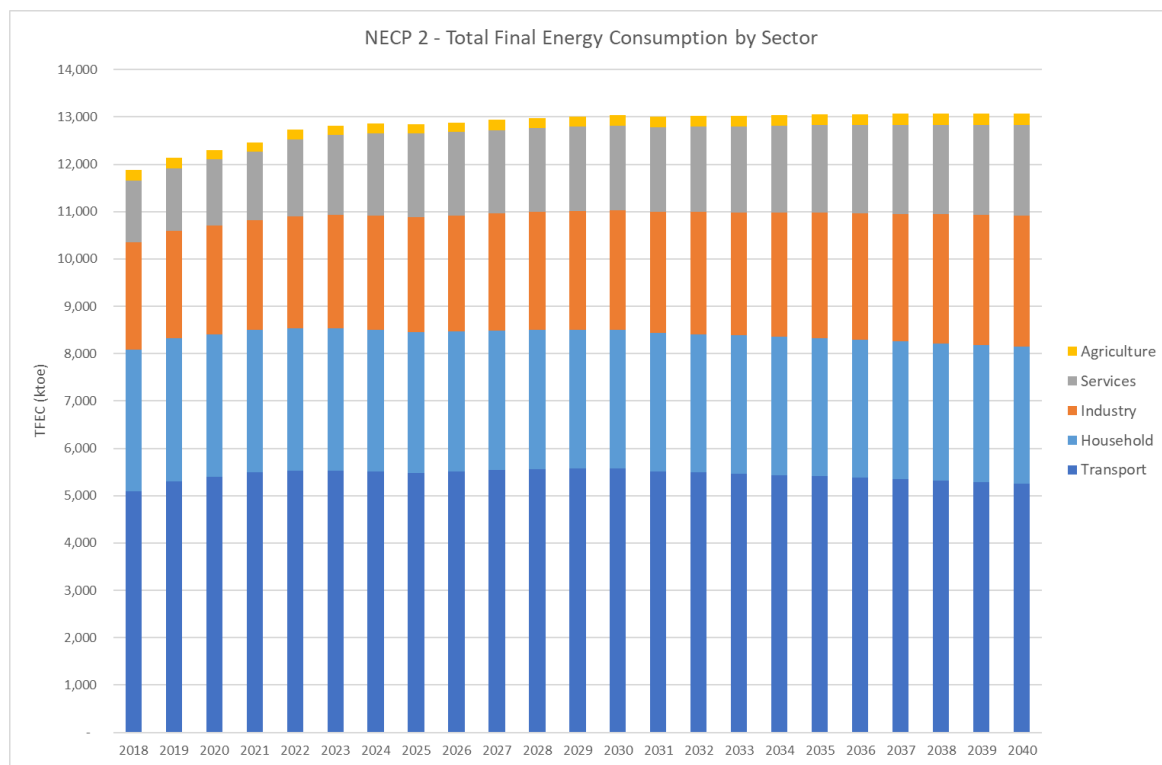


Figure 28 : NECP 2 – Total Final Energy Consumption by Sector

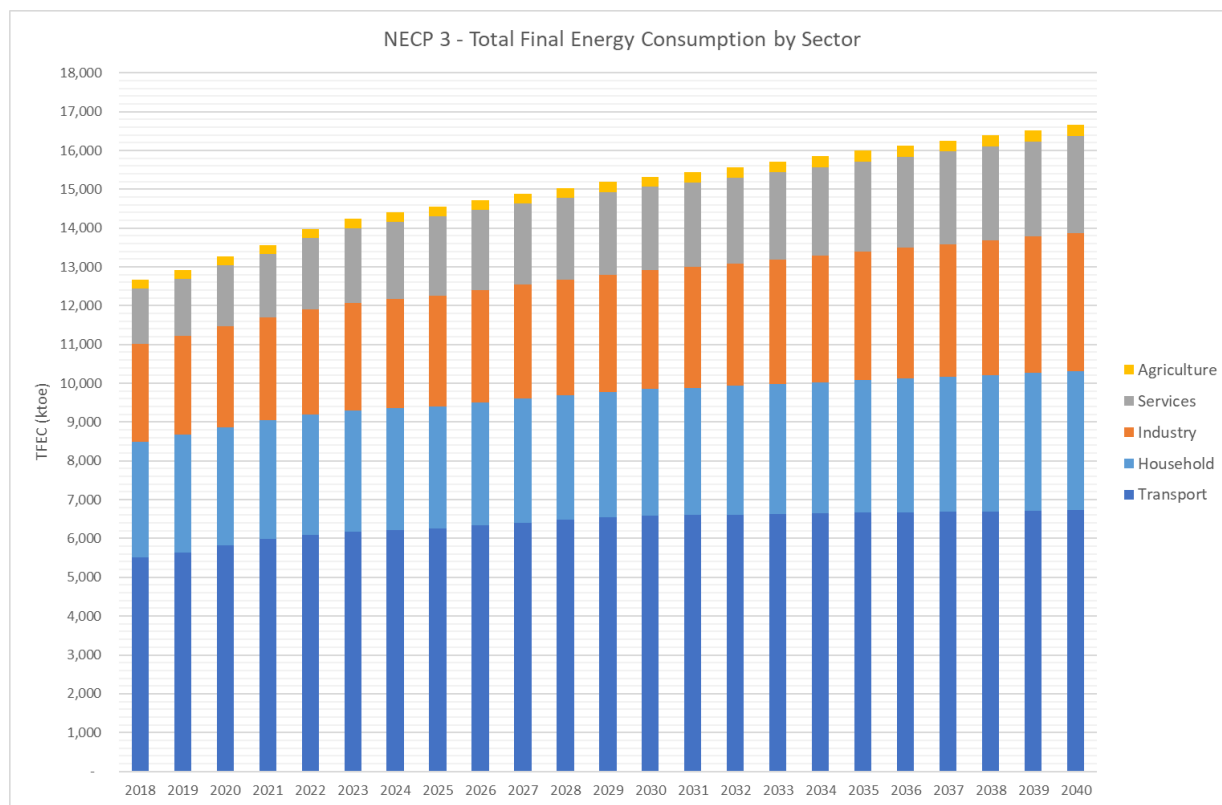


Figure 29 : NECP 3 – Total Final Energy Consumption by Sector

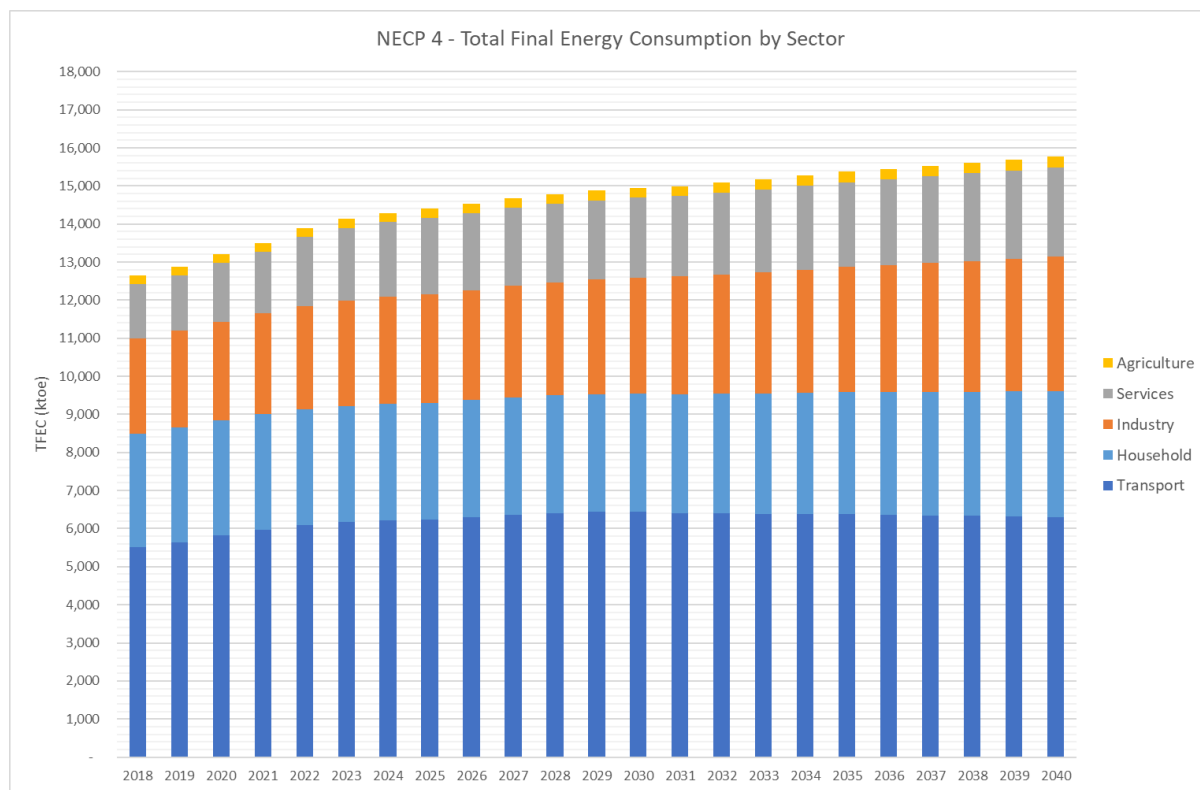


Figure 30: NECP 4 – Total Final Energy Consumption by Sector

Overall Renewable Energy Share

The following figure indicates Ireland's overall renewable energy share (RES) of gross final energy consumption across the 3 energy sectors, historically and for two projected years, 2020 and 2030. The impact of planned policies and measures can be observed by comparing the NECP2 scenario with NECP1.

Impact of planned policies

- By 2020 the planned policies deliver an additional percentage point on the overall RES target compared with NECP1, reaching 14.3 % of total final energy demand

from renewables in 2020 (compared to 13.3 % due to current trajectory in NECP1), falling short of Ireland's 16% 2020 target.

○ In this scenario RES-E is the biggest contributor in 2020 (8.6%) followed by heat (3.4 %) and transport (2.3 %).

○ Despite RES-E achieving the highest sectoral renewable share (almost 39% share of renewables in electricity) its impact on overall RES is significantly less as electricity accounts for only 22.5 % of total final energy demand.

○ In 2020 the biggest impact in the transport sector will be from biofuels

● In 2030, the impact of planned policies across the sectors on overall RES share is more pronounced. It is anticipated that planned policies will deliver a RES share of 27.7 % by 2030 in the NECP2 scenario.

○ The biggest contributions is from RES-E (15.6%), where the Renewable Energy Support Scheme (RESS) is assumed to deliver almost 54% RES-E by 2030.

○ RES-H contributes 8.4% with the full implementation of the Support Scheme for Renewable Heat (SSRH), supports for biomethane injection, and heat pump uptake through building regulations all driving growth of renewables.

○ Transport makes up the balance of the 2030 overall RES share of 3.7%. Further detail on the impacts of planned policies in on renewable target achievement each sector are provided in the sections that follow.

Price sensitivity

● In the lower fossil fuel price NECP4 scenario, total final energy demand is 7% higher compared to that in NECP2. Consequently in NECP4 in 2020 overall RES is lower, projected at 13.2 %.

● Similarly in 2030 the overall RES share is lower in NECP4. This can in part be explained by the total final energy demand which is projected to be 15% higher in the low fossil fuel price NECP4 scenario. The impacts of planned policies also vary in each sector compared with the high fossil fuel price case, and these impacts are explained in more detail in the charts that follow.

● The lower overall RES is also in part due to differing shares for electricity, heat and transport in total final consumption:

○ Although in 2030 additional renewable capacity is assumed in the NECP4 to deliver the same RES-E target as NECP2, the RES-E contribution to overall share is lower because the electricity modal share is lower in NECP4.

The share of RES-H in 2030 is also smaller in NECP4 as renewable heat sources are less competitive in a low oil price environment.

Overall Renewable Energy Share (RES) in Gross Final Consumption

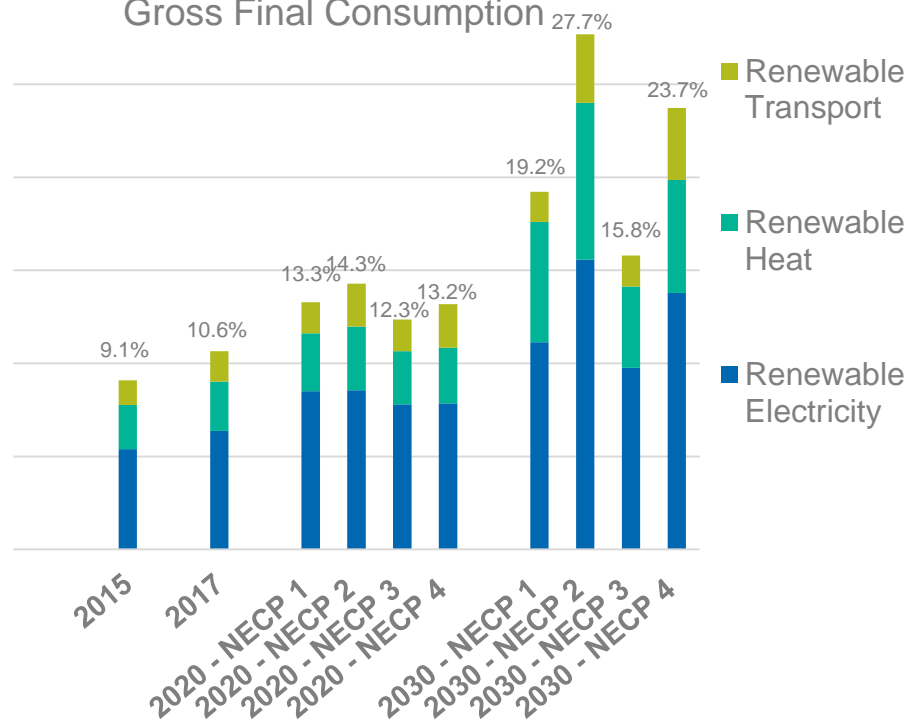


Figure 31: Overall renewable energy share in gross final consumption

Renewable transport (RES-T)

The impacts of planned policies and measures in the transport sector can be observed by comparing the scenarios in the figure 32 below. The impacts of measures in a high fossil fuel price future can be observed by comparing the results for NECP2 and NECP1. Some notable observations when comparing the impacts in each

sector:

- By 2020 in NECP2 the statutory biofuel blend is increased to require 11 litres of biofuel in every 100 litres of fuel (with the contribution of multiple counting included in this figure), compared with maintaining the current level of 8 litres for every 100 litres of fuel in NECP1. The corresponding average blend levels by volume are E5 and B6.8 in NECP2 (compared with E4.9 and B4.7 in NECP1). The higher biofuel blends combined with an additional 5,000 EVs supported through measures in Ireland's NDP deliver an additional 3.1 percentage points towards the regulation RES-T target in 2020 (i.e. the target including multiple counting factors).
- By 2030 the planned policies and measures included in NECP2 have an even more significant impact, delivering an additional 15 percentage points to the regulation RES-T target compared with NECP1. Through increased ambition in Ireland's Biofuel Obligation Scheme, average biofuel blends of E10 and B12 are assumed to be reached by 2030 (compared with E4.9 and B4.7 in NECP1). All of the biodiesel supplied in NECP2 is assumed to come from feedstocks listed in Annex IX parts A and B and their contribution will therefore count twice towards the target. NECP2 also includes 250,000 more electric vehicles on the road in 2030 compared with NECP1, supported by the provisions in the Irish NDP.

In the case that lower fossil fuel prices transpire the effect of planned policies and measures can be seen by comparing the results of NECP4 with NECP3. All of the relative impacts of the various policies and measures described above hold when comparing these two scenarios. The overall RES-T delivered by the planned policies in 2030 is slightly lower in the case of low prices primarily because total final consumption in transport is around 15% higher in NECP4 compared with NECP2. Although the ethanol and biodiesel blends are the same by volume for NECP4 and NECP2, their contribution to the target differs in each scenario because the relative share of petrol and diesel differs in both.

