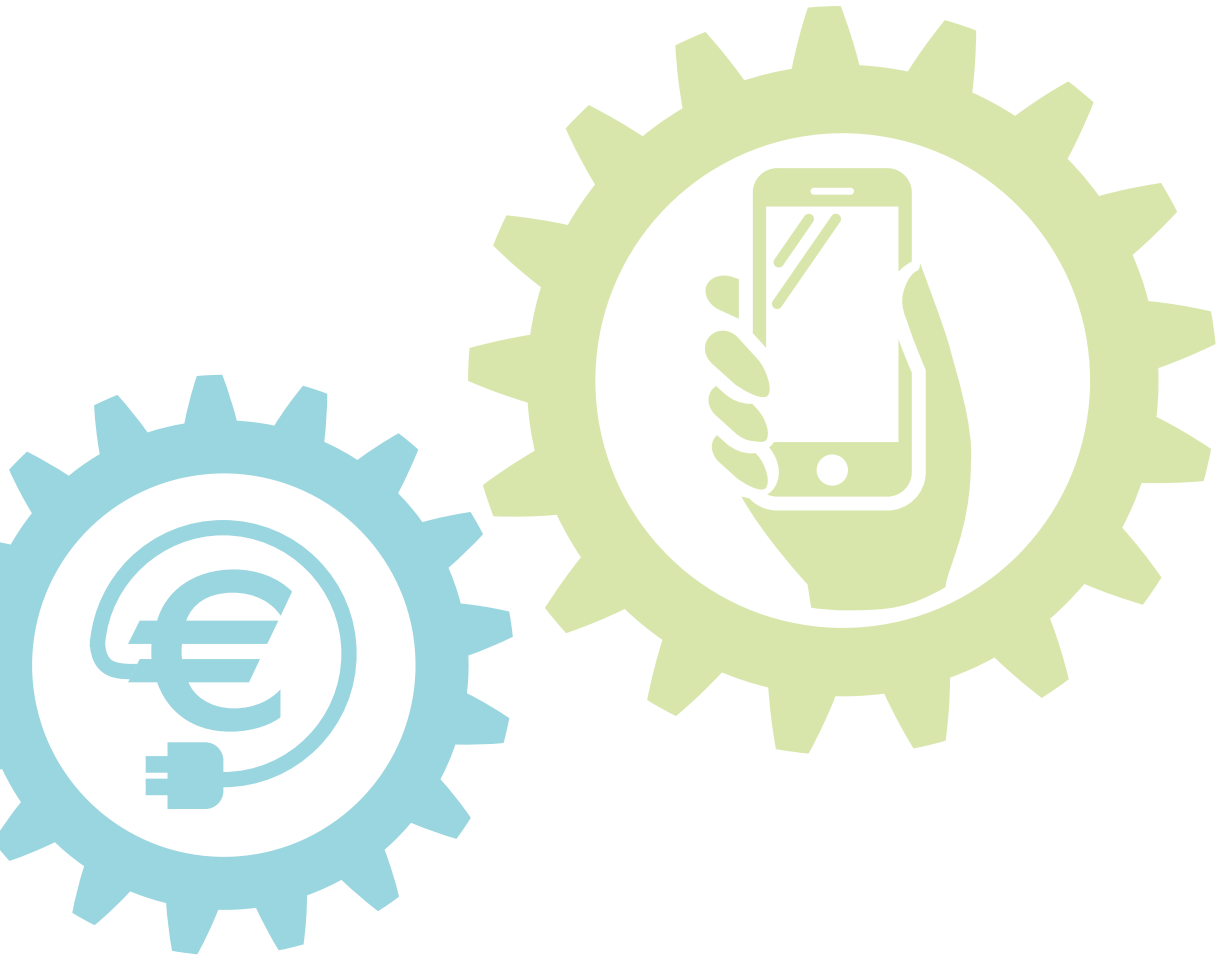
Roinn Cumarsáide,
Fuinnimh & Acmhainní Nádúrtha
Department of Communications,
Energy & Natural Resources

Ireland's Transition to a Low Carbon Energy Future

2015-2030



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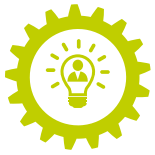

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MESSAGE FROM AN TAOISEACH

Ireland's access to secure, clean and affordable energy is essential to keep our recovery going. This White Paper on energy is an essential part of the Government's overall recovery plan that charts the future development of the Irish economy and energy sector. Our ability to attract and retain investment and build Irish enterprise depends on our ability to guarantee a reliable supply of energy, at competitive cost. At the same time, we must continue to lessen our dependence on imported fossil fuels, reduce our emissions, and embrace the transition to a low carbon and climate resilient future.

This White Paper sets out our energy future. It confirms our core objectives of sustainability, security of supply and competitiveness. It strikes a balance between these three pillars, whilst ensuring a low carbon future. It seeks to empower and engage communities across Ireland. Facilitating our people to engage and debate Ireland's energy challenges is essential for the future development of the industry.

A strong energy policy, focussing on cost competitiveness, innovation and the development of new technologies will create new jobs and promote new enterprise. This White Paper commits to managing policy costs within our control while developing Ireland as a hub for energy innovation.

The Policy Statement on Sectoral Economic Regulation highlights the importance of policy coherence, in providing direction and controlling costs. This White Paper ensures a regulatory framework that is supportive of the key national policy objectives of competition and the consumer, and that meets best international standards – all central to securing Ireland's ongoing economic recovery and maintaining international advantage – and is another example of the Government's approach to strengthening sectoral economic regulation, in line with the *'Regulating for a Better Future'* policy.

Our vision is to make Ireland a world leader in the cost effective renewable energy and the Government is determined to harness the opportunities presented by emerging technologies. In addition to reducing our dependence on imported fuels and providing a more sustainable path, these technology sectors have a pivotal role to play in economic development, creating jobs and delivering regional development. The Government's Capital Plan, *Building on Recovery: Infrastructure and Capital Investment 2016-2021*, will play a key role supporting this process.

I commend Minister White and his Department for presenting an energy policy framework that sets out a clear, high level strategic direction, underpinned by a solid body of plans and strategies. Combined with Ireland's first ever legislation to address climate change, it will make a significant contribution to achieving our climate change goals. This White Paper is a blueprint that provides certainty around our energy goals and will keep our recovery going long into the future.

An Taoiseach, Enda Kenny, T.D.

FOREWORD FROM THE MINISTER

This White Paper sets out a vision for transforming Ireland's fossil fuel-based energy sector into a clean, low carbon system by 2050.

It is a transformation that is already underway. But, like other nations, we need to intensify our efforts to combat the impact of global warming and to make sustainability the very foundation of our energy policy. This commitment comes with a pledge to all our citizens, communities and businesses – and those who work to provide energy to our homes and workplaces – that we will maintain stability, affordability, and security of supply as we make the transition to a low carbon energy future.

This policy framework gives a new impetus to energy efficiency, which will be at the centre of our energy transition. New technologies like smart meters, heat pumps, and mobile connectivity will allow citizens to boost energy efficiency and save money by managing their energy use. Government will reduce barriers to the installation of energy efficiency systems in homes, businesses and public places.

We will accelerate the development and diversification of renewable energy generation. Renewables currently account for almost 23% of our electricity generation. This demonstrates real progress, and it has been achieved more cost-effectively than in almost any other European country. But eventually we will have to generate 100% of all our energy needs – not just electricity – from clean sources.

Onshore wind will continue to make a significant contribution. But the next phase of our energy transition will see the deployment of additional technologies as solar, offshore wind and ocean technologies mature and become more cost-effective.

In the course of the transition we will gradually reduce our dependence on the fossil fuels – coal, peat, oil and gas – that currently dominate our energy mix. But, as the International Energy Agency acknowledges, there will continue to be a need for oil and gas (particularly gas) to meet our energy needs well into this century.

The White Paper reaffirms an evidence-based approach to policy development and implementation. This will help provide the confidence and certainty that investors need in policy, regulation and infrastructure. We need to encourage innovation in the technologies and services that will reduce our carbon footprint, cut costs, improve energy security, and promote national and regional employment and economic development.

This emphasis on technological change and innovation will be one of the central planks of our energy policy. Ireland is well placed to make further advances in this area, through our many research institutes and facilities, and because so many technology companies – large and small, indigenous and foreign-owned – are located here.

So there will be real and lasting economic and employment opportunities arising from the energy transition. And we are committed to supporting businesses, workers and communities to make the transition away from older energy technologies – in the direction of new jobs, new technologies, and new opportunities.

We will not lose sight of the need to minimise and control costs for households, who expect affordable bills and protection from energy poverty, and for industry, to maintain a competitive and job-friendly business environment.

Our energy transition will entail deeper cooperation across local and national government, agencies and departments, and with our neighbours on this island and across Europe.

There will be a new focus on citizens and communities as active participants, and agents of change in how we generate, transmit, store, conserve, and use our energy. In time, our energy system will become more decentralised, altering many traditional assumptions about demand and supply. This will require deep change in the mindsets of individual consumers, businesses, agencies, and utility companies right across our economy and society.

The White Paper offers stakeholders the opportunity to contribute to policy development and implementation, including through a new National Energy Forum, which will maximise consensus on the policy measures needed to decarbonise our country.

We all want to safeguard our environment for future generations, just as we all need and expect a secure supply of affordable energy. This means we will have to work together, drawing on all our human goodwill and ingenuity, to expedite our energy transition.

This White Paper provides a framework to enable each and every one of us to play our part in building a low carbon future, one of the most important and ambitious projects of our age. It is a vision that can – and must – engage every energy citizen, every energy community, and every stakeholder in our energy future.

Alex White T.D.
Minister for Communications, Energy and Natural Resources

EXECUTIVE SUMMARY

Chapter 1: Introduction

This White Paper is a complete energy policy update, which sets out a framework to guide policy between now and 2030.

Its objective is to guide a transition to a low carbon energy system, which provides secure supplies of competitive and affordable energy to our citizens and businesses.

This national energy policy framework has been developed in the context of the significant role played by European institutions in determining energy policy, markets, and regulation. It takes account of European and International climate change objectives and agreements, as well as Irish social, economic and employment priorities.

The White Paper does not set out detailed proposals, which can be found in specific work programmes that are either in place or under development. Progress in the implementation of energy policy since the last white Paper was published in 2007 is set out in Annex C.

The White Paper takes account of an extensive consultation conducted by the Department of Communications, Energy and Natural Resources (DCENR) following the 2014 publication of the Green Paper on energy policy in Ireland.

The ambitious energy transition outlined in this document requires the active engagement of Ireland's citizens, communities, businesses, academics and experts, and local and national State agencies. It will also require better public awareness of the nature and scale of the challenges we face, and a robust consensus about the broad policy measures required to meet those challenges.

We place great value on our relationship with Northern Ireland and will continue our close cooperation on a range of energy matters including the regulation of the all-island single electricity market (SEM) (in which Northern Ireland and Ireland are equal partners) the development of the Integrated-Single Electricity Market (I-SEM), energy transmission and the proposed North-South transmission line.

The publication of this White Paper will contribute to building that understanding, engagement and consensus.

To ensure that our long-term energy policy is transparent, robust and coherent, we intend to publish an annual update and undertake a comprehensive review every five years. The first comprehensive review will be undertaken in 2020.

Chapter 2: Climate change and a new energy policy framework

A radical transformation of Ireland's energy system is required to meet climate policy objectives.

Our vision of a low carbon energy system means that greenhouse gas (GHG) emissions from the energy sector will be reduced by between 80% and 95%, compared to 1990 levels, by 2050, and will fall to zero or below by 2100.

Ireland's energy policy addresses three core objectives: sustainability, security of supply, and competitiveness. It also addresses the need for affordable energy for domestic and business consumers.

The citizen will be at the centre of Ireland's energy transition, which will be underpinned by policy and regulatory stability.

Energy policy will seek to achieve optimum benefits at least cost. Government will ensure that policy measures are evidence based and subject to rigorous analysis and appraisal prior to being implemented. This will include analysis of the distributional impact of policy measures.

New technologies, services, energy network architectures and community-based energy initiatives will emerge to facilitate and drive the energy transition.

A low carbon future will involve:

- radically changing our behaviour as citizens, industry and Government
- becoming more energy efficient
- generating our electricity from renewable sources of which we have a plentiful indigenous supply
- moving to lower emissions fuels (e.g. moving from peat and coal to gas), and ultimately away from fossil fuels altogether
- increasing our use of electricity and bioenergy to heat our homes and fuel our transport
- increasing the Biofuels Obligation and improving take-up of zero and low carbon vehicles such as electric and natural gas vehicles
- supporting the wide scale deployment of renewable heat in the business, public and residential sectors
- adopting new technologies as they emerge.

Chapter 3: Ireland's energy future: The transition to 2050

Ireland's 2020 renewable energy target is to increase the share of final energy consumption made up of renewable energy sources (RES) to 16%. This target is broken into three key sectors with individual targets for each sector: 40% of electricity supply (RES-E), 12% of heating (RES-H), and 10% of transport (RES-T). Ireland also has a target of a 20% improvement in energy efficiency by 2020.

There will be substantial increases in the cost of carbon, in the short and medium-term, through the EU Emissions Trading Scheme.

Non-renewables currently account for over 90% of energy consumption in Ireland. This will fall to 84% in 2020 if we reach our binding EU targets for renewables.

In order to reduce GHG emissions by 80-95% by 2050, fossil fuels would account for 19-30% of final energy demand in Ireland. This means that non-renewable energy sources will make a significant – though progressively smaller – contribution to our energy mix over the course of the energy transition.

In the short to medium-term, the mix of non-renewables will shift away from more carbon-intensive fuels, like peat and coal, to lower-carbon fuels like natural gas.

In the longer-term, fossil fuels will be largely replaced by renewable energy sources.

Oil and natural gas will remain significant elements of Ireland's energy supply between now and 2035.

The continued operation of the Whitegate refinery, on a commercial basis, is highly desirable from a strategic energy security perspective.

No applications proposing the use of unconventional gas exploration and extraction (UGEE, also known as hydraulic fracturing) will be considered in advance of the consideration of the findings of a scientific study currently underway.

Chapter 4: From passive consumer to active citizen

Consumers will drive the transition by, for example, choosing to use less energy, adopting lower carbon options for transport and heating shifting energy use to off-peak times or investing in smart home technologies.

The energy system will change from one that is almost exclusively Government and utility led, to one where citizens and communities will increasingly be participants in energy efficiency and in renewable energy generation and distribution.

The energy transition will require improved community engagement in policy making and planning.

A National Energy Forum will be established to maximise and maintain consensus on the broad policy measures required in the energy transition.

The Government will keep legislation and procedures under review to ensure that citizens have ongoing opportunities to input into energy policy development, and that they are properly consulted on infrastructure developments that affect them.

Government will widen the opportunity for citizen participation in energy matters by:

- supporting community participation in renewable energy and energy efficiency projects
- facilitating access to the national grid for designated renewable electricity projects, and developing mechanisms to allow communities receive payment for electricity
- providing funding and supports for community-led projects in the initial stages of development, planning and construction
- providing a new support scheme for renewable electricity from 2016
- developing a framework for agreeing how communities share in the benefits of substantial new energy infrastructure located in their area, and establishing a register of community benefit payments
- examining shared ownership opportunities for renewable energy projects in local communities
- exploring the scope to provide market support for micro generation
- engaging with local government on advising consumers on energy efficiency initiatives and clean energy options, integrating energy options, scoping the opportunities for demand and supply related local energy action through integrating energy issues into local area planning, and bringing stakeholders together to find locally appropriate solutions that bridge the gap between demand and supply (e.g. biomass fuel, district heating solutions).

Chapter 5: Delivering sustainable energy: Efficiency, renewables, technology

Renewable energy and improved energy efficiency will play vital roles in reducing emissions. Decisions about the development and deployment of new technologies will inform the renewable energy mix and impact on the role of citizens as energy consumers.

By 2030, the Better Energy Programme will deliver enough deep energy efficiency upgrades to put the residential sector on a realistic trajectory to a low carbon energy future.

- We will support the development of affordable financing options for domestic energy efficiency.
- We will introduce a comprehensive and sustained information campaign and more advisory support for consumers to address the barriers to consumer decision-making on energy efficiency, starting in the first half of 2016 with the publication of new, more consumer-friendly Building Energy Rating.
- We will create an advice centre within the Sustainable Energy Authority of Ireland (SEAI) to support consumer awareness of the growing range of energy-efficient appliances and energy control systems.
- We will strengthen building regulations for the residential sector, with a focus on energy efficiency, heating and lighting.
- We will help householders identify cost saving energy efficiency investments through grant schemes.
- We will increase the scope of SEAI programmes to support community energy efficiency projects and facilitate the development of community networks.
- We will publish a new Affordable Energy Strategy in early 2016 to help those who are vulnerable to energy poverty.
- We will ensure that the SEAI continues to provide expert advice on energy efficiency, and technical support, to businesses.
- We will ensure that the SEAI engages with large energy users and promotes the ISO 50001 (energy management) and IS 399 (energy efficient design management) standards as essential requirements.
- We will update the Energy Efficiency Obligation Scheme to inform decisions relating to new sectoral targets for the next phase of the scheme, due to begin in 2017, and extend this obligation to include the electricity and gas distribution system operators.
- We will publish a Public Sector Energy Efficiency Action Plan in early 2016.
- The SEAI Schools Programme, in consultation with the Department of Education and Skills, will support schools, teachers and the curriculum in energy education matters, and extend energy education into further, higher and vocational education sectors.
- We will introduce a new support scheme for a range of renewables in the RES-E sector from 2016.
- We will update existing support schemes for renewable energy so that they are compatible with the wholesale electricity market reform.
- We will ensure that grid connection policy has due regard to current and future renewable energy policy, including in relation to community renewable energy projects.