Renewable transport (RES-T)

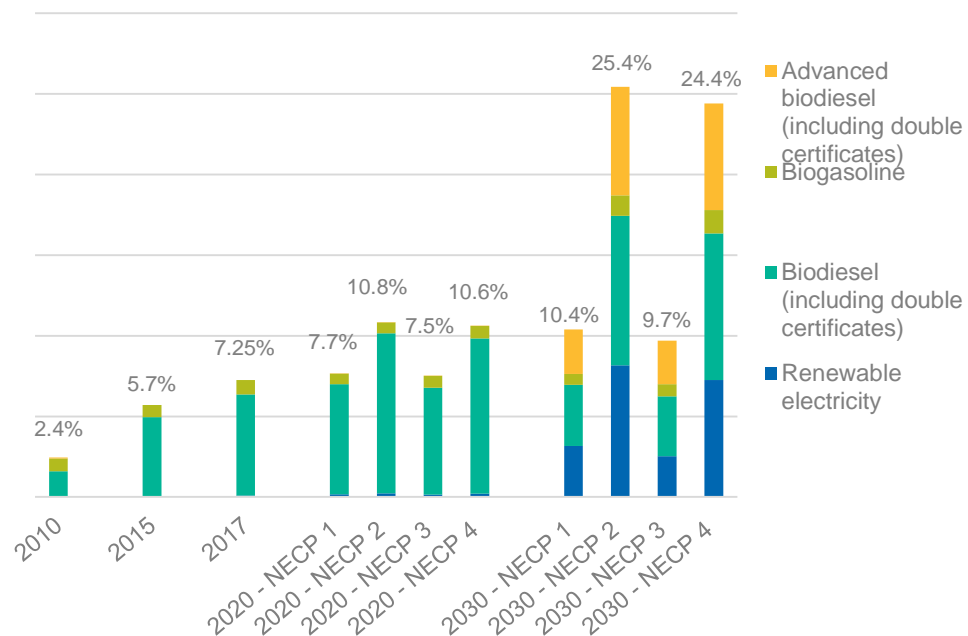


Figure 32 Renewable Transport

Renewable Electricity (RES-E)

Figure 33 shows the evolution of the RES-E share, over the four modelled scenarios, historically and projected for 2020 and 2030. This figure is discussed first comparing the impact of planned policies between NECP1 and NECP2 (high price scenarios) and secondly looking at the impact of lower fossil fuel price in NECP4 compared to NECP2.

Impact of policies

- RES-E of 38.9% is anticipated in 2020 in NECP2 (WAM), compared to 38.4 % in the NECP1 (WEM) scenario. This small difference is driven in part by 76 MW more solar and a 0.3% lower electricity demand in NECP2 due to increased ambition in national energy efficiency programs.
- o The installed capacities for renewables for wind and solar in 2020 are informed by the System Operatorss (Eirgrid and ESB Networks) projected connection of projects to the electricity grid.
- o In 2020, wind (primarily onshore) is the predominant contributor to renewable electricity (79 % of RES-E target)
- o biomass renewables makes up 12.8% of 2020 RES-E with policies, which is due in part to 30% co-firing biomass in the three peat power plants (with plant capacity of 356 MW).
- In 2030 there is a more prominent impact of RES-E policies, with achievement of 53.7 % RES-E in NECP2. This compares with NECP1 which assumes deployment of renewables to maintain 40 % RES-E share to 2030.
- o The growth in renewables in the WAM scenarios is driven by a new Renewable Energy Support Scheme (RESS) approved by the Government in July 2018. This scheme aims to support the achievement of 55 % RES-E by 2030 through an auction-based mechanism.
- o To achieve this in the NECP2 scenario requires a growth in renewables capacity between 2018 and 2030 at an average of 500 MW additional annual capacity per annum. This compares with a historical onshore wind deployment rate of 200 MW (ref. SEAI National Energy Projections 2018). This acceleration in deployment rate is driven by an additional 51% in electricity demand projected between 2018 and 2030.
- o In 2030 there is a broader mix of renewables, with growing shares for both solar and offshore wind assumed
- o Deployment of offshore wind capacity is assumed to grow from 2023 onwards.
- o Biomass renewables is the second largest share in 2030 being driven from predominantly 51% biomass co-firing in the three peat stations and also biomass CHP units.
- o Hydro capacity remains unchanged over the time horizon and sees a reducing share as other renewables in the mix grow.

o Deployment of 5 MW of ocean energy is modelled in WAM from 2023 onwards to take account of planned deployment of demonstration projects.

Price sensitivity

- A low oil price scenario drives a higher electricity demand of 5.3% in 2030 in NECP4.
- In 2020, the installed renewable capacities are the same across between the high (NECP2) and low (NECP4) fossil fuel price scenarios based on the Commission for Regulation of Utilities' ECP1 (enduring connection policy decision). There is therefore a lower RES-E of 38.6% achieved in NECP4 in 2020 due to the higher demand.
- In order to met the Government's current target of 55% RES-E in 2030, the higher demand in the low price NECP4 scenario requires a greater deployment of renewable capacity to achieve the target.

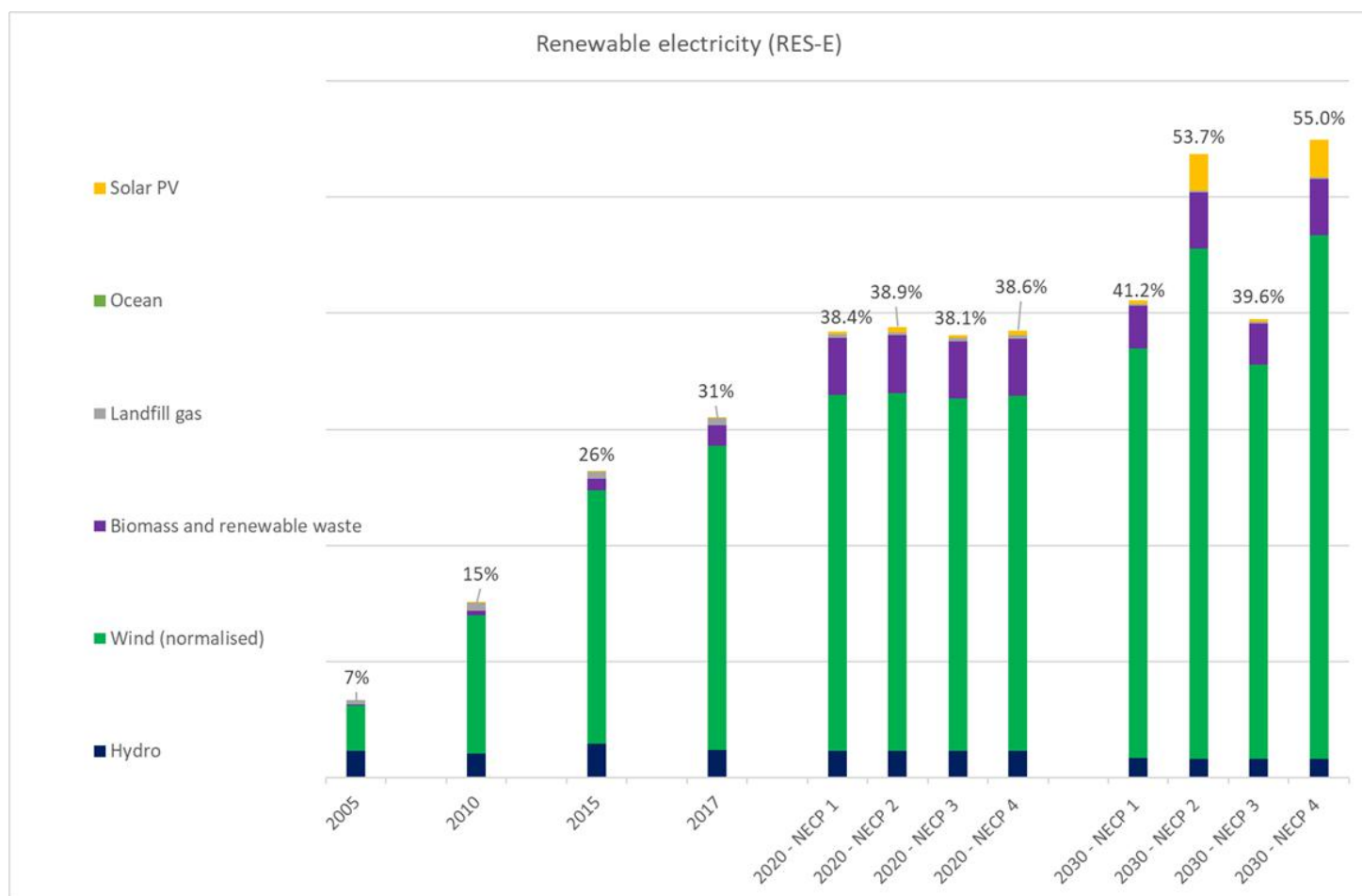


Figure 33: Renewable Electricity

Renewable heat (RES-H)