- We will publish a Renewable Electricity Policy and Development Framework to underpin planning and development of larger scale renewable electricity generation development on land.
- We will develop a policy framework to encourage the development of Combined Heat and Power (CHP).
- We will support the deployment of heat from renewable sources through the Renewable Energy Feed-In Tariff (REFIT) 3 scheme and develop new supports to meet 2030 renewable heat targets.
- We will facilitate the deployment of proven Renewable Energy Strategy-Heat (RES-H) technologies by updating building regulations as required by EU Directives.
- We will introduce a Renewable Heat Incentive (RHI) in the non-Emission Trading Scheme (non-ETS) sector from 2016.
- We will develop a comprehensive heating strategy to reduce the carbon intensity of the heating sector in the period beyond 2020.
- We will develop a policy framework to encourage the development of district heating.
- We will establish a regulatory framework to facilitate the development of geothermal energy resources.
- We will support transport modal shift through better alignment of land use and transport planning and a continuation of smarter travel programmes.
- We will develop a national smart driving programme across all transport sectors.
- We will support the adoption of electric and gas vehicles through grants and tax relief.
- We will develop a national policy framework to support infrastructure for alternative transport fuels.
- We will complete an economic assessment of the potential for the development of biogas.
- We will support the uptake of lower emitting public service passenger cars, including through a scrappage-type scheme for older taxis being replaced by electric vehicles.
- We will establish a green bus fund to support the purchase of cleaner and greener public transport vehicles in the period to 2020.
- We will support initiatives to improve the energy efficiency of the rail network.
- We will support the deployment of sustainable biofuels through increases to the Biofuels Obligation Scheme. The first such increase will take effect on 1st January 2016.
- We will address any administrative, market or regulatory barriers to the implementation of energy storage projects.
- We will examine the case for designating large-scale storage projects as strategic energy infrastructure under planning, regulatory and policy criteria.

Chapter 6: Energy security in the transition

Ireland will further develop a coordinated energy security policy, which encourages diversification of energy supplies and facilitates more integrated energy markets, through our membership of the EU and the International Energy Agency (IEA).

Achieving our sustainable energy goals, and having fully integrated and well-functioning markets, will enhance our energy security.

- We support the 2015 European Commission Energy Union strategy, which recognises the need for Europe to play a stronger role in global energy markets and for Member States to diversify energy supplies and work more closely together on security of supply.
- We support European Union (EU) and international efforts to improve planning for electricity and gas emergency management, and critical infrastructure protection including cyber security.
- We will review and enhance energy emergency plans on an ongoing basis and develop a framework to strengthen oil, gas and electricity emergency plans in line with the National Framework on Emergency and Crisis Management.
- We will maximise the level of oil stocks held on the island of Ireland, subject to increased storage availability and value for money considerations.
- We will commission research on future demand for fuel sources and interconnection requirements.
- We will review the existing primary and secondary fuel obligations in the power generation sector.
- We will analyse the options for increased gas storage.
- We will work with our counterparts in Northern Ireland to monitor and support relevant gas and electricity infrastructure proposals.

Chapter 7: Enabling the transition: Regulation, markets and infrastructure

Stable, transparent, evidence-based, and independent regulation is essential to facilitate competition, to support investment, and to ensure that the cost of capital and network costs are minimised.

The SEM is in the process of being reformed and regulators are working to implement the new I-SEM market by 2017. Integration between the SEM and its neighbouring electricity markets will gradually deepen.

Ireland's electricity and natural gas networks will be retained in State ownership.

The need for new energy infrastructure will be assessed through robust analysis and decisions will take account of the views of citizens.

EirGrid's Grid25 provides the strategic overview for the development of the electricity grid transmission system. Its 2015 review confirmed the urgent need for the implementation of the proposed North-South transmission line to improve security of supply and reduce transmission costs.

- Several initiatives are underway to promote further interconnection between Ireland and EU Member States.
- We will work with the EU and its partners to ensure the EU regulatory framework supports the transition to a low carbon future throughout Europe.
- We will review the legal and institutional framework for the regulation of electricity and natural gas markets, including the CER's mandate, in line with ongoing government sectoral economic regulation requirements.
- We will by mid-2016, publish an overview of the legislative work programme for the regulation of the electricity and gas markets.

- We will move any necessary regulatory legislation, including that already in the legislative programme in respect of the Commission for Energy Regulation (CER), administrative sanctions and I-SEM.
- We will engage with the EU in its review of the wholesale electricity market design.
- We will improve the experience of citizens and developers who engage with planning and permitting processes by building on the effective cross-departmental and cross-agency work initiated under the Projects of Common Interest (PCI) process.
- We will promote better engagement with citizens and communities, including by building on the success of the SEAI's Better Energy Programmes.

Chapter 8: Energy costs

- The costs of the energy transition will primarily be funded by commercial and household investment and charges on energy use, supported by Government initiatives and EU funding.
- The price of energy is primarily determined by the market. Irish energy prices are influenced by the country's scale and demography and the fact that we are relatively weakly interconnected. The main determinants of energy prices are set out in chapter 8.
- The cost of carbon will grow as future European energy policy measure's drive the market towards low carbon technologies.
- Government has a responsibility, through regulation and policy measures, to ensure that citizens and businesses are protected from unnecessarily high energy costs. Policy-related costs will be minimised as far as possible.
- The CER has a statutory responsibility to protect the interests of consumers and ensure that prices are fair and reasonable.
- We will ensure that adequate safeguards are in place to protect people at risk of energy poverty.
- A new National Affordable Energy Strategy, to be published in early 2016, will contain a new methodology for measuring and reporting energy poverty, actions to improve energy efficiency in the rental sector, measures to ensure better quality services to energy customers and a new pilot scheme for deep energy upgrades for people suffering from certain chronic health conditions.
- The CER will enhance consumer protection and market monitoring and become a more active advocate for energy customers. This will include publishing an assessment of the development of competition in retail markets (and its impact on prices), publishing advice on reducing energy bills, and publishing details of supplier compliance with consumer codes and requirements.
- The CER will ensure that competitive markets are delivering for all consumers. It will examine the structural factors that underpin consumer disengagement (such as the extent to which energy bills are understood by consumers) and outline remedial solutions.
- The CER will ensure that energy suppliers include additional information on their customer bills, including information on energy usage and how it compares to that of other customers.
- The Government will introduce any legislative changes required to support the CER in carrying out these actions.
- The Government will ensure policy choices are evidence-based with a focus on competitiveness, cost-benefit, security and sustainability.

Chapter 9: Innovation and enterprise opportunity

Our energy transition will have a positive impact on innovation, economic activity and job creation by encouraging investment in the products, services and technologies needed in our low carbon future.

We will help enterprises, sectors and localities that depend on more traditional energy activities to adapt to the changing environment as our dependence on these activities declines.

Sustainable energy is already worth €1.5 billion a year to Ireland, where it employs 18,000 people. The rapidly growing EU and global markets are much larger.

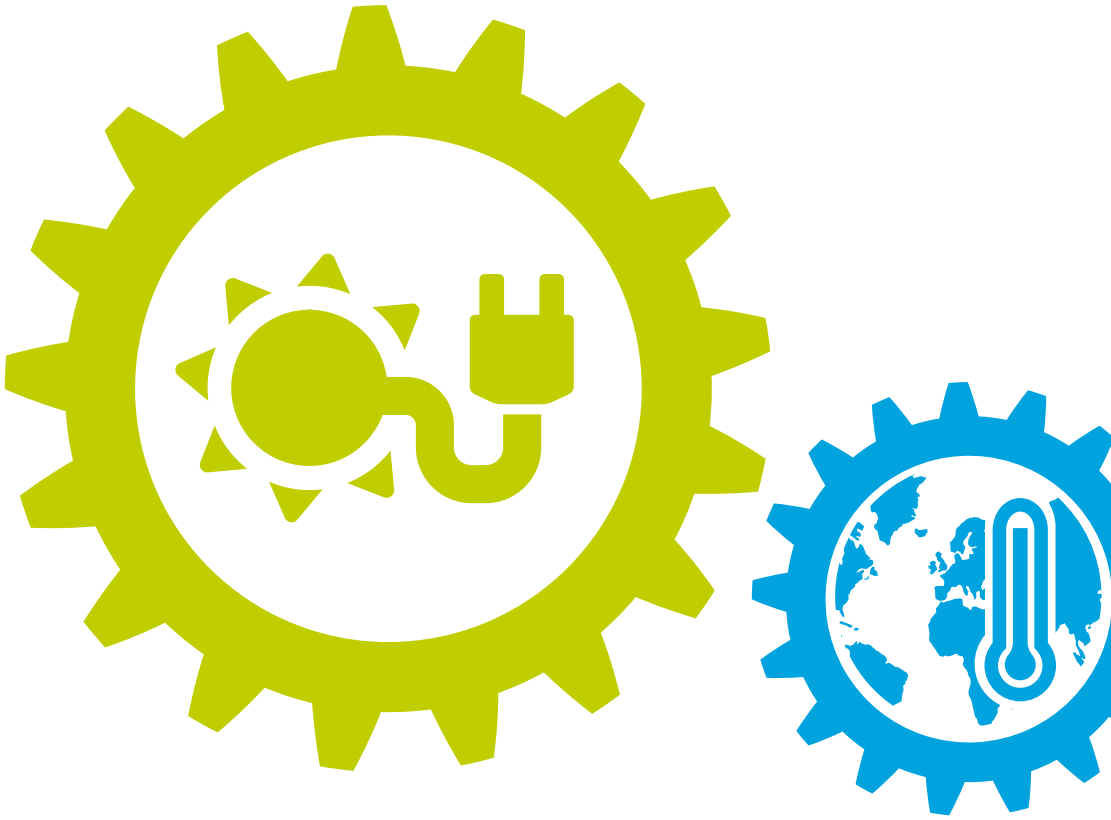
Irish government funding for energy R&D has been consistently high since 2005 and has increased in recent years. The Irish research community is home to several world-class centres of energy research excellence and our research organisations have had significant success in EU funding programmes.

An interdepartmental committee established under the Action Plan for Jobs is working to position Ireland as Europe's Energy Innovation Hub.

The Energy Research Strategy Group (ERSG), established by the DCENR, has identified research areas and requirements for ensuring world class energy research in Ireland. The implementation of this strategy will provide policy certainty in energy research.

- We will continue to support Ireland's energy research sector, with policies that allow for the identification and prioritisation of new concepts and technologies that enable the energy transition.
- We will oversee the implementation of the energy research strategy, aligning energy policy and research strategy with EU strategy and maximising our potential to secure funding under the EU Horizon 2020 research programme.
- We will work with national, regional and local economic development agencies to support jobs and local economic activity by attracting energy business and helping existing energy businesses to embrace new technologies and developments.

1 Introduction



1 Introduction

1. This White Paper sets out a vision and a framework to guide Irish energy policy between now and 2030. It is a complete energy policy update and its actions have been informed by our vision to transform Ireland into a low carbon society and economy by 2050, with 2030 representing a significant milestone. By this we mean that we will reduce GHG emissions from the energy sector by between 80% and 95% (compared to 1990 levels) by 2050, while ensuring that secure supplies of competitive and affordable energy remain available to our citizens and businesses.

2. Energy-related emissions of carbon dioxide (CO_2) dominate global GHG emissions. In Ireland, energy-related GHG emissions, which include those from electricity generation, transport, residential heating and fuel use in the commercial, public and enterprise sectors, account for 66% of total GHG emissions.

3. This national energy policy framework has been developed in the context of the significant role played by European institutions in determining energy policy, markets, and regulation. Similarly, it takes account of European and international climate change objectives and agreements, as well as Irish cross-governmental social, economic and employment priorities.

4. We place great value on our relationship with Northern Ireland and will continue our close cooperation on a range of energy matters including the regulation of the SEM (in which Northern Ireland and Ireland are equal partners) the development of I-SEM, energy transmission, and the proposed North-South transmission line.

5. In February 2011, the European Council reconfirmed the EU objective of a low carbon society by 2050. This was in line with the findings of the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) [1]. To ensure that Ireland can cost effectively and equitably contribute to this objective, as part of joint global mitigation efforts, it will be necessary to transform our energy sector and radically curtail our use of fossil fuels over the next 35 years.

6. Ireland will continue to make an active and progressive contribution to the development of European energy policy, which will place a progressively higher cost on GHG emissions in the period to 2050. An increasing EU and domestic 'cost of carbon' charge on GHG emissions will drive up the cost of carbon-intensive energy sources and lead firms and consumers to adopt low carbon fuels and energy efficient technologies.

7. This White Paper is a policy framework. Detailed policy proposals can be found in specific work programmes, some of which are under development or are already being implemented (Annex A and B).

8. The last Energy White Paper, 'Delivering a Sustainable Energy Future for Ireland' [2] was published in 2007. It was the first comprehensive energy policy statement in several decades and provided policy certainty and a vision for energy for the period from 2007. It underpinned substantial achievements at a time of significant change, which saw the introduction of the SEM in 2007 and the completion of the east-west electricity interconnector in 2012.

9. The period between 2007 and 2015 has also seen significant advances in Ireland's energy efficiency and renewable energy generation and use. Renewable energy sources (wind, hydro, landfill gas, biomass and biogas) accounted for nearly 23% of Ireland's electricity consumption in 2014, which is just over halfway to our 2020 target of 40%. The use of renewables in electricity generation in Ireland reduced our CO_2 emissions by 2.6 million tonnes in 2014. The Council of European Energy Regulators found that Ireland's approach to supporting renewable energy is one of the most cost effective in the EU. Meanwhile, our National Energy Efficiency Action Plan and the SEAI Better Energy Programme have helped significantly reduce our energy use and improve energy efficiency in the commercial, public and domestic sectors.

10. More details of progress in energy policy outcomes since 2007 is available in Annex C of this White Paper.

11. The development of this policy framework began in May 2014 with the publication of a Green Paper on Energy Policy in Ireland [3] which also highlighted policy developments and progress in the period 2007-2014. An extensive public consultation on the Green Paper heard evidence and opinion from a wide range of stakeholders.

12. We have taken careful account of almost 1,250 written submissions received in response to the publication of the Green Paper, and we listened to the many diverse and expert opinions expressed at public workshops organised by DCENR to inform the development of this policy framework. A report on the consultation process, including a summary of the responses received, is available at *www.dcenr.gov.ie*.

13. One of the clearest messages to emerge from the consultation concerned the need for much better engagement with citizens and communities about the energy policy decisions that affect them. The ambitious energy transition outlined in this document will not be possible without the active engagement of Ireland's citizens, communities, businesses, academics and experts, and local and national State agencies. It will also require better public awareness of the nature and scale of the challenges we face, and a robust consensus about the broad policy measures required to meet those challenges. The publication of this White Paper will contribute to building that understanding, engagement and consensus.

Green Paper on Energy Policy in Ireland

The Green Paper sought views on six priority energy policy areas:

- empowering energy citizens
- markets and regulation
- planning and implementing essential energy infrastructure
- ensuring a secure energy mix
- putting the energy system on a sustainable pathway
- driving economic opportunity.

Consultation on the Green Paper began in May 2014 and included written submissions, seminars on each of the six priority areas, and regional seminars around the country. There were almost 1,250 written responses to the Green Paper and around 850 people attended the seminars.

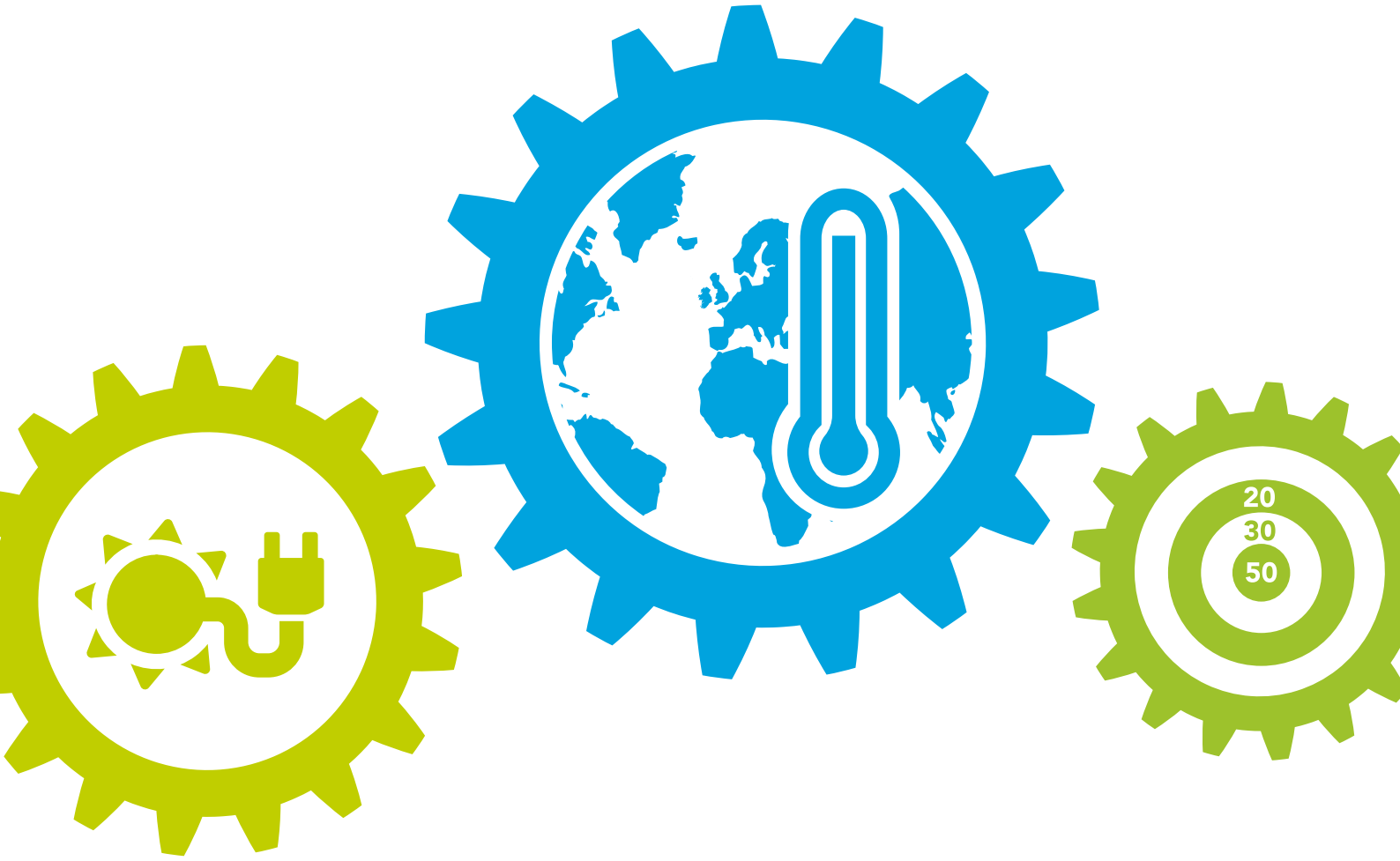
14. To ensure that our long-term energy policy is transparent, robust and coherent, we intend to publish an annual update and undertake a comprehensive policy review every five years. The first comprehensive review will be undertaken in 2020.

15. The White Paper is set out as follows:

- **Chapter 2: Climate Change and a New Energy Policy Framework** considers the need to develop Ireland's energy policy to meet the challenge of global warming. It introduces the new policy and legislative framework and sets out a vision for a low carbon future.
- **Chapter 3: Ireland's Energy Future: The Transition to 2050** starts with a review of Ireland's current status with respect to energy and climate targets, and outlines pathways to a low carbon energy system by 2050.
- **Chapter 4: From Passive Consumer to Active Citizen** outlines the role of citizens and communities in the energy transition.
- **Chapter 5: Delivering Sustainable Energy: Efficiency, Renewables, Technology** gives an overview of current and planned policies to progressively reduce our dependence on fossil fuels and support sustainability through energy efficiency, renewable energy and related technologies.
- **Chapter 6: Energy Security in the Transition** outlines how risks to energy security will be managed. It addresses emergency management, critical infrastructure protection, fuel security and EU cooperation.
- **Chapter 7: Enabling the Transition: Regulation, Markets and Infrastructure** describes the enablers that will support our energy transition, including cross-Government collaboration.

- **Chapter 8: Energy Costs** describes the factors that determine energy costs and outlines actions to keep energy competitive and affordable during the transition. It also sets out our approach to tackling energy poverty.
- **Chapter 9: Innovation and Enterprise Opportunity** discusses the economic and employment opportunities presented by the transition, with a focus on energy innovation.

2 Climate Change and a New Energy Policy Framework



2.1 Introduction

16. This chapter introduces the energy policy framework which sets out a vision for a low carbon future that maintains our competitiveness and ensures a secure supply of affordable energy to citizens and businesses.

2.2 Climate Change – A Global Imperative

17. There is overwhelming scientific agreement that human activities are impacting on the climate and, in particular, that GHG emissions are causing global warming.

18. The IPCC, established in 1988 under the auspices of the United Nations and the World Meteorological Organisation, has produced five assessment reports on the impact of human activity on the global climate. The most recent report, the Fifth Assessment Report (AR5), said that global warming was undeniable and that human behaviour was a significant cause of global warming [4].

19. It also concluded that the effects of climate change are already evident on all continents and across the oceans and that the world was ill-prepared for the consequences of a changing climate. It also warned that the continued emission of GHGs will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of pervasive and irreversible impacts for people and ecosystems including:
    - the risk of severe ill-health and disrupted livelihoods resulting from storm surges, sea-level rise, coastal flooding, inland flooding in some urban regions and periods of extreme heat
    - systemic risks from extreme weather events leading to the breakdown of infrastructure networks and critical services
    - the risk of food and water insecurity and the loss of rural livelihoods and income, particularly for poorer populations
    - the risk of loss of ecosystems and biodiversity.

20. Evidence of the impact of climate change in Ireland is emerging in the form of the increased frequency of extreme weather events. The Draft National Risk Assessment [5] identified climate change and extreme weather as a risk that requires national mitigation.

21. This challenge requires global solutions and every country, including Ireland, must play its role. Limiting climate change to avoid the most dangerous impacts requires significant reductions of GHG emissions, especially emissions of CO_2 from the combustion of fossil fuels.

2.3 Global Context

22. Ireland is a party to the United Nations Framework Convention[1] on Climate Change (UNFCCC) and to the Kyoto Protocol, which provide the international legal framework for addressing climate change at a global level.

23. The ultimate objective of the Convention, as set out in Article 2, is the stabilisation of global GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. It goes on to state that such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. Subsequent decisions by the Parties to the UNFCCC refined further this objective by agreeing to restrict the average global temperature increase to less than 2°C compared to pre-industrial levels.

24. According to the Fifth Assessment Report (AR5) of the IPCC [4], to achieve this 2°C objective, global greenhouse gas emissions must be reduced by 40-70% by 2050 compared to 2010 and be zero or below in 2100. Key to achieving this level of emissions reduction will be the preparation and implementation, of low carbon development strategies or plans in line with the Decisions taken by the Parties to the UNFCCC, at the Cancun climate conference in 2010.

25. COP 21, the 21st Conference of the Parties to the UNFCCC took place in Paris from 30th November to 11th December 2015. The 196 Parties to the Convention aimed to agree a new legally binding agreement on climate change.

26. Parties put forward their proposed mitigation commitments ahead of the Paris conference. Ireland's target will be part of the pledged EU target of at least 40% reduction in domestic GHG emissions by 2030 compared to 1990. This EU headline was agreed by the European Council in October 2014. The EU's internal negotiations on individual country targets will take place in 2016. Ireland will make a technically feasible, cost-effective and equitable contribution to this overall EU ambition.

27. A global treaty on climate change is in Ireland's interests because Ireland is vulnerable to climate change – including from sea level rise, increased storm frequency and changing precipitation patterns – and because a global treaty will result in a level playing field for all countries to pursue transition to a low carbon future.

2.4 EU Context

28. In February 2011, the European Council concluded that, as agreed in October 2009, "Reaching the EU objective... of reducing greenhouse gas emissions by 80-95% by 2050 compared to 1990 will require a revolution in energy systems, which must start now".

1 The ultimate objective of the Convention, as set out in Article 2, is the stabilisation of global GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. It goes on to state that such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

29. In the context of providing a long-term framework to achieve this objective, the European Commission published a Communication – 'A Roadmap for Moving to a Competitive Low Carbon Economy in 2050,' which set out several possible scenarios for the period to 2050.

30. Following the decisions taken at the 2010 Cancun climate conference, the EU adopted regulation (EU) No 525/2013 [6], Article 4 of which requires Member States to prepare low carbon development strategies to contribute to meeting their GHG emission reduction commitments.

31. The immediate EU focus is on the period 2015-2020 and planning for the period 2021-2030. The EU provided the legislative foundation for the 2013-2020 EU climate and energy agenda with the adoption of the 2020 Climate and Energy Package by the European Council in December 2008. The objectives of the package are to:

    - reduce GHG emissions by at least 20% compared to 1990 levels. Under the Effort Sharing Decision No. 406/2009/EC (ESD), each Member State has agreed to a binding emissions trajectory for emissions outside the Emissions Trading Scheme (ETS) for the years 2013-2020
    - reduce primary energy consumption by 20% compared with projected levels. This is a non-binding target
    - achieve a 20% level of EU energy consumption from renewable sources. Under the Directive on Renewable Energy [7], Ireland must achieve a binding renewables target of 16% of gross final consumption of energy by 2020.

32. In October 2014, the European Council agreed on a 2030 climate and energy policy framework for the EU [8]. The Council endorsed a binding EU wide target of a reduction in GHG emissions of at least 40% by 2030, compared to 1990 levels. The target will be delivered collectively by the EU in the most cost-effective manner possible, with reductions in the ETS (emissions trading scheme) and non-ETS sectors (Table 2-1) amounting to 43% and 30% by 2030, compared to 2005, respectively. Individual 2030 targets for Member State have yet to be agreed.

Table 2-1 – Examples of emissions from ETS and non-ETS Sectors

ETS	Non-ETS
EU Target: 43% reduction relative to 2005 by 2030	EU Target: 30% reduction relative to 2005 by 2030.
ETS scheme to be managed on a EU wide basis	Targets for member states to be finalised
Carbon dioxide (CO_2) from: • Power and heat generation, • Energy-intensive industry sectors and civil aviation sectors.	Sectors outside of the ETS include: transport (except civil aviation), agriculture, heating in buildings, waste and small industry.
Nitrous oxide (N_2O) from production of nitric, adipic, glyoxal and glyoxlic acids	
Perfluorocarbons (PFCs) from aluminium production.	

33. The treatment of land use, land use change and forestry (LULUCF) activities is also under discussion. This has important implications for Ireland, especially our agricultural sector [9].

2.5 National Context

34. A National Policy Position on climate action and low carbon development was published in 2014 [10] and the Climate Action and Low Carbon Development Bill 2015 [11] was passed in 2015. These are parallel and complementary pillars. The Bill is in the final stages of the legislative process and enactment is expected before the end of 2015.

Climate Action and Low Carbon Development Bill 2015

The Bill provides a statutory basis for the national objective of transition to a low carbon, climate resilient and environmentally sustainable economy by the year 2050. In doing so, it also gives a solid statutory foundation to the institutional arrangements necessary to enable the State to pursue and achieve the 'national transition objective' of moving to a low carbon economy and society.

In particular, the Bill provides for:

- the commitment of the State to GHG mitigation and climate change adaptation measures
- the approval by the Government of plans to pursue, and achieve, the national transition objective. The plans shall consist of:
  - a National Low Carbon Transition and Mitigation Plan (known as a National Mitigation Plan). The National Mitigation Plan will specify the manner in which it is proposed to move to a low carbon economy and society, and will specify the GHG mitigation policy measures to be adopted by relevant Departments in the low carbon transition process.
  - a National Climate Change Adaptation Framework (known as a National Adaptation Framework). The National Adaptation Framework will provide a strategic policy focus to ensure adaptation measures are taken across different sectors and levels of Government to reduce the vulnerability of the State to the negative effects of climate change and to exploit any positive effects of climate change that may occur. The Bill provides for the making and submitting to Government of Sectoral Adaptation Plans by relevant Government Ministers.
- Government Departments to be fully engaged in work under these plans.
- a local authority to notify the Minister or the Government of relevant mitigation measures in a local authority's administrative area which can potentially input to the development of the National Mitigation Plan.

The Bill also provides for the establishment of a Climate Change Advisory Council which will advise and make recommendations to Government and Ministers in relation to the National Mitigation Plan, the National Adaptation Framework and Sectoral Adaptation Plans. The Council will also advise on compliance with relevant obligations under EU legislation and international agreements.

35. The National Policy Position establishes a national objective of achieving transition to a competitive, low carbon, climate resilient and environmentally sustainable economy by 2050. It outlines a vision for the level of GHG mitigation ambition envisaged and sets out the context and the proposed process for achieving the overall objective. Work is already underway on developing the National Mitigation Plan, the primary objective of which will be to track the implementation of measures already underway and identify additional measures to reduce GHG emissions.

2.6 Our Energy Vision

36. By 2050:

A radical transformation of Ireland's energy system is required to meet our climate policy objectives. This transformation will result in a low carbon energy system by 2050. By this we mean that GHG emissions from the energy sector will be reduced by between 80% and 95%, compared to 1990 levels. By 2100 our GHG emissions will have fallen to zero or below.

37. By 2030:

- we will have achieved the highest possible level of energy efficiency particularly focussing on the non-ETS sector supported by increased Government and private investment
- we will be a leader in renewable energy deployment with a broad portfolio of large and small-scale renewable energy technologies
- the energy system will be part of a single, physically interconnected EU internal energy market, which will bring greater security of supply and easier access to cross-border flows of electricity and gas from other EU Member States
- there will be a marked reduction in our reliance on fossil fuels, with energy related GHG emissions falling in line with agreed targets
- we will excel in the application of innovative approaches and smart technologies for decarbonising energy systems
- we will have created sustainable jobs through the development and deployment of the new approaches and technologies required for the transition including through the exploitation of indigenous energy resources and by supporting industrial development
- we will continue to provide high quality, stable, transparent, cost efficient and predictable regulation for the electricity and gas markets, enabling cost efficient investment in the energy system
- the energy system will be underpinned by strong investor confidence and supported by substantial private investment
- the energy system will have the infrastructure necessary to provide the services that citizens and businesses need and want
- citizens and communities will be active participants in the energy transition, with robust public and stakeholder engagement in energy policy, and effective community consultation on energy infrastructure developments
- the energy system will act as a catalyst for change in how all citizens lead their lives – at home, at school, at work and in their communities.

2.7 Ireland's Energy Policy Objectives

38. Ireland's energy policy addresses three core objectives – the 'three energy pillars':
    - sustainability
    - security of supply
    - competitiveness – leading to affordable energy for domestic and business consumers.
39. Sustainability[2] is essential to reduce our dependence on imported fuels and to combat climate change through the reduction of energy-related GHG emissions in the transition to 2050.
40. Security of supply is necessary to the functioning of our society and economy.
41. Price competitiveness is needed both for business (which provides employment and creates wealth) and for households (which need affordable energy and protection against energy poverty).
42. Our new energy policy framework seeks to strike a balance between the three pillars to ensure a sustainable, secure and competitive energy system for Ireland.

2.8 Implementation

43. The development and implementation of policy to realise our objectives will be guided by five principles:
    - the citizen will be at the centre of the transition and the energy industry, Government and public authorities will all contribute to ensuring that citizens are involved in the transition, and benefit from it
    - the transition will be underpinned by policy and regulation that is stable and predictable
    - policy will seek to achieve optimum benefits at least cost, while recognising that decarbonisation will both incur costs and deliver benefits
    - policy measures will be evidence based and subject to rigorous analysis and appraisal prior to being implemented. This appraisal will include rigorous analysis of the distributional impacts of policy measures
    - new technologies, services, energy network architectures and community-based energy initiatives will emerge to facilitate and drive the transition. Policy will evolve to optimise the benefits from innovative initiatives.
44. Human ingenuity and technological development will be central to Ireland's energy transition. While certain actions can and must be taken immediately, there is also a need to phase other aspects of our policy response to ensure that we benefit from new solutions as they emerge. This will require careful and prudent judgement, and the flexibility to react to new developments and technologies at the optimal time.

2 The provision of energy that meets current demands without compromising the future – in terms of energy security and long term damage to the environment.

45. A range of policy measures will be employed to provide certainty and security to the market and consumers, while meeting our sustainability ambitions.

46. Creating a low carbon future in a manner that supports continued energy security and competitiveness will require government and citizens to work together, with support from the EU and other international partners.

47. The immediate priority for the energy sector between now and 2020 is to meet Ireland's climate change and energy sustainability targets by reducing emissions, increasing renewable energy and increasing energy efficiency.