The impacts of planned policies and measures on renewable heat can be observed by comparing the scenarios in Figures 34 and 35 below. The impacts of measures in a high fossil fuel price future can be observed by comparing the results for NECP2 and NECP1. Some notable observations when comparing the impacts in each sector:

- Planned policies deliver an additional percentage point of renewable heat by 2020. This is primarily due to the assumption that the Support Scheme for Renewable Heat (SSRH) runs for several years in NECP2, whilst in NECP1 the scheme operates in the year 2019 only (based on the budget commitments made by the end of 2017). This drives additional biomass and heat pump ('geothermal') uptake in NECP2. There is also a small increase in household heat pump uptake driven by the domestic grant which is included in NECP2.
- Planned policies contribute an additional 7.1 percentage points to RES-H by 2030. The increase is driven by the full delivery of the SSRH in the services and industry sectors, additional supports for biomethane injection from 2025, and the continued impact of the heat pump grant for homes switching from oil boilers. In both scenarios the role of building regulations in driving uptake of new low carbon heating technologies is also significant with 430,000 heat pumps added in new buildings between 2018-2030.
- Uptake of low carbon heating solutions in industry and service sectors is modelled using SEAI's BioHEAT model which captures the investment decision making process, factoring in fuel and technology prices, attitudes of investors and building stock characteristics. In the high fossil fuel price scenarios it can be noted that uptake of biomass boilers and heat pumps continues to grow in these sectors in the latter half of the 2020s (after SSRH supports come to an end) as fossil fuel prices are assumed to reach sufficiently high levels to drive this fuel switching.
- The BioHEAT model also keeps track of the allocation of biomass resource across all energy end-use sectors. It accounts for the impact of biomass use in electricity on the availability of biomass resource for heating and the consequent impact on the price of biomass fuels. Scenarios with a higher level of biomass co-firing in Ireland's peat power stations therefore result in higher biomass prices in the heating sector and thus uptake of biomass heating technologies is partly curtailed. This explains why the contribution of biomass to RES-H is only slightly higher in NECP2 compared with NECP1, despite the inclusion of the full SSRH in NECP2.

The effect of fossil fuel prices on uptake of renewable heat technologies is significant as can be seen by comparing the results from NECP4 with NECP2. The policies included in these scenarios are identical but the comparably low fossil fuel prices in NECP4 mean that less fuel switching occurs. This underscores the significance of fossil fuel price dynamics and the sensitivity of the modelled outcomes to the assumptions used.

Renewable Heat (RES-H) by Sector

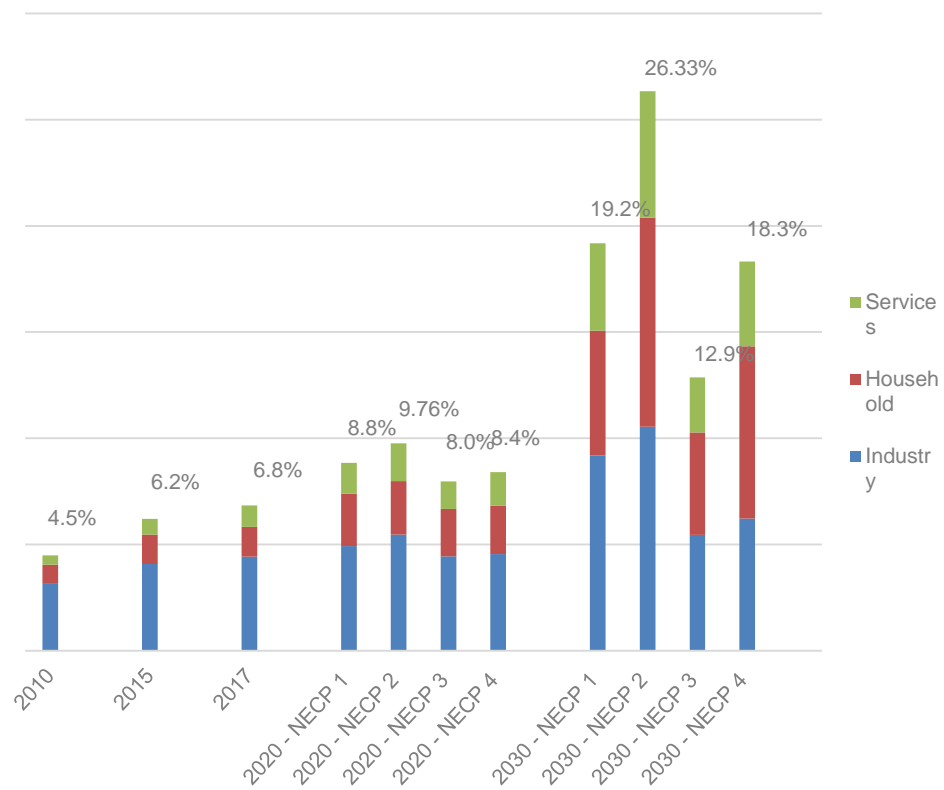


Figure 34: Renewable Heat by sector

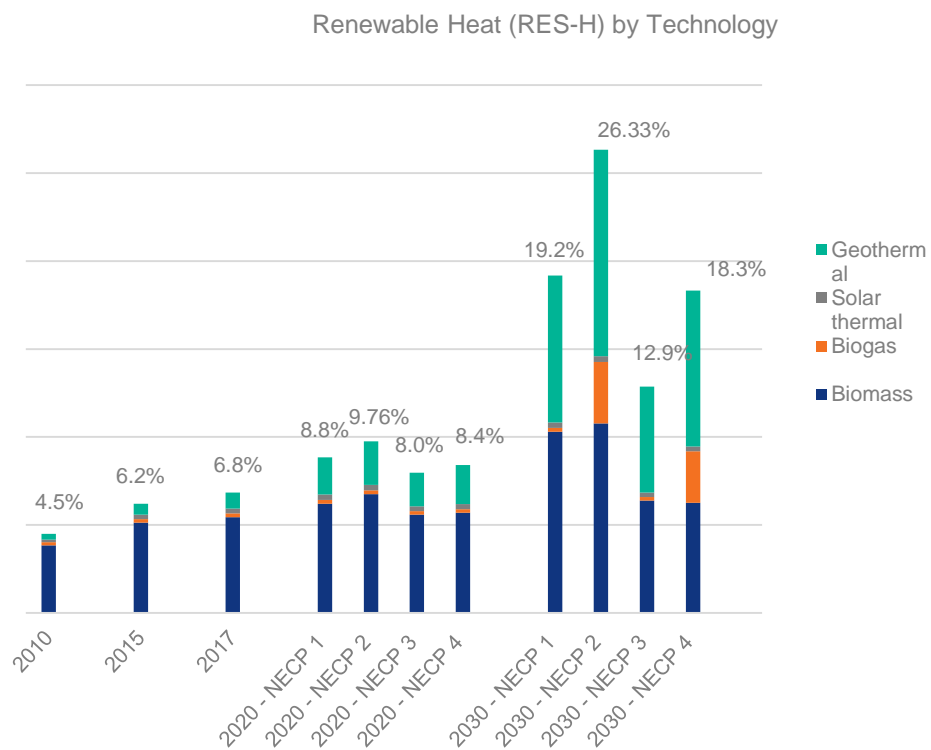


Figure 35: Renewable heat by technology

Projections in total greenhouse gas

Emissions from four scenarios are presented in Figure 36. The impacts of planned policies and measures in the case of high fossil fuel prices (EU Reference Price) can be observed by comparing the trajectory for NECP2 with that of NECP1. Some notable observations when comparing these two trajectories:

- Under the 'With Existing Measures' scenario, total greenhouse gas emissions continue to rise out to 2029.
- The closure of the Moneypoint coal-fired power plant in 2025, in conjunction with increased interconnection, introduces a dramatic reduction in NECP2 – the high oil price scenario (EU Reference scenario) with additional policies and measures.
- There are further gains in NECP2 which results in a continuous reduction in demand from 2025 to 2030.