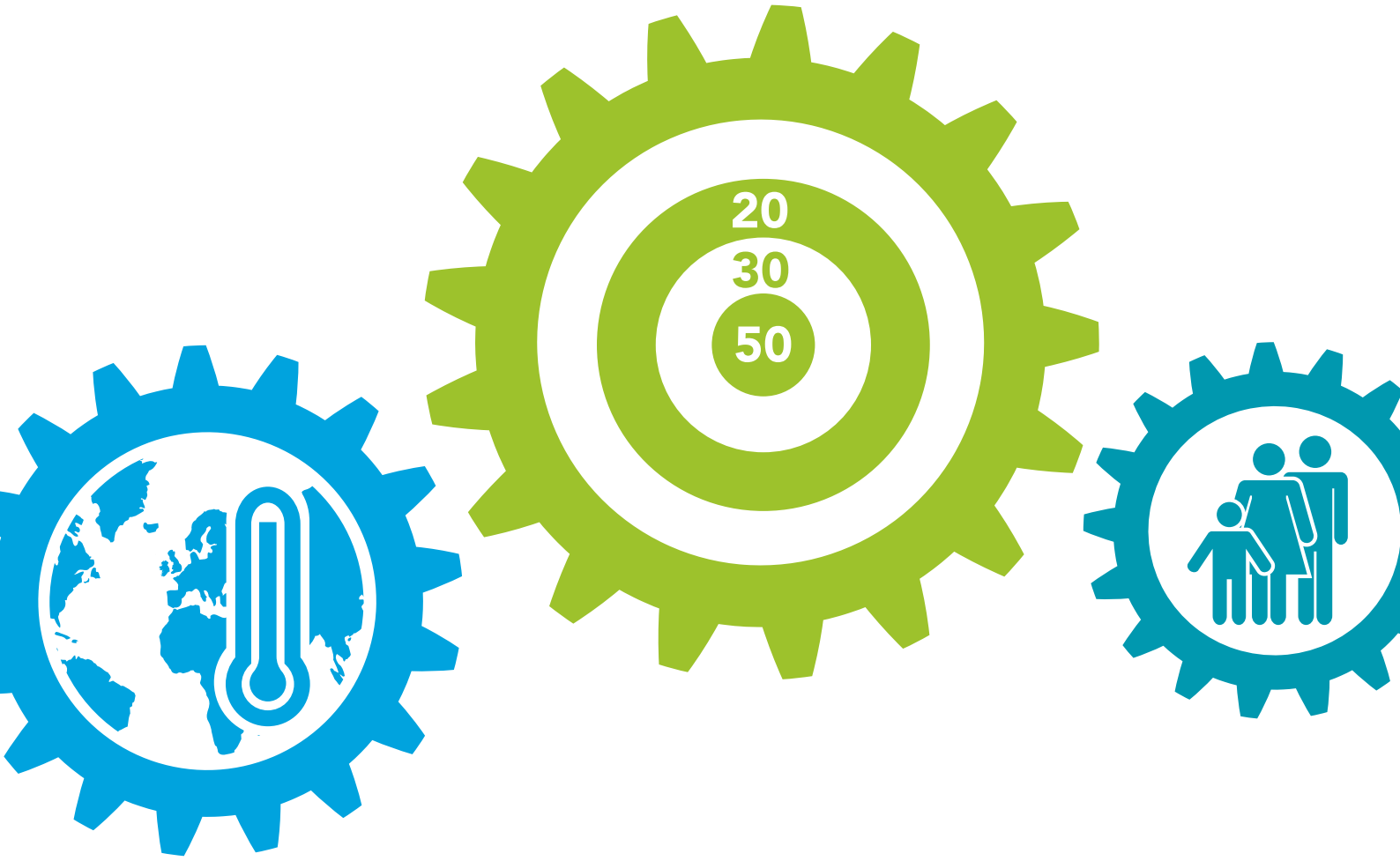
48. A low carbon future will involve:

    - radically changing our behaviour as citizens, industry and Government
    - becoming significantly more energy efficient
    - generating our electricity from renewable sources of which we have a plentiful indigenous supplies
    - moving to lower emissions fuels (e.g. moving initially from peat and coal to gas), and ultimately towards a lower reliance on fossil fuels
    - increasing the use of electricity and bioenergy to heat our homes and fuel our transport
    - increasing the biofuels obligation and improving take-up of zero and low carbon vehicles such as electric and natural gas vehicles
    - supporting the widescale deployment of renewable heat in the business, public and residential sectors
    - adopting new technologies as they emerge.

49. Detailed national strategies and plans including a National Energy Plan are being, and will continue to be, developed[3] and implemented to help progress the transition to a low carbon future.

3 Such as the National Energy Efficiency Action Plan and/or the National Renewable Energy Action Plan.

3 Ireland's Energy Future: the Transition to 2050



3.1 Introduction

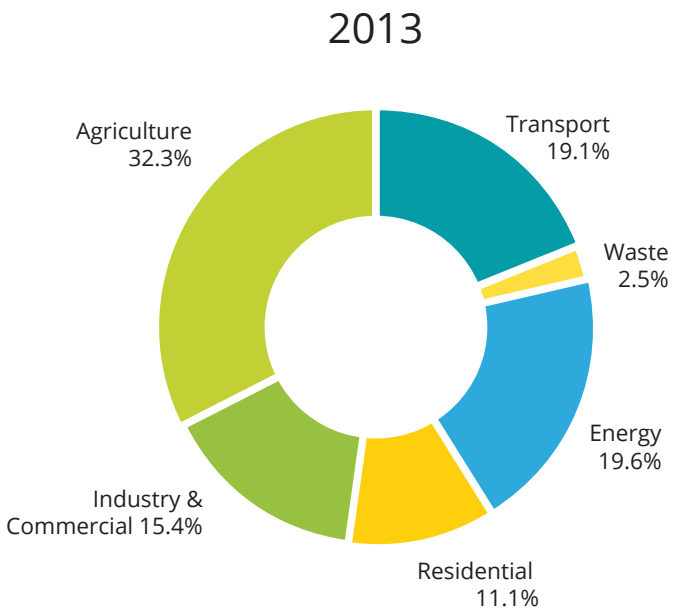
50. Ireland will have a low carbon energy system by 2050. The transition will be driven by the implementation of robust and appropriate policy measures, strategies and plans that will facilitate behavioural change and the required significant investment from the public and private sectors. It will also see the development of new industries, which will sustain green growth and jobs. This chapter starts with a review of Ireland's current status with respect to energy and climate targets, and then outlines some pathways to a low carbon energy system.

3.2 Ireland's Climate Change Targets

51. A summary of climate change targets and commitments is set out in Tables 3-1 and 3-2 below.

52. Ireland's total GHG emissions in 2013 amounted to over 58 million tonnes of CO_2 ($MtCO_2$ equivalent) [12]. The Environmental Protection Agency's (EPA) breakdown of 2013 emissions is shown in Figure 3-1.

Figure 3-1 – GHG emissions for Ireland by sector in 2013 (courtesy EPA [12])



53. Energy-related emissions comprise emissions from the energy sectors as well as the transport, residential, industry and commercial sectors. Altogether, energy-related emissions account for 66% of the total (2013). The majority of the non-energy emissions are from the agriculture sector.

54. The climate change targets that apply to Ireland are based on specific periods of time, namely:
    - 2008-2012 target under the Kyoto Protocol
    - 2013-2020 targets as detailed in the EU's growth strategy Europe 2020
    - 2030 target, which will be based on the overall EU target set by the EU Council decision of October 2014
    - 2050 target, which is likely to be based on the European Commission's Energy Roadmap 2050.

55. Under the Kyoto Protocol, the EU adopted an overall target of an 8% reduction in GHGs between 1990 and 2012. Individual targets were established for each EU country and Ireland was set a target of a 13% increase in emissions relative to 1990 levels which Ireland achieved.

56. Under the EU's growth strategy Europe 2020, Ireland has three 2020 targets related to climate change:
    - a GHG emissions reduction target (in the non-ETS sector)
    - a renewable energy target
    - an energy efficiency target.

57. Ireland's 2020 GHG emissions reduction target applies to the non-traded sector which encompasses the elements of the economy outside the EU's ETS (Table 3-1). The 2020 target is a 20% reduction in non-ETS emissions compared to 2005 levels. The final determination of whether Ireland meets its 2020 emission target will be based on the cumulative performance on against the annual targets between 2013 and 2020.

Table 3-1 – Progress towards 2020 Renewable Energy and Energy Efficiency Targets for Ireland

Target	2020 (Target)	2014 (Actual)	Distance to Target
Renewable Energy (Overall)	16%	8.6%	7.4%
Renewable Electricity (RES-E)	40%	22.7%	17.3%
Renewable Heat (RES-H)	12%	6.6%	5.4%
Renewable Transport (RES-T)	10%	5.2%	4.8%
Energy Efficiency	20% saving	8-9% saving	11-12% saving

58. Ireland's 2020 renewable energy target is to increase the share of final energy consumption that is made up by renewable energy sources (RES) to 16%. This target is broken into three key sectors with individual targets for each sector as in Table 3-1.

59. The overall renewable energy target and the renewable transport (RES-T) target are both binding at EU level. In 2014, Ireland was over halfway to reaching each of its sectoral targets and the overall 2020 target.

60. Ireland has set a target of a 20% improvement in energy efficiency by 2020. While the target is not binding, implementation of a comprehensive range of measures set out in the 2012 Energy Efficiency Directive is obligatory and supports the rationale for a national energy improvement target of 20%. In 2014, Ireland was almost halfway (8-9%) to achieving its 2020 target.

Table 3-2 – GHG Emissions Targets

Target	Baseline	2008-2012	2013-2020	2021-2030	2031-2050[4]
EU Wide	1990	-8%	-20%	-40%	-80-95%
EU Wide	2005		-14%		
ETS – EU Wide	2005		-21%	-43%	-2.2%/year[5]
Non-ETS – EU Wide	2005		-10%	-30%	
Non-ETS – Ireland	2005		-20%	TBD	
Ireland Economy Wide	1990	+13%			

61. The GHG emissions targets at a national and European level are shown in Table 3-2. Ireland's non-ETS emissions targets are a 20% reduction in emissions by 2020 and a further reduction by 2030 (both relative to 2005 levels).

62. The 2030 target ('TBD' in Table 3-2) will be progressed in 2016. Note that the non-ETS sector also has binding annual limits (not shown in Table 3-2). These limits range from a 4% reduction in 2013 relative to 2005 increasing linearly to a 20% reduction in 2020.

63. The ETS sets a carbon price for emissions from large industry, power generation and energy intensive and civil aviation sectors. Organisations are required to purchase permits for their emissions under a cap and trade system. The ETS sector is operated at EU level, and the EU target for the sector is to reduce emission caps by 1.74% each year until 2020. It is expected that from 2021 onwards, the emissions cap will be reduced by 2.2% a year. As the cap declines, the carbon price will progressively rise, and companies operating in this sector will need to take this into account in their investment and operational choices. For example, coal which has a high carbon content is likely to become more expensive than gas.

64. Ireland has set a carbon tax of €20 per tonne on certain fuels. Over time, and in tandem with the price set in the ETS sector and in the non-ETS sector by other EU Member States, the price for carbon is expected to be set consistently. In its analysis, the EPA assumes that carbon prices (per tonne of CO_2 equivalent) for the ETS and non-ETS sectors will rise from €10 (ETS) and €20 (non-ETS) in 2020 to a common level of €35 in 2030 and €57 in 2035 [13]. The European Commission has carried out research that examines the price required in order to achieve 2030 and 2050 objectives. The research forecasts the need for a price of €40 per tonne of CO_2 equivalent in the year 2030 [14] and further increases over the

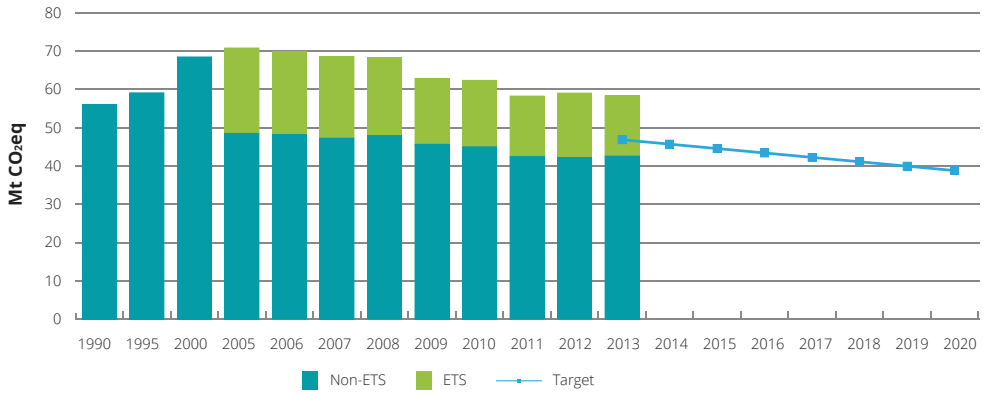
4 Indicative targets.

5 The 2.2% per year applies from 2021 to 2050.

period to 2050. The 'cost of carbon' on greenhouse gas emissions in the ETS and non-ETS sectors will continue to drive emissions reductions in a cost-efficient manner. As the 'cost of carbon' increases, the cost of carbon-intensive energy sources, services and products will increase. This will lead to changes in behaviour and the adoption of low carbon fuels and energy efficient technologies and solutions.

65. Figure 3-2 shows Ireland's total GHG emissions since 1990 and, from 2005 (when the ETS commenced), the breakdown between the ETS and non-ETS sectors. It also shows the non-ETS target for each year from 2013 to 2020. Ireland non-ETS emissions were below target in 2013.

Figure 3-2 – Total GHG emissions for Ireland from 1990 to 2013 (courtesy EPA [12]): Note that the blue target line is for non-ETS emission only



66. The non-ETS sector is the primary focus of Government policy and there have been several interventions to reduce emissions in this sector and improve energy sustainability. These include the introduction of a carbon tax, rebalancing of Vehicle Registration Tax and motor tax on a CO_2 emissions basis, the Biofuels Obligation Scheme (§173), a potential Renewable Heat Incentive (§172), and grants and excise relief for certain low carbon vehicles. The effectiveness of these instruments will be kept under review to ensure that there is no slippage on our target.

67. Ireland's circumstances are different from those of other EU countries. The Irish non-ETS sector is proportionately larger than in most other Member States. It accounts for approximately 70% of emissions in Ireland, compared to an EU average of 57%. Agriculture emissions in Ireland (in 2013) measured over 32%, compared to an EU average of 10% which means that a greater proportion of the burden sharing falls on the energy sector in Ireland. In the absence of emission reductions in agriculture, the large size of that sector in Ireland will lead to a greater share of the required adjustment falling to other non-ETS sectors (such as transport and heat).

68. The EPA has projected that Ireland's non-ETS emissions will fall by between 9% and 14%, compared to 2005, by 2020. The 2020 emissions target is based on the cumulative performance in the period 2013 to 2020. Therefore Ireland can achieve its 2020 emissions target by a combination of overachievement in earlier years and underachievement in later

years. Projections by the EPA [13] indicate that Ireland will not achieve its 2020 emissions target without further measures being put in place. The measures required would ensure Ireland meets it renewable energy and energy efficiency targets. Examples include achieving increased levels of renewable energy in transport via the Biofuels Obligation Scheme and electric vehicles, and greater energy efficiency in buildings via the Better Energy Programme.

3.3 Pathway to 2050

69. During 2013, the Department of the Environment, Community and Local Government (DECLG) commissioned the Economic and Social Research Institute (ESRI) and the Environmental Research Unit of University College Cork (UCC) to provide technical advice and guidance on the development of a Low Carbon Roadmap for Ireland [15].

70. In addition, DCENR commissioned technical analysis, to inform the White Paper [16].

71. The UCC/ESRI work focussed on identifying ways of achieving 80% and 95% reductions of energy related[6] CO_2 emissions for three of the key sectors specified in the National Policy Position, i.e. electricity generation, transport and the built environment (energy for lighting, heating, appliances etc) [16]. The analysis also included the creation of a "business as usual" baseline (assuming no further policy actions) in order to enable comparisons between options and to help quantify the scale of the transition required. All scenarios focussed on the period to 2050, building on the EPA's projections that cover the period to 2020. This work was published in June 2015 and is available on the DECLG website.

72. Based on the UCC/ESRI Low Carbon Energy Roadmap for Ireland [15], business-as-usual (BAU) and CO_2 reduction scenarios of 80% and 95% for the energy system have been evaluated. The share of fossil fuels in these scenarios based on an input and consumption basis are shown in Table 3-3:

Table 3-3 – Share of fossil fuels under CO_2 reduction scenarios of 80% and 95%

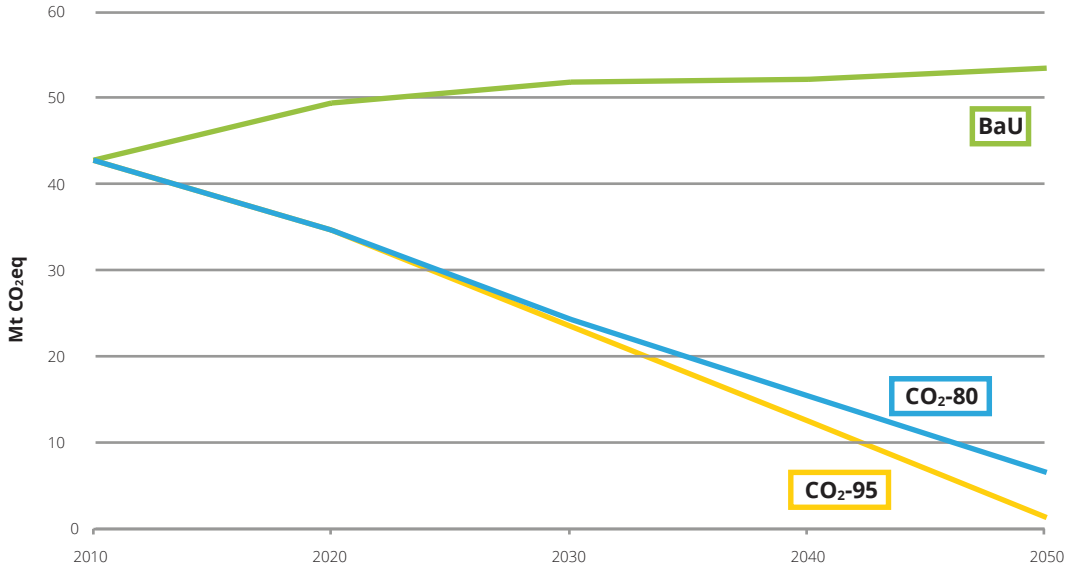
	TPER[7]	TFC[8]
BAU	92%	79%
$C0_2$-80	51%	30%
CO_2-95	26%	19%

6 The EU ambition referred to previously of CO_2 reductions of 80-95% by 2050 refers to the entire European economy whereas these scenarios refer to CO_2 reductions of 80% and 95% from the energy system alone, which in the case of Ireland accounts for 66% of national emissions.