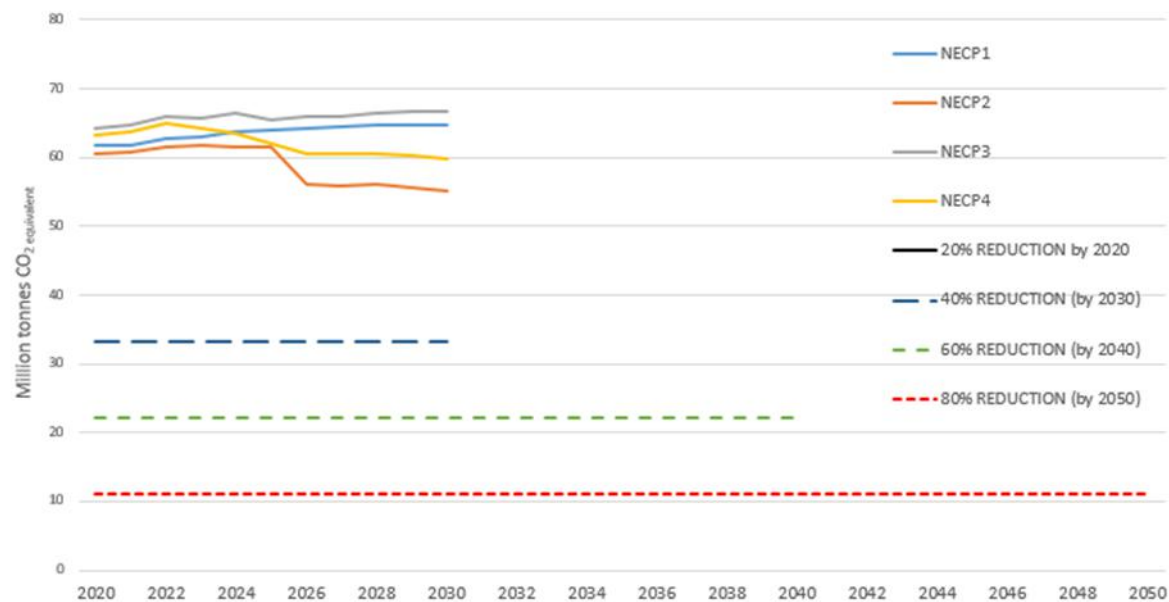


Figure 36 All greenhouse gas emissions with targets

Also included in the figure are the low oil price scenarios (UK BEIS). It can be clearly seen that there are significantly greater emissions in the low oil price scenarios relative to their high oil price complements. This is because a low oil price environment leads to greater energy demand and provides a more challenging environment in which to increase energy efficiency and renewable energy penetration, as the monetary incentive to diversify away from fossil fuels is weaker than at times of high prices. Notable differences to the high oil price scenarios are:

- Greater overall emissions for the low price scenarios relative to the high oil price scenarios;
- A smoother phase-out of Ireland's coal-fired power plant (Moneypoint) but still greater emissions throughout the period (approximately 4% higher on average between 2020 and 2025) and over 8% higher on average between 2025 and 2030 under the With Additional Measures scenarios.

The effect of planned policies and measures in the low oil price scenarios can be seen by comparing NECP4 with NECP3. Similar to the high oil price scenarios:

- Without policies and measures, total greenhouse gas emissions mostly continue to rise out to 2029 – with the exception of 2023 and 2025 in NECP3.
- In the With Additional Measures scenario, the closure of the Moneypoint coal-fired power plant in 2025, in conjunction with increased interconnection, is less dramatic than the high oil price scenario as the coal-fired power plant was less competitive in the low oil price environment, leading to a more gradual phase-out rather than a step change. Nevertheless, overall emissions are still greater overall in the low oil price scenario.

It is interesting to look at split of emissions between the Emission Trading System (ETS) and those sectors outside covered by the Effort Sharing Regulation. ETS emissions are dominated by electricity generation. As discussed earlier, the closure of Moneypoint has a dramatic step change in the high oil price with additional measures scenario (NECP2). As the coal-fired power plant is less competitive from several years before its closure in the low oil price With Additional Measures scenario (NECP4), there is a more gradual transition. However, post-2025 there are still higher emissions in the low oil price With Additional Measures scenario (NECP4) relative to the high oil price With Additional Measures scenario (NECP2). It is interesting that in the high oil price With Existing Measures scenario (NECP1) there are greater emissions from 2022 relative to the low oil price equivalent scenario (NECP3). The greater demand for electricity in the high oil price scenario (NECP1) is the reason behind that trend.

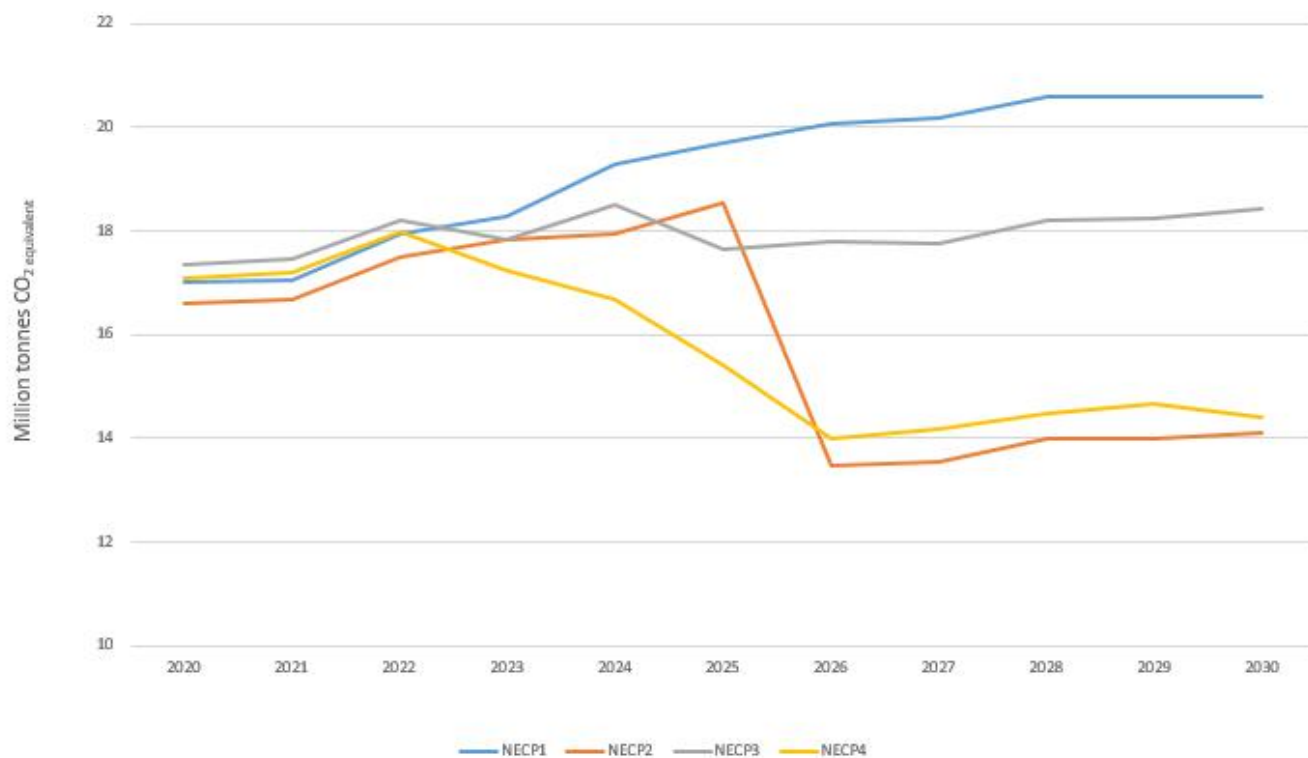


Figure 37 Emissions trading sector trends

Looking at the emissions in the Effort Sharing Regulation sector, which included EPA projections for non-energy agriculture, wastes and industrial process emissions, it can be seen from Figure 38 that the low oil price scenarios result in greater GHG emissions. The With Additional Measures scenarios introduced annual GHG

emissions reductions from 2023. Without any new policies and measures, emissions continue to rise until 2029.