7 Total Primary Energy Requirement.

8 Total Final Consumption.

Figure 3-3 – CO_2 emissions scenario results for Ireland 2010 to 2050: Three scenarios are shown: business-as-usual and emissions constrained to 80% or 95% below 1990 levels [16]



3.4 Fossil Fuels in the Energy Transition

73. Non-renewables currently account for over 90% of energy consumption [17]. This will fall to 84% in 2020 if we reach our binding EU targets for renewables. Reducing GHG emissions from the energy system by 80-95% by 2050 will require the share of fossil fuels to be of the order of 19-30% of final energy demand (Table 3-3). This means that non-renewable energy sources will make a significant – though progressively smaller – contribution to our energy mix over the course of the energy transition. In the short to medium-term, driven by carbon pricing, the mix of non-renewables will shift away from more carbon-intensive fuels, like peat and coal, to lower-carbon fuels like natural gas. By 2050, fossil fuels will be largely replaced by renewable energy sources.

Peat and Coal

74. Fuels with higher carbon content (peat and coal) will become relatively more expensive and be replaced over time by fuels with lower carbon content, for example natural gas and renewables. In effect, higher carbon fuels will be phased out by a combination of sustainable policy measures and consumer reaction to the higher price of carbon intensive fuels.

75. The public service obligation (PSO) for the Edenderry peat-fired power station expires in December 2015. PSOs for the West Offaly and Lough Ree power stations, which are supplied with peat from Bord na Móna, expire in 2019. In October 2015, Bord na Móna published its Sustainability 2030 report, which outlined its strategy to complete the replacement of large-scale peat production with alternative energy sources, including biomass, wind and solar by 2030 [18]. The strategy includes a target to achieve a 75% reduction in the company's CO_2 emissions intensity by 2020, compared to 2007 levels.

76. Moneypoint, Ireland's only coal burning electricity generation station is owned and operated by the ESB. It contributes to Ireland's security of supply by diversifying the fuel mix. It also provides competitively priced electricity. It is expected that coal will remain a significant element of our power generation mix for the next decade. Before Moneypoint comes to the end of its operating life in its current configuration, in 2025, the most suitable replacement low-carbon generation technology will have to be identified. Key decisions on the future of Moneypoint will be taken before 2020.

Oil and Gas

77. There is a clear link between oil and gas production and consumption and global climate change. In recognition of this fact, many nations, and indeed oil and gas industry producers, have committed through their actions and investments to contribute to a reduction in the GHG intensity of the global energy mix in the coming years.

78. The White Paper commits Ireland to radically reducing our GHG emissions by 2050. Ireland has embarked on a firm course to sustainability, mindful of the need to balance competitiveness and security of supply. Oil and gas will contribute to security of supply through the period of transition, on a declining basis over time. This curtailment (and, in the longer term, elimination) of oil and gas in our energy mix will be accomplished gradually in the coming decades through a range of reduction and substitution measures using more sustainable alternatives.

Exploration and Production

79. Even with demand reduction, energy efficiency efforts and a greater use of low carbon fuels, the IEA forecasts that oil and natural gas will remain significant elements of the global energy mix out to 2035, especially in transport. The IEA estimates that US$900 billion a year in upstream oil and gas development will be required by the 2030's [19] to meet forecast demand.

80. In this context, the development of Ireland's indigenous oil and gas resources has the potential to deliver significant and sustained benefits, particularly in terms of enhanced security of supply, import substitution, fiscal return, national and local economic development and technology learning. The Corrib natural gas field which created over 1000 jobs during development will meet on average 42% of the all-island gas demand over its first two years of operation and will add up to 0.6% to GDP when brought into production [20].

81. Industry perspectives on the potential of the Irish offshore have been transformed in recent years and the most recent licencing round, which closed in September 2015, attracted an unprecedented 43 applications. Policy approach to this sector will:

    - ensure that the financial risk associated with exploration is carried by industry rather than the State

- maintain a robust and effective regulatory framework that protects human health and the natural environment on land and at sea
- deliver a fair return to the Exchequer whilst encouraging exploration investment through measures such as the revised fiscal regime outlined in the Finance Bill 2015.

82. Over the past five years we have taken a series of measures to modernise the policy and regulatory framework applying to Ireland's offshore oil and gas exploration sector, including legislating to provide for a strengthened fiscal regime, to introduce a new petroleum safety framework and to provide for greater certainty and transparency with respect to environmental assessment processes. It is the intention of the Government, in consultation with key stakeholders, to build on these measures with further initiatives in the future.

Oil Refining[9]

83. Ireland is a member of the EU Refining Forum, which is reviewing the regulatory impact of EU legislation on the energy sector [21]. In the context of significant rationalisation of refining capacity across Europe, it is important that the European refining industry retains the capacity to compete with other regions to maintain security of supply for Europe, including Ireland. We will continue to engage with our European partners and with the IEA on this issue.

84. Ireland's single refinery at Whitegate, County Cork, is a significant domestic supplier of oil products and its presence provides flexibility in the event of an oil supply disruption. The refinery is also an important source of competition in the retail oil market and could be an important asset in the event of a commercial oil discovery in the Irish offshore. While the future of domestic refining capacity is primarily a commercial matter, the Government considers that the continued operation of the Whitegate refinery on a commercial basis is highly desirable from a strategic energy security perspective.

Hydraulic Fracturing

85. There is currently an all-island research programme on unconventional gas exploration and extraction (UGEE), also known as hydraulic fracturing or fracking. This programme is examining the potential impact on the environment and human health associated with high volume UGEE projects in Ireland. This research programme was commissioned by the EPA on behalf of DCENR and the Northern Ireland Environment Agency. The outputs of this all-island research programme will be published in 2016. No applications proposing the use of UGEE will be considered in advance of analysis of the research findings. This study will help inform policy in this area. However, any policy decision will be taken in the context of the objective of achieving a low carbon energy system in which the use of oil and gas is gradually curtailed and, in the longer term, is eliminated from our energy mix.

9 Oil refining is the process by which crude oil is transformed into oil products such as gasoline, diesel and kerosene.

4 From Passive Consumer to Active Citizen

4.1 Introduction

86. The transition to a low carbon future will impact on the lives of Irish citizens and energy consumers. Responding to market forces, consumers will drive the transition by choosing to use less energy, adopting lower carbon options for transport and heating, and participating in energy markets by shifting their energy use to off-peak times, or investing in smart home technologies.

87. The transition will see the energy system change from one that is almost exclusively Government and utility led, to one where citizens and communities will increasingly be participants in renewable energy generation, distribution and energy efficiency.

88. Improved community engagement will be essential to renewable energy policy making and implementation.

4.2 Energy Citizens

89. All citizens are energy citizens, interacting with the energy system as consumers, employees, transport users, householders and landowners. Every citizen has a role to play in the energy transition. Consumer choice, in the home, in the community, at work and when travelling is an important aspect of the energy citizen's role and responsibility.

90. Energy citizens will play an active role in the transition to a low carbon energy future in the following ways:

- communities of citizens, in rural and urban areas, will be able to work together on energy efficiency initiatives and renewable energy projects (§97-99)
- the public and business sectors will set examples of best practice in sustainable energy (§121-122)
- innovators will contribute by developing new models and technologies that will help Ireland move to a low carbon energy system
- entrepreneurs will avail of business opportunities in energy efficiency building work, clean technologies and innovative digital technology applications, creating jobs and increasing prosperity
- the energy industry will work to ensure that all relevant policies, regulation, products, services and technologies, as well as the generation and supply of energy itself, contribute to a secure, competitive, sustainable and low carbon energy system
- landowners, neighbours and communities will be able to engage with infrastructure providers and local government to ensure acceptable outcomes for all energy users.

Tipperary Energy Agency

Tipperary Energy Agency (TEA) was established in 1998 by the Tipperary local authorities and Limerick Institute of Technology. TEA supports sustainable energy use in all sectors via a team of energy experts.

Its work enables local authorities, communities and businesses to deliver renewable energy projects and become more energy efficient. It has facilitated the achievement of several projects, including the Templederry Community Wind Farm, the installation of solar photovoltaic panels in nine Tipperary local authority buildings and the development of Cloughjordan Ecovillage. It also collaborates with third level institutions on EU projects.

The TEA showcases how regional intermediaries can combine expertise with local leadership and knowledge to engage citizens and support project development that delivers long term benefits for communities.

Current Initiatives to Support Energy Citizens

Funded by Government, SEAI undertakes several initiatives to support energy citizens, including:

- its Customer Support Centre helps citizens to access the Better Energy Homes, Better Energy Warmer Homes and Better Energy Communities grant schemes
- it gives advice on the Building Energy Rating (BER) system that has produced over 500,000 BERs across Ireland to date
- its Small and Medium Enterprise (SME) Support Centre provides advice and training for businesses looking to reduce their energy spend
- its Large Industry Energy Network (LIEN) facilitates networking for over 160 of Ireland's largest industrial energy users
- for the last 12 years, citizens, communities, businesses and organisations have been encouraged to showcase their exemplar energy projects at the annual Sustainable Energy Awards
- almost 4,000 people attended SEAI's Energy Show in 2015. The event showcases the latest sustainable energy technologies and practices and includes an in-depth seminar programme
- around 75,000 students engage with the SEAI's schools programme each year. The programme includes a wide range of active teaching and learning resources for primary and secondary level pupils
- a methodology to assist local authorities in the preparation of local authority renewable energy strategies (LARES) has been developed. This includes training to enable local authorities to engage and consider local needs during the transition.

4.3 Energy Infrastructure

91. The installation of new energy infrastructure can give rise to a wide range of local concerns including the siting of the infrastructure, the decision-making process, the distribution of costs and benefits, and the impact on individuals, local communities and the environment [22].

92. Formal processes for community consultation and engagement on infrastructure planning and implementation are well established. However, in some instances the approach used by industry and public authorities in the past, has resulted in a lack of trust. Significant practical steps have been taken to address this, particularly by EirGrid [23]. For large projects An Bord Pleanála requires project proposers to demonstrate in-depth community consultation, public engagement, and a thorough understanding of the concerns of affected communities. The actions set out at the end of this chapter will strengthen community and citizen engagement on the development of new energy infrastructure.

93. There is increasing recognition of the value that effective communication and a participative approach between developer, local community and local authority can bring to the development of energy infrastructure. Effective engagement between these parties is a two-way process of sharing information, understanding different views, listening and responding to ideas and suggestions and developing trust and communications to the mutual benefit of all involved.

94. The National Economic and Social Council (NESC) [24] [25] examined how social support for the transformation of Irish energy could be achieved. It identified three components of social support, based on national and international best practice:

    - an overarching energy transition process that facilitates and guides society-wide efforts to transform energy systems
    - an effective and inclusive process of public participation that helps to shape and share local value, and
    - enabling organisations, and, in particular, intermediary actors, which support the kind of problem solving and entrepreneurialism necessary to initiate renewable energy developments.

4.4 Community Energy Projects

95. Community-level energy efficiency and renewable energy projects, using a range of technologies, will play an important role in the energy transition.

96. There will be opportunities for communities to collaborate, including with local government and energy agencies, to develop community energy efficiency and renewable energy projects.

97. SEAI will continue to provide a range of supports to communities and homeowners in relation to the deployment of renewable energy technologies and energy efficiency projects, including training, advice and grant support.

Aran Islands Project

The population of the Aran Islands has an ambition to become energy independent and carbon neutral by 2022. An energy co-op was established to coordinate the efforts of the 1,247 inhabitants of the three islands to achieve this. Their vision will be achieved by saving energy in homes and businesses through energy efficiency, by generating energy locally using renewable energy and by using EVs for transport. The co-op is run by volunteers and is committed to ensuring that there is stakeholder involvement.

Funded through the Government's Better Energy Programme, the project initially focussed on energy efficiency improvements for businesses, public buildings and homes and then encompassed local energy generation, including solar photovoltaic (PV). In 2013, 50 homes were upgraded with increased insulation, window and door replacements, new boilers, fireplace replacement, heat pumps and solar panels. Applications for similar schemes in 2014 soared to 180 following significant community engagement. Householders reported increased disposable incomes through reductions in heating bills. Following an upgrade of the nursing home, residents reported improved comfort, at reduced energy costs. There have also been tourism benefits, with a number of groups travelling to the island to view projects.

Thirty residents participated in a trial of 8 electric vehicles (EVs) over a period of 3 years. The trial resulted in a 78% reduction in transport energy costs and a 68% reduction in energy imports, compared to a new diesel car. Around 20% of the electricity used to run the EVs came from wind energy sources. Separately, a bicycle renting business purchased 14 electric bikes and had 2 kW of PV panels installed.

Data collected from monitoring devices installed at a number of projects are being used to develop a web-based interface to monitor energy supply and use on the islands.

The Aran Islands project is a prime example of a community reaping the rewards of its own efforts to transit to sustainable energy technologies and practices.

Marino Schools Community

The Marino Schools Community (Dublin North City) in partnership with a local primary school, a secondary school, a third level college and a university, undertook a series of projects to reduce energy consumption and costs and provide more sustainable heating and lighting solutions.

Energy efficiency measures included natural gas conversion, an oil boiler replacement, solar thermal panels, cavity and loft insulation, heating controls and efficient lighting. Through understanding the benefits of the programme the students and teachers are creating increased energy awareness within the local community.

Collectively the Marino Schools Community improved its energy efficiency by 28% and also made significant savings in water usage.

The schools are now managing their energy through a 10 year energy services contract and were able to benefit from improvements to the energy performance of their buildings, and therefore reduce energy costs, without needing to provide the capital to fund the investment.

4.5 Actions

98. Achieving our energy transition, and the vision set out in chapter two of this White Paper, will be a huge collective national undertaking. It will depend on the active engagement of citizens and communities. It will also require a deeper national awareness of the nature and scale of the challenge, and the development of consensus about the broad policy measures required to meet it. To help achieve this consensus, we will:

    - establish a National Energy Forum modelled on the successful National Economic Dialogue, which took place in July 2015. The National Energy Forum will meet periodically to consider evidence-based inputs on the challenges arising from the energy transition outlined in this White Paper and a report on the findings of the Forum will be published thereafter. The first National Energy Forum will take place in Q3 2016
    - invite representatives of community and environmental groups, politicians from Government and opposition, as well as business, unions, research institutes and the academic community to participate in the Forum with a view to maximising and maintaining consensus on the broad policy measures required to meet existing and emerging challenges. The Forum will have a respected independent chair and rapporteur. It will also work to stimulate constructive and informed national debate on energy-related issues.

99. Meaningful public consultation and engagement by Government and infrastructure developers are prerequisites for the successful achievement of the energy transition [25] [26]. We will:

- work with energy agencies, community experts and local government to ensure that information is provided to citizens in a timely and accessible manner[10]
- Work with NESC and SEAI to encourage the development of local intermediaries with expertise to facilitate and support local engagement
- keep legislation and procedures under review to ensure that citizens have ongoing opportunities to input into energy policy development, and that they are properly consulted on infrastructure developments that affect them.

100. The development of this White Paper revealed a wide citizen and community desire to be consulted on, and participate in, Ireland's energy transition and the development of energy-related projects. We acknowledge the need to develop mechanisms and instruments to make this happen. We will work to widen the opportunity for participation by:
    - supporting community participation in renewable energy and energy efficiency projects, via the SEAI, to share best practice, provide information and ensure that local strategies align with broader Government policy
    - facilitating access to the national grid for designated renewable electricity projects, and developing mechanisms to allow communities to avail of payment for electricity, such as the ability to participate in power purchase agreements
    - providing funding and supports for community-led projects in the initial stages of development, planning and construction. These will be defined using criteria such as scheme size and degree of community ownership
    - providing a new support scheme for renewable electricity which will be available from 2016
    - developing a framework for how communities can share in the benefits of substantial new energy infrastructure which is located in their area
    - establishing a register of community benefit payments
    - examining shared-ownership opportunities for renewable energy projects in local communities
    - supporting, in particular, the emerging energy co-operative movement as one means of facilitating community participation
    - exploring the scope to provide market support for micro generation. This will be informed by an SEAI analysis of the potential of technologies in the field of small-scale wind, solar, micro-CHP and small-scale hydro
    - engage with local government on advising consumers on energy efficiency initiatives and clean energy options, integrating energy options, scoping the opportunities for demand and supply related local energy action through integrating energy issues into local area planning, and bringing stakeholders together to find locally appropriate solutions that bridge the gap between demand and supply (E.g. biomass fuel, district heating solutions).

10 This will include information on actions that citizens can take to lower their carbon footprints, as well as guidance on grant schemes, sources of additional local information and community initiatives.

5 Delivering Sustainable Energy: Efficiency, Renewables, Technology

5.1 Introduction

101. The goal of the transition is to make the energy system secure and sustainable for future generations while minimising costs. This chapter provides an overview of current and planned policies to deliver sustainable energy through energy efficiency and renewable energy. It also describes some of the technology options that are expected to contribute to making Ireland's energy system more sustainable.

102. Improving energy efficiency is a critical element of the transition.

103. Renewable energy will also play a central role in the transition. No single renewable energy technology – existing or emerging – will alone enable Ireland to overcome the low carbon challenge. Rather, a diverse range of technologies will be required along the supply chains for electricity, heat and transport.

104. New technologies and processes will include better ways of harnessing current energy sources, new techniques for unlocking untapped energy sources, alternative sustainable fuel sources, innovative approaches for distributing and storing energy, and advanced solutions to enable consumers to control and use energy efficiently.

105. The SEAI was established in 2002 to promote and assist the development and deployment of sustainable energy in Ireland. The SEAI works under the aegis of the DCENR to deliver sustainable energy programmes and develop markets and sectors in energy efficiency and renewable energy. The SEAI administers the Better Energy Programme, the Building Energy Rating Scheme, and a range of programmes tailored to communities, business and the public sector. It also conducts research to inform and support energy users and innovators. Through its statistical and modelling unit it provides evidence to support Government decision making. It advises businesses, homeowners and public bodies on how to reduce energy costs and enhance sustainability. The SEAI has direct contact with citizens, offering information, advice and financial support in the transition to a low carbon society. It also works actively with the sustainable energy innovation sector.

106. A robust, collaborative, cross-departmental approach will be essential to the delivery of a low carbon energy future.

5.2 Energy Efficiency

107. Research commissioned by the SEAI [28] shows that there is potential to achieve significant additional energy efficiency savings by 2030. It identified potential non-transport savings of up to 16,000 gigawatt hours (GWh) after 2020. This is an additional 50% on the saving to be delivered by 2020 under existing targets. However, this will demand more extensive measures than have generally been implemented so far, including deep retrofit of existing building stocks and utility infrastructure upgrades.

108. It will be necessary to continue to provide financial and advisory supports and the regulatory regime required to realise the potential of energy efficiency for a cost efficient energy transition. This will require the introduction of affordable financing options to complement and leverage grant aid. Work on affordable financing in Ireland will learn from the experience in other countries such as the UK and Germany, which clearly indicates that such options must be both compelling for consumers and viable for financial providers. The SEAI will continue to pilot affordable financing schemes, and conduct market research, with a view to identifying how Ireland can avail of EU funding for energy efficiency in the residential sector.

109. The EU has set indicative targets of at least a 27% reduction by 2030 compared to projections of future energy consumption, which are set out in the EU's 2030 Climate and Energy Framework. EU Directives set obligatory requirements for energy efficiency in buildings through the Energy Efficiency Directive and the Energy Performance of Buildings Directive. In addition to decarbonisation there are multiple co-benefits of energy efficiency in homes, such as alleviating fuel poverty and improving health and comfort level.

110. The success of energy efficiency depends on the response of energy consumers. Ultimately, it will be decisions by individuals that will make homes warmer, businesses more competitive and public services more cost efficient, while helping to create Ireland's low carbon energy system. Energy citizens will be instrumental in realising Ireland's energy efficiency potential (§90).

111. Improving energy efficiency is already paying dividends. Ireland is almost halfway (Table 3-1) to achieving its 2020 target and the SEAI estimates that Government-supported policy initiatives have saved households and businesses over €700 million in fuel costs so far [27]. The continued provision of funding for physical works will be required to meet our energy efficiency targets. In addition, we will incentivise energy efficiency by providing access to affordable financing in the period to 2030.

112. This will require innovation in public investment in energy efficiency. International experience highlights that there are benefits to funding comprehensive education and technical advice to energy consumers at times when they make important decisions, e.g. renovating a house, reviewing business operating costs, changing car or buying an appliance. Providing trusted advice to energy consumers will encourage positive changes in behaviour on energy efficiency. This approach will be critical to the establishment of flexible and affordable finance options, the availability of which will, in turn, greatly increase the likelihood of users making energy efficient decisions. This support for behavioural change will underpin our policy on energy efficiency. An important element of this approach will be the provision of advice and support to local communities.

Green Schools[11]

The Green Schools initiative is part of an international environmental education programme known as Eco-Schools. It is a long-term programme that introduces participants (students, teachers, parents and the wider community) to the concept of an environmental management system while building a strong sense of citizenship and leadership that spreads beyond the school, into the wider community.

Energy is one of several themes, which also include waste, water, travel, biodiversity and citizenship. The programme develops students' decision-making skills and builds their confidence. It also provides a network of support agencies and links with other schools along with curriculum material for projects and events. In addition to the awareness and skills that it develops, it can provide benefits to schools through energy savings.

Energy Efficient Homes

113. The domestic sector comprises 1.7 million homes and, after agriculture and transport, is the third largest emitter of energy-related GHG emissions in the non-ETS sector. Stimulating a significant step-change in domestic energy efficiency, including by empowering consumers to better manage their energy consumption, will reduce emissions, cut energy bills, enhance health and wellbeing, and help older people to live independently.

114. Since 2009, more than 300,000 homes have become warmer and cheaper to heat as a result of energy efficiency upgrades supported by over €370 million of Government grant aid, which is administered through the SEAI's Better Energy Programme. SEAI estimates that, by the end of 2015, this investment will have reduced domestic energy use by over 2,000 GWh and CO_2 emissions by 500,000 tonnes, while SEAI estimates it yielded around €130 million in annual savings.

115. SEAI research [28] identified the potential for post 2020 energy savings of up to 9,400 GWh in the residential sector. Achieving these savings will require householders to "deep retrofit" their homes.

116. SEAI estimates a capital investment of the order of €35 billion over 35 years would be required to make the existing housing stock low carbon by 2050. This assessment is based on the assumption that an average retrofit cost of €20,000 is necessary to bring all existing homes up to a 'B' building energy rating (BER). This level of investment is currently beyond the means of most households.

11 *http://www.greenschoolsireland.org/*

117. Therefore, informed by innovative solutions in other countries, we will develop flexible and affordable finance for domestic energy efficiency improvement, drawing on national resources and, where possible, EU funding opportunities. Significant additional regulatory measures, such as enhanced building regulations and the implementation of EU energy labelling and eco-design requirements [29] will be introduced in consultation with relevant authorities and stakeholders.

118. The ongoing retrofit of social housing will continue to improve energy efficiency in local authority housing, help in addressing fuel poverty, build market capacity and support jobs in the energy efficiency sector.

Energy Efficient Enterprise

119. The enterprise sector faces the challenge of expanding economic activity while controlling energy costs. Energy efficiency measures can reduce costs for businesses and enhance competitiveness. Recent research has shown that there is scope for businesses, especially SMEs, to be more proactive in this area. Expanding the energy services sector and developing the concept of energy performance contracting will be necessary to unlock the energy efficiency potential of the enterprise sector [28]. Therefore, Government intervention will continue to focus on increasing demand for energy services and ensuring that technical support (e.g. in the areas of energy management and energy services financing and contracting) is available to the enterprise sector.

120. This focus underpinned the Government's decision to commit €35 million as seed capital for investment in the commercial Ireland Energy Efficiency Fund (IEEF). By October 2015, the IEEF had achieved its target of €70 million in committed funds, including an additional €35 million from the private sector. The Fund has the potential to invest €300 million in energy saving projects in the commercial, industrial and public sectors.

Energy Efficient Public Sector

121. In 2009, when Government first set the national energy efficiency target of 20% by 2020, it said the public sector should set an example. Consequently, the public service was assigned a 33% target. The SEAI Public Sector Programme was established to support the public service in achieving this target and included the establishment of a performance monitoring and reporting system. The implementation of this programme contributed to energy efficiency improvements of 17% by the end of 2013. A greater level of effort is needed from the public sector to reach the 2020 target.

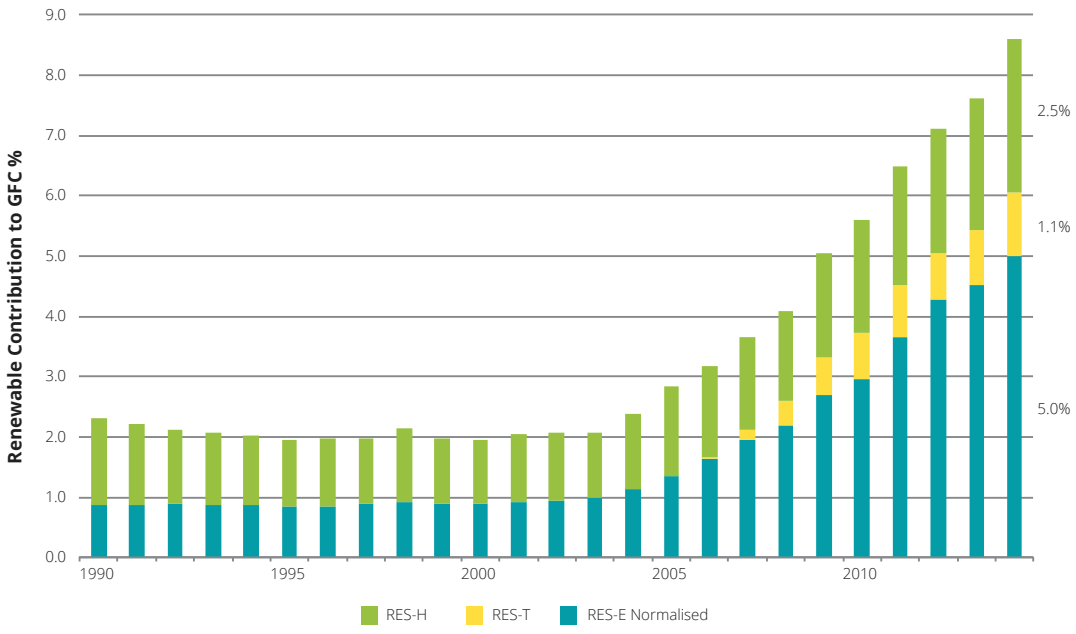
122. We will publish a Public Sector Energy Efficiency Action Plan in early 2016 to provide a clear policy statement on energy efficiency in the public sector and to drive achievement of the further 16% improvement needed by 2020. Public sector energy efficiency requires action across the whole of Government. The Action Plan will provide guidance to public servants on how they can take ownership of energy efficiency in their organisations.

5.3 Renewable Energy

123. The long term development of Ireland's abundant, diverse and indigenous renewable energy resources is a defining element of this energy policy. Not alone is renewable energy of key environmental importance, it also provides a sustainable, economic opportunity for Ireland, both in terms of providing a secure, indigenous, source of energy, and as an export in the longer term. As we move to a decarbonised energy system, support for renewable energy is vital from both an economic and environmental perspective.

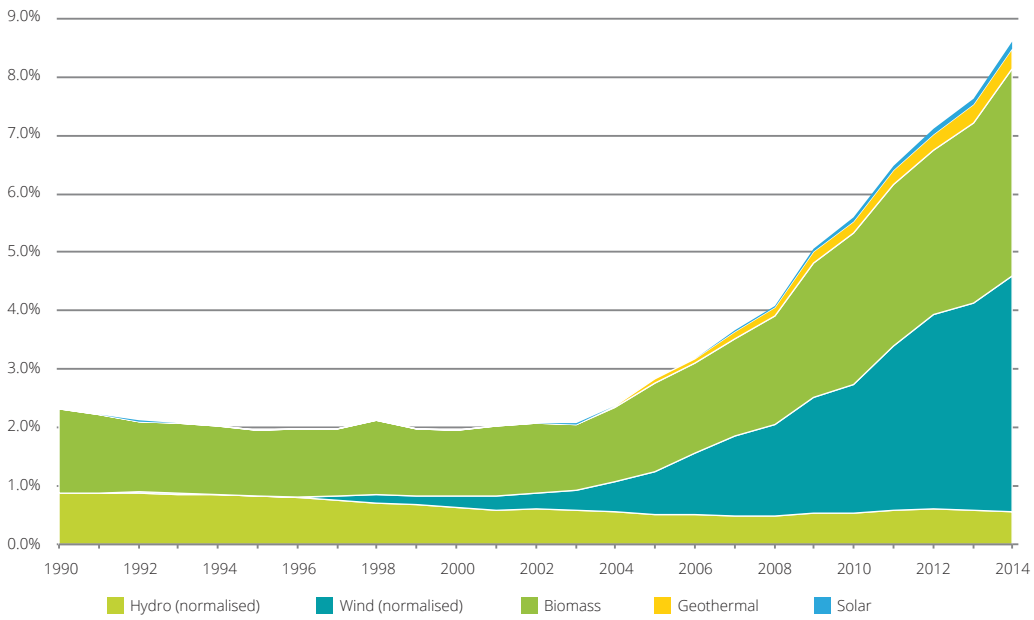
124. Ireland has an excellent track record of achievement to date in deploying renewable energy. Currently, we have an overall target of 16% of gross final energy consumption to come from renewable energy sources (RES) by 2020. Ireland had achieved a level of 8.6% by 2014, which is over halfway to the 2020 target. The share of renewable energy is measured across three sectors: electricity (RES-E), transport (RES-T) and heating (RES-H). Each of the three renewable energy sectors has a 2020 target (40% RES-E; 10% RES-T; 12% RES-H). By 2014, Ireland was over halfway to meeting each of these targets. The contribution of each sector to the overall RES target of 16% is shown in Figure 5-1.

Figure 5-1 Renewable Energy (%) Contribution to Gross Final Consumption (GFC) by Sector [17]



125. Since 1990 there has been a fourfold increase in the renewable energy (%) contribution to gross final consumption. The growth in renewable energy has been led by onshore wind (RES-E) and bioenergy in the form of biomass (RES-H) and the biofuel obligation scheme, which requires fuel suppliers to include a level of biofuel in their annual sales of transport fuels (RES-T). Other technologies that have seen some growth in recent years include geothermal (RES-H) and solar (predominantly RES-H) (Figure 5-2).

Figure 5-2 Renewable Energy (%) Contribution to Gross Final Consumption (Directive 2009/28/EC) [17]



126. Specifically in 2014, renewable electricity generation, consisting of wind, hydro, landfill gas, biomass and biogas, accounted for 22.7% of gross electricity consumption. The use of renewables in electricity generation in 2014 reduced CO_2 emissions by 2.6 Mt and avoided €255 million in fossil fuel imports. In 2014, wind generation accounted for 18.2% of electricity generated and as such was the second largest source of electricity generation after natural gas.

127. In order to achieve the transition to a low carbon future, action will continue to be taken across all three sectors transforming how we generate electricity and heat, and fuel transport.

Renewable Electricity (RES-E)

128. Onshore wind continues to be the main contributor (18.2% of total generation and 81% of RES-E in 2014). It is a proven technology and Ireland's abundant wind resource means that a wind generator in Ireland generates more electricity than similar installations in other countries. This results in a lower cost of support. Due to the variability of wind conditions, wind generation poses challenges to the operation of electricity grids. In Ireland, these challenges are being addressed by the electricity system operators under their DS3 programme [30]. The All-Island Grid Study [31] established an upper limit of 42% for wind penetration that could be accommodated onto the transmission grid without compromising security of supply standards. Higher levels of penetration would require additional interconnection (§242) and/or storage (§161-162).

Delivering a Secure Sustainable Electricity System (DS3 Programme)

Several forms of RES-E, such as wind, solar and ocean energy are reliant on weather conditions and have an inherent variability. They cannot be dispatched in the same way as traditional generators and this presents challenges for the electricity system.

In order to achieve the 40% RES-E target by 2020, the electricity system will, at specific times, have to accommodate up to 75% renewable electricity. Today, the grid can accommodate an instantaneous level of 50% RES-E and does so regularly. However moving to higher levels requires a fundamental change in the way the system is operated.

The system operators have embarked on the DS3 programme [30] on an all-island basis to assess and implement the changes needed to achieve this transition. As these challenges are being encountered on the island of Ireland before they become critical for larger electricity systems elsewhere, Ireland and Northern Ireland have the opportunity to lead the way in the integration of renewable generation.

129. The 2020 target of 40% RES-E is likely to require a total of 3,500-4,000 MW of onshore renewables generation capacity, compared to the 2,500 MW available at end December 2014, of which wind generation accounted for 2,200MW. To achieve our target, the average rate of build of onshore wind generation will need to increase to up to 260 MW per year. The current rate of build is about 170 MW per year.

130. Thus far, renewable electricity projects have typically been large scale. While there will continue to be an important role for larger projects, there will also be an increasing role for smaller, community-level projects (§95-97). As new renewable energy solutions such as bioenergy, solar photovoltaic (PV) and offshore energy mature and become more cost effective they will be included in the renewable energy mix.

131. The REFIT 2 and 3 schemes remain open to applicants until the end of 2015 and each scheme requires projects to meet certain milestones regarding construction. The policy context and requirements of the new wholesale market for electricity (I-SEM) continue to emerge. Regulatory certainty is needed as early as possible in that process, to enable promoters to continue to access funding and progress projects. In parallel with market developments, the DCENR is developing a new support scheme for renewable electricity to be available from 2016. A key component of this process is stakeholder engagement. The scheme will be subject to the new rules on public support for projects in the field of energy, adopted by the European Commission in 2014, which seek to promote a gradual move to market-based support for renewable energy.