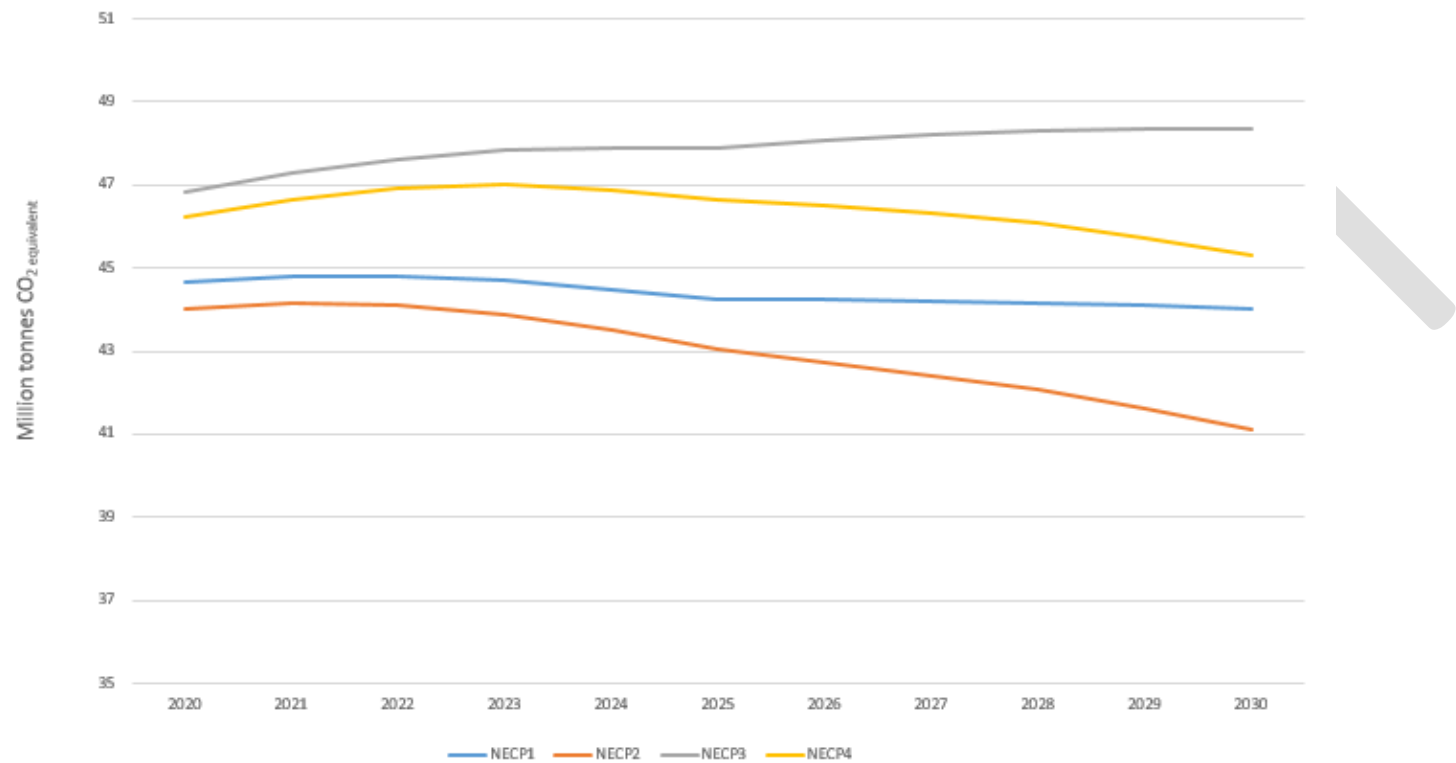


Figure 38 -Effort sharing sector GHG emissions including non-energy agriculture, wastes and industrial process emissions

In terms of compliance with the EU’s Effort Sharing Decision (Decision No 406/2009/EC) 2020 targets, Ireland’s non-Emissions Trading Scheme emissions are projected to be 5% and 7% below 2005 levels in 2020 under the high oil price With Existing Measures and With Additional Measures scenarios, respectively. This compares to the target of 20% below 2005 levels by 2020. For the low oil price scenario there is less progress towards the target with emissions of only 1% and 2% below 2005 levels by 2020 under the low oil price With Existing Measures and With Additional Measures scenarios, respectively.

Ireland's 2030 target under the new Effort Sharing Regulation setting out 2030 targets for EU Member States is a 30% reduction of emissions compared to 2005 levels by 2030 with binding annual limits over the 2021-2030 period to meet that target.

The projected cumulative non-ETS emissions for the scenarios are included in Table 63 with the addition of agriculture emissions and accounting for land use and land use change and forestry (LULUCF) – thereby representing the total anticipated non-ETS emissions. Agriculture and transport dominate non-ETS sector emissions.

The 2030 cumulative non-ETS emissions target is 380.2 Mt CO_{2eq} which means that, given current projections, at best Ireland is projected to exceed its target by 42.5 kt CO_{2eq} in the high oil price With Additional Measures scenarios. At worst, without any additional policies and measures and in a low oil price environment, Ireland is projected to exceed its target by 94 kt CO_{2eq}.

Non-ETS Scenarios	Cumulative emissions from 2021 including non-energy use emissions in Agriculture, wastes and industrial processes including LULUCF									
KtCO _{2e}	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
NECP1	42,302	86,266	130,911	174,741	218,444	262,734	306,798	350,448	394,769	437,815
NECP2	41,652	84,912	128,736	171,586	214,068	256,870	299,150	340,694	382,541	422,687
NECP3	44,793	91,558	139,327	186,552	233,906	282,038	330,123	377,914	426,486	473,860
NECP4	44,141	90,199	137,143	183,363	229,447	276,007	322,206	367,764	413,721	458,028

Table 63 Effort sharing sector GHG emissions

- ii. Assessment of policy interactions (between existing policies and measures and planned policies and measures within a policy dimension and between existing policies and measures and planned policies and measures of different dimensions) at least until the last year of the period covered by the plan, in particular to establish a robust understanding of the impact of energy efficiency / energy savings policies on the sizing of the energy system and to reduce the risk of stranded investment in energy supply

It should be noted that many of the planned policies and measures affecting the energy system are those same policies included in the existing measures scenarios (NECP1, NECP3) but with additional levels of ambition assumed in the planned policies scenarios (NECP2 and NECP4). For example, the Renewable Electricity Support Scheme is included in all scenarios but with different levels of ambition for RES-E in 2030. Therefore it is not possible to assess the policy interactions for all measures. However there are some notable interactions between certain existing policies and planned policies:

- **Electric vehicle supports:** the additional supports for electric vehicles included in NECP2 affect the impacts of other policies in the transport sector. In particular the displacement of petrol and diesel fuel by EVs is also accompanied by a displacement of ethanol and biodiesel fuel. However the shift to electric vehicles still provides a sizeable efficiency gain and shifts demand from a non-ETS sector into the ETS. The increased sales of EVs also mean that car manufacturers do not need to reduce tailpipe emissions from conventional cars to the same extent, since EVs contribute in the calculation of the average emissions of their new car sales. The increased EV stock also contributes to increasing electricity demands, meaning additional renewable generating capacity must be installed via the Renewable Electricity Support Scheme in order to deliver on the RES-E ambitions in 2030.
- **Biomass co-firing supports:** supports for increased co-firing of biomass in Ireland's three operational peat stations in NECP2 affect the uptake of supports for biomass heating offered under the Support Scheme for Renewable Heat. Biomass use in electricity affects the availability of biomass resource for heating and has a consequent impact on the price of biomass fuels for consumers in services and industry. The uptake of biomass heating technologies in NECP2 is partly curtailed by the price effects arising from this additional demand
- **Heat pump supports:** NECP2 includes a grant supporting homeowners to invest in a heat pump targeting the replacement of oil boilers. This results in some modest increases in electricity demand which, similar to electric vehicles, increases the onus on the RESS to deliver additional renewable generating capacity. However the effect is relatively small when compared with the number of heat pumps installed in new homes driven by new building regulations (an outcome which features in all scenarios). The majority of new heat pumps supported by the SSRH installed in the service and industry sectors are assumed to displace existing electric heating systems. Therefore the heat pumps supported under the SSRH actually result in a reduction in electricity demand from these sectors, given the improved coefficient of performance of heat pumps compared with electric heating.
- **National energy efficiency programmes:** as noted below, the additional savings in electricity, gas, oil and solid fuels delivered by national energy efficiency programmes in NECP2 partially reduce the burden on supply-side policies (such as RESS, heat pump supports) in meeting their objectives.

The scenarios which include planned policies and measures assume a sustained, and in some cases augmented, level of ambition in Ireland's national energy efficiency programmes. This includes the ambitions for domestic and commercial retrofit set out in Ireland's National Development Plan.

The impact of the additional supports can be noted by comparing the assessment of primary energy savings in NECP2 with NECP1 in the tables below. The additional effort across national energy efficiency programmes in NECP2 delivers an additional 9.5TWh of primary energy savings by 2030 on top of the savings achieved in

NECP1. Most of the additional savings are from reduced oil consumption, particularly in home heating oil demand.

Energy Efficiency Contribution	2017	2020	2030	2040
Primary Energy Savings (GWh)	17,448	21,674	29,832	31,895
Total Primary Energy Consumption (GWh)	168,787	179,223	202,665	205,582
Savings as share of total consumption (%)	10.3%	12.1%	14.7%	15.5%

Table 64 NECP 1 - Energy efficiency contribution 2017-2040, with existing measures, high oil price

Energy Efficiency Contribution	2017	2020	2030	2040
Primary Energy Savings (GWh)	17,448	22,643	39,377	51,323
Total Primary Energy Consumption (GWh)	168,787	176,909	185,232	193,965
Savings as share of total consumption (%)	10.3%	12.8%	21.3%	26.5%

Table 65 NECP 2 - Energy efficiency contribution 2017-2040, with additional measures, high oil price

The additional policies also deliver electricity savings which translate to a further 1.5TWh reduction in final electricity demand on top of the savings achieved in NECP1. In total the energy efficiency policies in NECP2 account for a reduction in final electricity demand of 5.7TWh in 2030 compared with a scenario in which none of the energy efficiency policies are implemented. These programmes thus deliver a modest reduction in the need for electricity generation assets. However it should be noted that these savings are outweighed by the expected growth in electricity demand arising from increased economic activity and data centre demand in particular.

iii. Assessment of interactions between existing policies and measures and planned policies and measures, and between those policies and measures and Union climate and energy policy measures

- We need final clarification from the Commission on the possibility of including savings from EU measures against EED Article 3 target (e.g. for nZEB regulations and efficiency of passenger car regulations). This will increase the savings % across all years and scenarios
- The accounting here, for NECP, is slightly different to previous NEEAP reporting in that we are only including demand side savings in the main table – and separately reporting supply side impacts. There have also been some refinements of some line item estimates - as part of ongoing refinement/alignment of methods

etc. It would be worth noting this in the NECP given our last projections and NEEAP communications included supply side and has us at 16% EE in 2020, where here we are showing 14.2% – 14.4% (NECP 2 and 4 respectively).

- We will separately provide a savings summary by sector for the main report on the understanding the attached is likely an annex - with summary tables to be included in the main report.

5.2. Macroeconomic and, to the extent feasible, the health, environmental, employment and education, skills and social impacts including just transition aspects (in terms of costs and benefits as well as cost-effectiveness) of the planned policies and measures described in section 3 at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

The Macroeconomic forecasts published by the Department of Finance, contained in the annual Budget and Stability Programme Updates, take into account policies introduced at an aggregate level over the forecast horizon (typically 3 to 5 years). The most recent economic forecast is available in Table 3 on page 8 of http://www.budget.gov.ie/Budgets/2019/Documents/Budget_2019_Economic_and_Fiscal_Outlook_E.pdf

In so far as policies impact on domestic demand, personal consumption and government consumption, it is the overall or aggregate impact of the policies that will impact on the economic forecast rather than an individual measure.

Investment in the low carbon economy has the potential to create decent work and quality jobs to support local communities and workers in regions most strongly impacted by the on-going transformation to a decarbonised society. The Government's National Mitigation Plan recognises that fully realising the economic opportunities in the low carbon economy are key to ensuring a just transition.

To inform this process, the National Mitigation Plan contains a commitment to prepare a report on the economic and employment implications of the transition to a low carbon economy. The exact terms of reference for this work are still to be finalised but will be cognisant of the need to take on board a range of factors. This may include but not be limited to the following areas:

- Employment impacts
- Social and regional dimension
- Need for stakeholder dialogue
- Skills and training aspects

Health

IEA analysis of research has found that “energy efficiency retrofits in buildings (e.g. insulation retrofits and weatherisation programmes) create conditions that support improved occupant health and well-being, particularly among vulnerable groups such as children, the elderly and those with preexisting illnesses. Several studies that quantified total outcomes found benefit cost ratios as high as 4:1 when health and well-being impacts were included, with health benefits representing up to 75% of overall benefits. Improved mental health (reduced chronic stress and depression) has, in some cases, been seen to represent as much as half of total health benefits”.

These health and wellbeing benefits are being validated in an Irish context under the Warmth and Wellbeing scheme. Interim results of this analysis will be available for the final NECP.

Decarbonisation of heat and transport may also lead to health gains where levels of fine particulate matter (PM_{2.5}) air pollution are reduced. Biomass combustion for renewable heat can increase levels of air pollution so careful consideration of this potential negative health impact is required when assessing renewable heat policy. The WHO guidelines recognise that “no threshold has been identified below which there is no damage to health. Therefore, the WHO recommend aiming for the lowest concentrations of particulate matter possible.”

Therefore reduced adverse health impacts from reduced air pollution in Ireland can be a significant co-benefit of the decarbonisation of power generation, heat and transport where climate and clean air policy objectives are fully aligned.

5.3. Overview of investment needs

i. existing investment flows and forward investment assumptions with regard to the planned policies and measures

The modelling underpinning the NECP is based on planned climate and energy measures and underpinning investment in the National Development Plan 2018-2027 being fully delivered, the 55% RESS renewable electricity objective being achieved (funded via the PSO levy) with the necessary grid enhancements and investment being undertaken in the framework of EirGrid’s DS3 programme to permit the grid to accommodate that level of variable generation. The biofuels obligation scheme will continue to be used to ensure increased amounts of biofuels and that funding for the support scheme for renewable heat will be extended beyond the current funding period.

The National Development Plan (NDP) 2018-2027 sets out investment priorities of €21.8 billion for climate action for the 10 year period of which €7.6 billion would come from the Exchequer. The remaining investment would be made by Ireland’s semi-state companies and by the private sector. In addition, some €8.6 billion

funding has been made available for sustainable mobility projects, mostly in public transport. This substantial funding increase will facilitate upscaling of investments and implementation of actions needed to move the country towards the 2030 climate targets. The funding will support the implementation of energy efficiency and renewable measures in the electricity, transport and built environment, especially for heating and cooling. In addition, the NDP contains a commitment to establish a new €500m Climate Action Fund to leverage investment by public and private bodies to contribute to the achievement of Ireland's energy and climate targets.

The National Development Plan 2018-2027, which was published earlier this year alongside the National Planning Framework as part of Project Ireland 2040, commits to investment of €8.6 billion in new public transport infrastructure over the period to 2027. The Department of Transport, Tourism and Sport is currently producing analysis that will form the basis for a framework for investing in land transport up to 2040 – Planning Land Use and Transport – Outlook 2040 (or PLUTO 2040). This will form part of Project Ireland 2040. PLUTO 2040 will be an update to the Department's 'Strategic Investment Framework for Land Transport' (SIFLT), published in 2015. It will focus explicitly on how to ensure the realisation of the National Strategic Objectives set out in the National Planning Framework, taking account of the investment plans in the National Development Plan.