132. The objective of the new support scheme will be to incentivise the introduction of sufficient renewable generation to deliver the broader policy objectives of security of supply, climate change and economic development in a cost effective manner. Key issues in developing this support scheme include assessing the various technologies available and feasible for deployment in Ireland, including their cost effectiveness, and determining whether supports are necessary to incentivise their deployment and if so, the level of support required. This analysis will inform the development of a support scheme that provides regulatory and policy certainty to developers, enables cost effective investment in renewable energy, seeks to minimise cost to the consumer, supports effective market operation, and minimises the administrative burden of the scheme.

133. Bioenergy is a versatile source of energy that can be used for heating, transport and power generation. The most advantageous economic benefits arise when it is used for heating. Bioenergy encompasses a range of fuels in solid, liquid and gaseous forms, including forest-based biomass, dry agricultural residues, energy crops, organic materials including wastes, and landfill gas and other biogases. Bioenergy can contribute to broader policy objectives such as waste recovery and rural development, as is the case with anaerobic digestion, which not only generates energy, but also gives effect to national waste policy in terms of utilising waste as a resource. It has been highlighted in waste management plans as a technology suitable for development at a local and regional level and at varying scales. Anaerobic digestion also has the potential to improve air quality, for example through mitigation of ammonia emissions and odour by diverting slurry from land spreading. However, expanding the uptake of bioenergy involves several challenges, including the availability of sufficient sustainably-sourced biomass, competition with other land uses such as food production, and the cost of support. Consideration must be given to the most prudent uses for bioenergy.

134. Biomass is currently co-fired in one peat-fired power station in Edenderry. This is supported under REFIT 3 [32], up to a level of 30% average co-firing and 125 MW in total. Some of the biomass being used is imported. A Government-commissioned technical analysis [16] considered biomass usage and concluded that Ireland's limited biomass resource would be more efficiently deployed in the heating sector. Future support for biomass will be decided in the context of the renewable electricity and renewable heat consultations that are currently underway.

135. The Draft Bioenergy Plan [33] sets out the policy areas that must be coordinated to support the development of this sector. It also identifies next steps to support the sustainable development of the sector. DCENR is conducting a strategic environmental assessment (SEA) and an appropriate assessment (AA), including public consultation (due to be completed in Q1 2016), prior to finalising and implementing the plan.

The Draft Bioenergy Plan provides a mechanism to inform and coordinate policy and implementation across the sector.

It consists of two sections:

- section 1 sets out the broader context for the development of Ireland's bioenergy sector, and the current state of play with regard to the range of policy areas that must be coordinated in order to create the conditions necessary to support the development of this sector. There are a wide range of Government departments, agencies and state bodies that are critical enablers for bioenergy development by virtue of their responsibility for areas such as forestry, agriculture, waste, research funding and business development. A key output from the Bioenergy Plan is the identification of ways to ensure the optimal coordination of all of these players
- section 2 of the plan goes on to identify the next steps that must be taken to support the sustainable realisation of the economic potential of Ireland's bioenergy resources.

136. Waste Management Policy in Ireland recognises the need to develop efficient ways to extract as much value as possible from waste in accordance with the requirements of the waste hierarchy and the opportunity for waste to be used as an indigenous energy resource [34]. In this regard, three new regional waste management plans for the period 2015-2021 support the development of additional thermal recovery and biological treatment capacity within the State. The REFIT schemes, which support the generation of electricity and CHP technologies including waste-to-energy, anaerobic digestion and landfill gas, continue to support the use of waste as a renewable energy feedstock.

137. Solar photovoltaic (PV) technology is rapidly becoming cost competitive for electricity generation, not only compared with other renewables but also compared with conventional forms of generation. The deployment of solar in Ireland has the potential to increase energy security, contribute to our renewable energy targets, and support economic growth and jobs. Solar also brings a number of benefits like relatively quick construction and a range of deployment options, including solar thermal for heat and solar PV for electricity. It can be deployed in roof-mounted or ground-mounted installations. In this way, it can empower Irish citizens and communities to take control of the production and consumption of energy. Solar technology is one of the technologies being considered in the context of the new support scheme for renewable electricity generation which will be available in 2016.

138. Ireland's sea area is around ten times the size of its landmass and the country has one of the best offshore renewable energy resources in the world. This offers significant potential for offshore wind, wave and tidal energy. Offshore wind has been effectively used in other EU Member States and can yield a higher relative energy output than onshore wind. SEAI analysis [35] notes a potential for 30,000 MW of offshore wind energy by 2050. However, the installation cost is currently significantly higher than that of onshore wind, so the level of support required would be far greater. Offshore wind also poses

the same grid operational challenges as onshore wind does (§125). Therefore, the more cost effective onshore wind resource is being used to meet short-term targets in the first instance. Ireland's offshore resource could, in future, be considered as a potential export opportunity. In the longer term, as the cost of deployment reduces, it will also present an opportunity for domestic use.

139. Other ocean technologies (e.g. wave and tidal) are at the pre-commercial stage. Given the current state of readiness of these technologies, we do not anticipate they will make a large contribution in the short term. However, we expect them to play a part in our energy transition in the medium to long term.

Ocean Energy Prototype Development Fund

The SEAI Ocean Energy Prototype Development Fund is stimulating the development and deployment of ocean energy devices and systems. The emphasis is on industry-led projects to develop and test wave and tidal energy capture devices and systems. It also provides for independent monitoring of projects and technologies, industry-led R&D aimed at the integration of ocean energy into the electricity market and the national electricity grid and data monitoring, forecasting, communications and control of ocean energy systems.

140. The potential for offshore renewable energy is set out in the Offshore Renewable Energy Development Plan (OREDP) [36], which provides a framework for the sustainable development of the sector. Exchequer support for ocean research, development and demonstration is being increased under the OREDP. Subject to EU state aid clearance and Government approval, this plan will provide an initial market support scheme of €260 per megawatt hour, limited to 30 MW of installed capacity, for wave and tidal energy from 2016.

141. Together with our partners in the EU, the North Seas Countries Offshore Grid Initiative (NSCOGI) and the Irish-Scottish Links on Energy Study (ISLES), we will continue to examine how electrical interconnection between jurisdictions (§240-243) should be configured to facilitate offshore renewables, while minimising overall infrastructure requirements. This will build on the comprehensive work undertaken and published by NSCOGI and ISLES.

142. Grid energy storage involves the storage of electrical energy on a large scale, transfomed into other forms of energy, for optimum utilisation by the grid. A variety of technologies can be used including pumped storage hydroelectricity, compressed air storage, battery storage and thermal storage devices. Electrical energy is stored during times when production exceeds consumption and this is returned to the grid when production falls below consumption. Grid energy storage can mitigate some of the grid-connection challenges posed by intermittent power plants, such as renewable electricity plants powered by wind, solar or tidal power, and can help to better manage the electricity system.

143. CHP is the generation of usable heat and electricity in a single process. It is also referred to as cogeneration. Electricity generation from fossil fuels (and some renewable sources such as biomass) involves much of the input energy being lost as waste heat. This may be released to the atmosphere or river systems. CHP systems put this heat to useful purposes such as industrial processes or heating buildings. Therefore, CHP can provide a method of improving the efficiency of energy use leading to emissions reduction.

Renewable Heat (RES-H)

144. The RES-H sector comprises a diverse range of participants, fuel types and technologies. Modern RES-H technologies are well established in other countries and will play an increasingly important role in Ireland as solutions continue to emerge and fuel supply chains develop. While some progress has been made in Ireland, uptake has been impeded by cost and the strength of the fuel supply chain. Ireland's dispersed settlement patterns also mean that it is more difficult and expensive to install some renewable domestic heating systems than in other EU countries.

145. Biomass will make a more significant short term contribution to meeting our targets for renewable energy and GHG emissions reductions. Analysis shows that greater use of biomass in renewable heat will bring positive macroeconomic and employment benefits, with the potential to support up to 5,000 rural jobs through reduced fuel costs and reduced imports. The benefits of biomass are greatest when local biomass resources are used [37].

146. There are a number of supports already in place and progress has been made in addressing the challenges that face RES-H. In 2014, RES-H accounted for 6.6% of thermal demand and is growing steadily. This growth has been driven by a number of large installations of biomass heating technologies, particularly in industry. Policy will address supply and demand issues, and build strong supply chains matching resources to demand opportunities. SEAI has developed mapping resources [38] to assist developers, and has supported a number of pilot and demonstration projects. Energy efficiency is also essential to the delivery of our RES-H target by lowering overall demand and hence the amount of RES-H required.

147. Work has commenced on the introduction of a Renewable Heat Incentive (RHI) aimed at the non ETS-sector, which will be in place in 2016 subject to EU state aid clearance and further Government approval. It is intended that the renewable heat support will be based on the principle of providing an incentive payment rewarding users for each unit of renewable heat produced and used, based on a unit rate of payment (tariff) applied to metered renewable heat output. The tariff would be calculated to compensate for the additional capital cost for the renewable technology (which could include technologies other than biomass e.g. heat pumps) relative to fossil fuel heating. It is envisaged that the RHI will be funded by the Exchequer.

148. In order to contribute to meeting our renewable heat target, the proposed RHI will need to incentivise a change to renewable heating for the equivalent of an additional 200 large industrial sites, or 2,000 large services sector buildings, or 300,000 residential dwellings (or some combination of the three) between now and 2020. It is important that such a change take cognisance of other environmental priorities, such as clean air.

149. Increased decarbonisation of home heating will also be vital to our energy transition. We will raise awareness of the benefits to consumers of low carbon electricity heating systems, and develop policies to promote the replacement of domestic boilers with air and ground source heat pumps, which have the lowest running costs of any heating and cooling systems.

Renewable Transport (RES-T)

150. The transport sector is heavily reliant on fossil fuels and has few alternatives in terms of renewable energy technologies or substitute fuels.

151. Sustainable liquid biofuels will be the largest contributor to RES-T in the period to 2020, with a small contribution coming from electrification. We will remain mindful of the impact of biofuel policy on food security.

The Electric Vehicle Grant Scheme

The Government's Electric Vehicle (EV) Grant Scheme supports and incentivises the early deployment of EVs in Ireland. The scheme provides grant aid of up to €5,000 towards the purchase of a new EV. These grants are in addition to the VRT reliefs of up to €5,000 that also apply to EVs. This intervention is designed to help progress our ambition, set out in the National Energy Efficiency Plan, of having 50,000 electric vehicles on our roads by 2020.

While the number of EVs registered in Ireland in the last few years has increased to approximately one hundred per quarter (January-September 2015), the rate of growth has been slower than expected. The extent to which EVs are adopted in the short to medium term will depend on several factors, including the strength of the economy, the overall numbers of new cars being purchased, the purchasing costs compared to alternatives and the choice of EVs on the Irish market.

152. Other technologies are likely to become more cost effective and widely adopted over time. These include electric vehicles, renewable fuels such as biogas and advanced liquid biofuels, as well as less carbon-intensive fossil fuels, including compressed natural gas (CNG) and liquefied petroleum gas (LPG).

Natural Gas Vehicles

There are over 18 million natural gas vehicles (NGVs) in operation globally, including over 1.9 million in Europe. They are fuelled by Compressed Natural Gas (CNG) and, while they are particularly suited for commercial road transport (i.e. trucks, buses and large vans), CNG is also used in cars.

NGVs have several benefits over conventional diesel vehicles including a 10-20% reduction in CO_2 emissions and 70%, 80% and 99% reductions in nitrogen oxide, sulphur dioxide and particulate emissions respectively. They can also deliver fuel savings, can reduce noise emissions and can operate on natural gas or biogas. The technical performance of NGVs is similar to that of diesel vehicles, with comparable range, refuelling times and vehicle configurations.

The 2015 Budget confirmed that the excise rate for natural gas and biogas as a propellant will be set at the current EU minimum rate (€2.60 per GJ) and that this rate will be held for 8 years. This equates to a rate of approximately €0.11 per diesel-litre-equivalent.

The recently approved Alternative Fuels Infrastructure Directive requires the provision of a sufficient number of publicly accessible CNG refuelling points to be built by end-2025. In order to determine the number of refuelling points required, the level of infrastructure must be sufficient enough to allow for the circulation of CNG vehicles, in urban and suburban areas, as well as on the TEN-T core network. The target number of refuelling points will be included in a National Policy Framework on Alternative Fuels Infrastructure for Transport, due for publication in late 2016.

153. Ireland's settlement patterns and low population density limit cost effective options for decreasing transport energy consumption. However, recent research from SEAI provides strong evidence that smart driving can reduce energy use in the sector [28]. It involves adopting a driving style that reduces fuel consumption, GHG emissions, noise pollution and accident rates. These smart, smooth and safe driving techniques lead to an average fuel saving of 5-10%. Such behavioural change will be an important element in improving transport energy efficiency and Government has identified the potential for a national smart driving programme to deliver energy savings.

154. The Government's smarter travel policy [39] is designed to show how we can reverse current unsustainable transport and travel patterns, reduce the health and environmental impacts of current trends and improve our quality of life. It supports more sustainable modes of transport like walking, cycling and public transport. It aims to reduce the distances travelled by private car and encourage smarter travel. The sustainable transport agenda is largely dependent on sustainable land use and transport planning policies.

155. Rail electrification substantially reduces the use of fossil fuels in public transport. There has been significant progress with the introduction of DART and LUAS, and the recently published Capital Plan 2016-2021 [40] provided for further such public investment in the Greater Dublin Area. Further rail electrification will be a priority in future capital plans.

5.4 Technology Choices

156. Decisions about the development and deployment of new technologies will inform the sustainable energy mix and impact on the role of citizens as energy consumers. The transition offers opportunities for the relatively passive energy consumer of today to become a more proactive consumer (sometimes called a 'prosumer'). Smart metering, the broadening of renewable heat and transport options, local energy storage solutions, smart appliances, and micro-generation all have the potential to transform and enhance the way homes, businesses, communities and citizens use energy.

Energy Network Innovation

157. Ireland is acknowledged as a world leader in energy systems integration technology and innovation, which will have a major influence on how energy networks are developed and operated during the transition. In particular, electricity system operators are likely to adopt innovative ways of improving efficiency and adapting to a diversifying electricity generation portfolio.

Smart Meters

158. The EU has set a target of 80% of residential consumers having smart electricity meters by 2020, subject to a cost-benefit analysis. Mandated by Government, the Irish National Smart Metering Programme was established in 2007 by the CER.

159. It has five strategic objectives to:

- encourage energy efficiency
- facilitate peak load management
- support renewable and micro generation
- enhance competition and improve consumer experience
- improve network services.

160. The programme is being developed by the CER with a consumer focus that takes account of the requirements of different customer groups, including vulnerable customers and those in financial hardship (§167). It envisages a national rollout of smart meters to all residential consumers and the vast majority of SMEs subject to the conclusion of a costs-benefit analysis. The timing of the rollout and the approach to the delivery of new customer services will be finalised in 2016.

Smart Meters

The National Smart Metering Programme aims to fundamentally transform the range of consumer services, technologies and options on offer, with:

- better information on electricity and gas consumption, delivered in-home and real-time, to help consumers reduce their overall energy use and bills
- simplified and user-friendly pay-as-you-go options readily available to help consumers monitor and manage their bills, with no requirement to pay for extra devices
- time of use tariffs to help consumers shift energy consumption and reduce costs, for example by running washing machines and dishwashers off-peak
- "smart home" devices like smart hot water or heating controllers which will link with digital meter data to automatically choose the lowest-cost schedule
- more sophisticated services for consumers who choose dynamic tariffs along with smart home technologies. For example, at times of very high wind generation, domestic hot water or heating systems will be incentivised to switch on and then turn down when wind generation drops
- consumers who invest in micro-generation, solar PV or storage systems are enabled and incentivised to participate actively in the electricity market.

Electricity Storage

161. Electricity storage is expected to play an important role in facilitating the deployment of intermittent renewable energy technologies like wind, solar PV and ocean energy. The EU's Energy Roadmap 2050 [41] confirms that storage technologies remain critical, and that future integration of RES-E will depend on increased storage capacity. Electricity storage can be deployed in a number of circumstances in Ireland, including at grid-scale and at consumer level.

162. DCENR and the Northern Ireland Department of Trade and Investment commissioned work to model the impact on the electricity grid of different types of storage. These included very short-term storage in intelligent storage heaters in domestic premises, intermediate-level storage in battery and ice banks, and very large-scale compressed air storage in salt caverns. The work demonstrated that significant levels of storage, in particular multi-megawatt-scale grid-connected storage, would be needed to maximise the utilisation of RES-E. Small-scale storage would facilitate more efficient use of the networks, maintain high standards of security of supply, and keep network operating costs lower than they would be without storage.

Carbon Capture and Storage

163. Carbon Capture and Storage (CCS) involves the capture of CO_2 from major energy users and its injection deep underground. To support the development of the technology, the EU adopted Directive 2009/31/EC [42], which creates a stand-alone regulatory framework for the development of a CCS industry.

164. Although commercial realisation of CCS technology has been limited so far, it is recognised as a potential bridging technology that could support the transition. The EU has promoted pilot projects and considerable work has been done to improve understanding of the technological and geological issues involved.

165. Pending the development of technology and markets, Ireland adopted a five-yearly CCS review process, the outcome from which will inform any decision on whether to commit resources to put regulatory and permitting systems in place. The next review of CCS will take place in 2017. We continue to be informed of research advances through the Geological Survey of Ireland.