The Public Service Obligation levy ⁹⁶ is chargeable to electricity consumers and is used to support new electricity projects generated from renewable sources. The amount of the levy varies from year to year depending on the amount of supported generation connected, the wholesale electricity market price and the agreed rate at which the generation is to be supported in accordance with the schemes in place.

The draft NECP includes two planned electricity interconnectors. The Greenlink interconnector to Wales is a proposed €400m project. Whilst the project is proposed as a private (merchant) investment, the promoters have sought a “Cap and Floor” regulatory treatment for the interconnector from the Irish and UK regulators. Under such a regulatory arrangement, if revenues from the interconnector operations were to fall below the “floor” price, then the Irish and British consumers would fund the difference. The Celtic interconnector, proposed by the Irish and French TSOs, is a €930m investment, that is expected to be funded in part by a CEF grant and in part by electricity consumers in Ireland and France. For both interconnectors the consumer portion of the cost would be “socialised” – the costs will be included in the costs of distribution networks in the same way as all other electricity infrastructure investments are paid for.

EirGrid's latest Generation Capacity Statement ⁹⁷ as well as Gas Network Ireland's Network Development Plan⁹⁸ provide insights into investments required in the coming decade.

The Biofuels Obligation Scheme (BOS) places an obligation on suppliers of mineral oil to ensure that set percentages of the motor fuel (generally gasoline and motor

⁹⁶ https://www.cru.ie/document_group/pso-levy-2018-19/

⁹⁷ http://www.eirgridgroup.com/site-files/library/EirGrid/Generation_Capacity_Statement_2018.pdf

⁹⁸ <https://www.gasnetworks.ie/corporate/gas-regulation/system-operator/publications/GNI-Network-Development-Plan-2017.pdf>

diesel) they place on the market in Ireland is produced from renewable sources e.g. ethanol and biodiesel.

Figures are published relating to agricultural investment in the Annual Review and Outlook ⁹⁹ (see section 2.11 Investments, Borrowings and Interest.) These amounts are total investment in Agriculture, broken down into Farm Buildings, Land Improvements, Transport Equipment, Agricultural Machinery and Equipment, Other equipment and Breeding Stock.

ii. sector- or market-risk factors or barriers in the national or regional context

Public funding is, as in all jurisdictions, dependent on the pace of economic growth and planned tax takes being available to fund planned policies and measures. The ability to harness increased amounts of electricity generated from renewable sources on a relatively isolated grid system such as Ireland's depends on innovation and technical solutions being brought forward and delivered on. Delays arising as a result of legislative appeals under the Spatial Planning System are also a risk to the delivery on time of planned infrastructure projects. It is assumed that EU regulation over the period will ensure that industry deliver products meeting higher environmental standards.

The planned exit of the UK from the EU presents Ireland with challenges. Ireland will be the EU Member State most affected by the UK's decision to leave the European Union.

Decarbonising the transport sector will require a transition away from conventional fuel use to alternative fuels and new technologies. This transition must have the capacity to cater for increasing travel demand, consequently, it is imperative that investment decisions avoid inflexible 'lock-ins' that would inhibit or delay growth of the transport network. Major operational and infrastructural changes are costly and take time; therefore, an initial transition must not preclude any subsequent transitions between technologies as this will create undesirable and expensive delays in providing for transport expansion.

Alternatively fuelled vehicles are currently still more expensive than conventionally fuelled options. It is also important to note that alternatively fuelled right hand drive vehicles are less readily available; this is a particular risk factor in the bus sector where the number of models available is severely limited. Generally, as greater market availability of low and zero-emission vehicles becomes more pronounced their economic viability should improve in the longer term. Transitioning to alternatively fuelled vehicles potentially requires a significant change in infrastructural and fuel supply requirements. Impact assessments of the capacity and

⁹⁹ <https://www.agriculture.gov.ie/media/migration/publications/2018/AnnualReviewandOutlook2018310818.pdf>

availability of renewable power and gas supplies will be required as more vehicles convert to alternatively fuelled models.

iii. analysis of additional public finance support or resources to fill identified gaps identified under point ii

A number of EU supports are available to encourage sustainable mobility across Europe; these include the Connecting Europe Facility which is supporting the roll out of CNG refuelling stations across Ireland (Causeway Project). There are also several public-private partnerships and initiatives that provide support and resources such as the Fuel Cells and Hydrogen Joint Undertaking, the Joint Initiative for Vehicles across Europe (JIVE) and the **Clean Bus** Deployment Initiative.

The Connecting Europe Facility and Projects of Common Interest are also important funding sources in the energy area, as is the ability to borrow from the European Investment Bank.

5.4. Impacts of planned policies and measures described in section 3 on other Member States and regional cooperation at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

i. Impacts on the energy system in neighbouring and other Member States in the region to the extent possible

Electricity interconnection flows between Ireland and:	Unit	2018	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
UK (not including NI because of All-Island electricity system on Island of Ireland)															
Electricity imports	GWh	360	356	341	434	483	940	807	879	971	874	942	1047	1083	1007
Electricity exports	GWh	2377	2380	2279	2108	2121	1929	2092	2083	1953	2198	2134	2012	2085	2394
France															
Electricity imports	GWh														
Electricity exports	GWh														

Table 66 NECP 1 - With existing measures (WEM) – high oil prices - Projected electricity imports and exports 2017-2040, with existing measures, high oil price

Electricity interconnection flows between Ireland and:	Unit	2018	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
UK (not including NI because of All-Island electricity system on Island of Ireland)															
Electricity imports	GWh	479	507	446	545	520	962	1451	1214	1390	1134	1216	1585	1216	1323
Electricity exports	GWh	1842	1823	1865	1662	1800	1796	3313	3425	3578	3958	3828	3372	4063	4082
France															
Electricity imports	GWh	0	0	0	0	0	0	0	5112	5059	5028	4855	4666	3387	1681
Electricity exports	GWh	0	0	0	0	0	0	0	316	385	414	474	490	1294	2591

Table 67 NECP 2 - With additional measures (WAM) - high oil prices With additional measures (WAM) – high oil prices - Projected electricity imports and exports 2017-2040, with additional measures, high oil price

Electricity interconnection flows between Ireland and:	Unit	2018	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
UK (not including NI because of All-Island electricity system on Island of Ireland)															
Electricity imports	GWh	358	499	384	607	720	1008	957	1032	1275	1113	1149	1329	1078	1020
Electricity exports	GWh	2311	2106	2093	1731	1136	1231	1291	1284	1284	1492	1489	1396	1686	2098
France															
Electricity imports	GWh	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity exports	GWh	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 68 NECP 3- With existing measures (WEM) - low oil prices: Projected electricity imports and exports 2017-2040, with existing measures, low oil price

Electricity interconnection flows between Ireland and:	Unit	2018	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040
UK (not including NI because of All-Island electricity system on Island of Ireland)															
Electricity imports	GWh	507	600	476	675	746	896	1900	1409	1609	1409	1462	1835	1570	1504
Electricity exports	GWh	1823	1690	1809	1633	1180	1391	2423	3206	3286	3465	3562	3348	3322	3489
France															
Electricity imports	GWh	0	0	0	0	0	0	0	4942	4815	4732	4634	4413	3440	1979
Electricity exports	GWh	0	0	0	0	0	0	0	439	511	621	681	629	1054	2204

Table 69 NECP 4- With additional measures (WAM) – low oil prices - Projected electricity imports and exports 2017-2040, with additional measures, low oil price

- ii. Impacts on energy prices, utilities and energy market integration

Until Ireland is interconnected with France and in light of the UK's planned exit from the EU, the ability of Ireland to impact on energy prices, utilities and market integration at the EU level is limited.

- iii. Where relevant, impacts on regional cooperation

Planned interconnection with France would connect Ireland to the EU electricity market.

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Annex 1, Part 2 List of parameters and variables

[See attached spreadsheet](#)

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