Ireland's Geothermal Potential

IRETHERM [43] was a four-and-a-half year, all-island, North-South, academic-government-industry collaborative project to develop a strategic and holistic understanding of Ireland's geothermal energy potential. It involved the integrated modelling of new and existing geophysical and geological data and identified considerable potential in this area. The programme generated new data on Ireland's deep geology and geothermal potential and made recommendations for areas where further work could prove useful.

Nuclear Energy

166. Nuclear energy currently provides a significant proportion of the low carbon electricity consumed in the EU. However, Ireland is one of a small number of EU countries that does not have nuclear power in its domestic electricity generation mix. Nuclear power generation in Ireland is currently prohibited by legislation.

5.5 Energy Efficiency Actions

167. To support energy efficiency in the domestic sector, we will:

- ensure that, by 2030, the Better Energy Programme delivers the number of deeper energy efficiency upgrades required to put the residential sector on a realistic trajectory to a low carbon energy future, maximising the 9,400GWh of energy saving potential that has been identified post 2020. This will be supported by the additional funding allocated in the Government's 2016 to 2021 capital investment programme and further resources as they become available. The Better Energy Programme will be redesigned following consultation with consumers and other stakeholders

- support the development of affordable financing options for domestic energy efficiency. SEAI will continue to work with the consumer finance sector to implement affordable financing pilot schemes to complement the current grant-aid offering, with a view to mainstreaming commercial financing for the residential sector in the longer term. DCENR will also work to avail of EU funding opportunities for energy efficiency
- introduce a comprehensive and sustained information campaign and more advisory support for consumers to address the barriers to consumer decision-making on energy efficiency, starting in the first half of 2016 with the publication of new, more consumer-friendly Building Energy Rating documentation
- create an advice centre within the SEAI to support consumer awareness of the growing range of energy-efficient appliances and energy control systems on the market which allow consumers to exercise more control over their energy use
- strengthen Part L of the Building Regulations Conservation of Fuel and Energy, which will include energy efficient heating and lighting in the non-residential sector and to achieve Nearly Zero Energy Buildings by 2020 as mandated by the EU Energy Performance of Buildings Directive. The construction supply chain will also be further developed in order to ensure the long-term sustainability of energy efficiency upgrades
- Provide information to householders to enable them to identify cost saving energy efficiency opportunities, and to avail of grant schemes
- increase the scope of SEAI programmes to support community energy efficiency projects
- publish a new Affordable Energy Strategy in early 2016 to help those who are vulnerable to energy poverty to manage and reduce their energy bills and adequately heat and power their homes (§275).

168. To support energy efficiency in the enterprise sector, we will:

- ensure that SEAI continues to provide expert advice and technical support to businesses, enabling them to access energy services expertise and commercial funding to achieve large-scale energy efficiency upgrades in buildings, business processes and utility networks
- ensure that SEAI engages with large energy users through its Large Industry Energy Network (LIEN) and promotes the ISO 50001 (energy management) and I.S. 399 (energy efficient design management) standards as essential requirements
- update the Energy Efficiency Obligation Scheme, following consultation, to inform decisions on new sectoral targets due to begin in 2017
- designate SEAI as Ireland's market surveillance authority to ensure that we fulfil our EU obligations on energy labelling and eco-design. This function will ensure compliance and best practice by wholesalers and retailers for energy efficient products and appliances on the Irish market, support industry innovation in energy efficient design of products and applications, and support consumer decision making with respect to these products and appliances.

169. To support energy efficiency in the public sector, we will:
    - publish a Public Sector Energy Efficiency Action Plan in early 2016 to provide clear policy direction for public sector action on energy efficiency and sustainable energy management. This will:
        - drive the delivery of large-scale energy efficiency projects which will include deep retrofitting of buildings, public lighting and transport (improving efficiency in public fleets)
        - introduce a requirement for each public sector body and government department to appoint a senior manager as an energy officer with clear reporting obligations and a strong mandate from senior management as part of a comprehensive governance system
        - establish multi-disciplinary project development assistance to provide 'end to end' support for large scale public sector energy efficiency projects.
    - ensure that the public sector continues to contribute substantially to Ireland's energy efficiency effort to 2030 with the establishment of a further target for public sector energy efficiency for the period 2020-2025.

170. We will support sustainable energy education, helping children and young people to develop a better understanding of sustainable energy through inquiry-based education across a range of subjects. This will be done through the SEAI Schools Programme, in consultation with the Department of Education and Skills. This work will ensure that:
    - schools are supported to adopt a whole-of-school approach to energy education
    - teachers are supported to develop and deliver cross-curriculum energy education
    - sustainable energy is embedded into the curriculum in an integrated way
    - energy education is extended into further, higher and vocational education.

5.6 Renewable Energy Actions

171. To ensure that the 40% renewable electricity target is achieved by 2020, and to prepare for more renewable electricity deployment in the period to 2030, we will:
    - introduce a new support scheme for a range of RES-E technologies from 2016
    - update the existing support schemes so that they are compatible with the wholesale electricity market reform
    - ensure that grid connection policy will have due regard to current and future renewable energy policy, including in relation to community renewable energy projects; this policy, will be defined using criteria such as scheme size and degree of community ownership
    - publish a Renewable Electricity Policy and Development Framework (with a spatial dimension) to underpin the proper planning and development of larger scale renewable electricity generation development on land. This plan will give guidance to those seeking development consent in relation to larger-scale onshore renewable electricity projects, and to planning authorities, statutory authorities and citizens

- develop a policy framework to encourage the development of CHP, taking account of the findings and recommendations of the comprehensive assessment required by the European Union (Energy Efficiency) Regulations 2014.

172. To bridge the gap to the 2020 renewable heating target, and to develop the sector beyond 2020, we will:
    - support the deployment of heat from renewable sources through the REFIT[12] schemes and develop new supports to meet 2030 renewable heat targets
    - facilitate the deployment of proven RES-H technologies through the proposed heating policy and the strengthening of the building regulations as required by EU Directives
    - introduce a Renewable Heat Incentive (RHI) from 2016 in the non-ETS sector
    - develop a comprehensive heating strategy to reduce the carbon intensity of the heating sector in the period beyond 2020
    - develop a policy framework to encourage the development of district heating, taking account of the findings and recommendations of the comprehensive assessment required by the European Union (Energy Efficiency) Regulations 2014
    - establish a regulatory framework to facilitate the exploration for, and development of, geothermal energy resources.
173. To support energy efficient and renewable transport, we will:
    - support modal shift through better alignment of land use and transport planning and a continuation of smarter travel programmes administered by the Department of Transport, Tourism and Sport (DTTAS) [39]
    - develop a national smart driving programme, targeted at both new and existing drivers across all transport sectors
    - continue to support the adoption of zero and low carbon tail pipe emission vehicles such as electric vehicles and gas vehicles, using natural gas and biogas, through grants and/or tax relief
    - develop a national policy framework to underpin and support the deployment of infrastructure for the use of alternative transport fuels, including compressed natural gas (CNG), liquefied petroleum gas (LPG), liquefied natural gas (LNG) and electricity
    - complete an economic assessment of the potential for the development of biogas and, if appropriate, develop policy options to support its use in the transport sector
    - introduce measures to support the uptake of lower emitting public service passenger cars including a scrappage-type scheme for older taxis that are being replaced by alternate fuel vehicles
    - establish a green bus fund to support the purchase of cleaner and greener public transport vehicles in the period to 2020
    - support the introduction of a suite of initiatives to improve the energy efficiency of the rail network

12 Renewable energy feed-in tariff.

- support further rail electrification
- undertake further analysis of additional energy efficiency measures in the transport sector for the period to 2030
- support the deployment of sustainable biofuels through increases to the Biofuels Obligation Scheme. Account will be taken of the potential for indirect land use change impacts (which can negate the GHG emissions abatement benefits of biofuels), the availability of advanced biofuels, the ability of the Irish fleet to accommodate higher blends of biofuel, and the role that high blend biofuels could play. The first such increase will take effect on 1st January 2016.

5.7 Actions on Technology Choices

174. New low carbon and energy storage technologies are expected to evolve from research to deployment and will play a significant role in the energy transition. To facilitate this, we will:
    - monitor and encourage the development of new transition technologies (see also chapter 9)
    - examine and address any administrative, market or regulatory barriers to the implementation of energy storage projects
    - examine the case for designating large-scale storage projects as strategic energy infrastructure under planning, regulatory and policy criteria.

6 Energy Security in the Transition

6.1 Introduction

175. This chapter outlines our energy security policy and explains how risks to security of energy supply will be managed. It also discusses how we will address emergency management, critical infrastructure protection, fuel security and EU cooperation.

6.2 Energy Security

176. An uninterrupted supply of energy is vital to the functioning of society and the economy. Energy security procedures and practices include operational measures to mitigate risk and recover from potential disruptions, as well as longer term initiatives.

177. The main energy security policy objective is to maintain the security of Ireland's energy system in the most cost effective manner.

178. This requires adequate infrastructure and diversity of energy supply that avoids over-dependency on any particular fuel, supplier, route or region.

179. A range of potential oil, gas and electricity infrastructure projects could enhance our energy security, in some cases with EU support as Projects of Common Interest (PCIs). Such projects would help to address interconnection and enhance security of supply, market integration and sustainability.

180. Achieving our sustainable energy goals and having fully integrated and well-functioning markets that promote investment will also impact positively on energy security.

6.3 EU Energy Security

181. The production of oil and gas is declining in the EU and more imports are coming from other markets, principally Russia, Africa and the Middle East. This means that Europe will be increasingly dependent on imports between now and 2030 unless enhanced security measures are put in place.

182. The EU Energy Security Strategy [44] seeks to promote enhanced cooperation among Member States, while respecting national energy choices and sovereignty over fuel mix. The first action from the strategy was a stress test of Europe's resilience to a prolonged gas supply disruption. It found that the adverse impact of a gas disruption would be reduced if Member States adopted a cooperative approach to potential disruption.

183. Ireland will, therefore, work with its European partners to further develop a coordinated energy security policy, which will enhance Europe's collective strength in negotiations with energy suppliers. Through Ireland's membership of the EU and IEA, we will support policies that encourage diversification of energy supplies and facilitate more integrated energy markets.

184. Ireland will support European Commission cooperation to safeguard security of gas supply on foot of lessons learned during recent geopolitical crises.

185. Ireland supports the 2015 European Commission Energy Union strategy, which builds on the EU Energy Security Strategy and recognises the need for Europe to play a stronger role in global energy markets and for Member States to diversify energy supplies and work more closely together on security of supply [45]. Both strategies highlight how the EU's low carbon climate and renewable energy strategies complement energy security. Energy Union stresses five key dimensions – energy security, solidarity and trust; the internal energy market; energy efficiency as a contribution to the moderation of energy demand; decarbonisation of the economy; and research, innovation and competitiveness. It also underlines the principle of solidarity amongst Member States.

6.4 Gas and Electricity Security

186. Ireland's gas and electricity security are closely linked because of our reliance on natural gas for almost half our electricity generation. Ireland is particularly vulnerable to a gas supply disruption because of our high natural gas import dependency and limited gas and electricity interconnection capacity (§241-243). This will be mitigated by the Corrib natural gas field until the early 2020s.

187. Developing, maintaining and upgrading the electricity and gas networks is essential to ensure that our energy system remains safe, secure and ready to meet increased demand as economic conditions improve. These roles are performed by the gas and electricity system operators, which are regulated by the CER.

Gas Security

188. Successive IEA reviews of Ireland have noted that Ireland has no strategic gas storage, and very limited operational gas storage capacity. This makes Ireland vulnerable in the event of a prolonged gas supply disruption in Europe. The IEA has also identified a vulnerability to a single point of failure in the gas interconnection with Great Britain and has highlighted the need for Ireland to examine greater secondary fuelling.

189. While gas storage infrastructure has the potential to improve energy security and be of strategic value to Ireland, the cost is likely to be significant. A comprehensive LNG and gas storage strategy which is to be brought forward by the European Commission, will address the potential roles of those technologies.

190. The proposed new legislative framework for gas storage in the foreshore and maritime area, to be enacted in 2016, will facilitate a streamlined process for the necessary consents to enable suitable gas storage projects to be undertaken.

191. The CER has approved the investment for the construction of a new section to the existing gas pipeline from Cluden to Brighouse Bay in south west Scotland which will twin a 50km stretch of pipeline to address Ireland's vulnerability to a single point of failure [46]. This is a PCI and will bring significant benefits in terms of increased reliability, resilience and additional capacity for peak demand.

192. The development of indigenous biogas resources for heating and transport will likely play a part in gas diversification in the future.

Gas-fired Electricity Generation

193. Since 2009 conventional gas-fired electricity generators are required to be capable of operating on secondary fuel for five days in the event of a gas supply disruption. In 2015, the CER issued a consultation paper [47] to examine whether the current five-day fuel stock regulatory obligations are sufficient in light of recent changes in the gas and electricity sectors. It is expected that the Regulator will issue a decision on secondary fuelling in 2016. Thereafter we will review the longer-term security of supply implications that may arise.

6.5 Oil Security

194. Oil accounted for 57% of Ireland's total energy consumption in 2014 [17]. All of Ireland's oil demand is met through imports. The downstream oil sector is fully privatised, liberalised and deregulated.

Strategic Oil Reserves

195. Ireland holds 90 days of oil as a strategic reserve to be used in the event of a supply disruption.

196. The National Oil Reserves Agency (NORA) manages these reserves, which are now wholly held as physical oil reserves, as opposed to the previous practice of partial holding through 'stock tickets'. Currently 70% of our oil reserve is stored on the island of Ireland and 30% is held in other Member States. We will maximise the level of stocks held on the island, subject to increased storage availability and value for money considerations.

6.6 Emergency Management

197. Responding to and recovering from the impact of unanticipated disruptions to electricity, gas or oil supplies are important aspects of energy security. The National Risk Assessment for Ireland [48] approved by the Government Task Force for Emergency Planning in 2012 and the National Risk Assessment 2015: Overview of Strategic Risks [5] by the Department of the Taoiseach have both identified "disruption to energy supply" as a risk that requires national mitigation. Energy emergency management is therefore an important element of national energy security.

198. Our approach to energy emergency management sits within a broader national emergency management framework. Relevant government departments and principal response agencies meet periodically under the auspices of the Government Taskforce on Emergency Planning. This structure provides a coordination framework for managing emergencies, including energy emergencies.

199. A Draft National Strategy/Framework for Emergency Management is currently being developed by the Government Task Force on Emergency Planning for Govenment approval in 2016, which will provide direction to government departments on managing disruption to energy supply from extreme weather events, cyber-attacks and other emergencies.

200. An important dimension of our approach to emergency management will be to build on the cooperation that already exists between Ireland and Northern Ireland, and between Ireland and Great Britain.

201. An ongoing programme of energy emergency management training exercises will be undertaken to improve responses to extreme energy emergency scenarios. Stakeholders, including those outside the energy sector, such as other government departments and principal response agencies, will be invited to participate.

Oil Emergency Management

202. The most important emergency response mechanism in the oil sector is NORA's ability to release strategic oil reserves to the market to counteract supply disruptions.

203. An oil emergency programme will be delivered in 2016 to manage and plan for severe oil disruption scenarios. It will result in a set of schemes for use in an extreme oil emergency. The programme will involve NORA, the Irish Petroleum Industry Association (IPIA), the Government Taskforce on Emergency Planning, and other agencies.

Electricity and Gas Emergency Management

204. The DCENR regularly works with the Government Task Force on Emergency Planning, suppliers, network operators and other stakeholders to review and test plans for use in the event of an electricity or gas emergency.

205. The CER has responsibility for the safe operation of the gas system through the Gas Safety Regulatory Framework. All gas undertakings[13] must produce a safety case that provides details on how they manage safety risks. They are also required to have emergency procedures in place to fulfil the requirements and obligations set out in the Natural Gas Emergency Plan.

206. We will continue to support EU and international efforts to improve cooperation in developing and implementing cost efficient preventative action and emergency plans, which are flexible enough to address the circumstances of individual Member States.

Critical Infrastructure Protection

207. Polices to protect critical infrastructure, which includes critical energy infrastructure, overlaps with cyber security policy, which is set out in the National Cyber Security Strategy 2015-2017 [49], and in the ongoing work of the Government Task Force on Emergency Planning as a key stakeholder.

13 Including gas suppliers, shippers and the operators of the gas transmission and distribution network.

208. The proposed EU Network and Information Security Directive [50] will require Member States to work collaboratively and to have a minimum set of cyber security capabilities in place. The Directive, which is expected to be agreed by the end of 2015, will constitute a significant step towards ensuring a consistent approach to the security of critical infrastructure across Europe. It will require operators of critical energy infrastructure to manage security risks to their networks and information systems, to report serious incidents to national competent authorities and to comply with any specific security measures that national authorities deem necessary.

6.7 Actions

209. Throughout the transition, energy security risks will be continually evaluated and managed. Improved energy efficiency and the further development of indigenous energy supplies, which were discussed in the previous chapter, will enhance our energy security. We will also work with regulatory authorities, industry, consumers and regional and EU partners to implement a range of specific measures to maintain and enhance energy security. These will include:

- diversifying energy supply to include more renewables, which reduce the reliance on imported fuels
- promoting competitive markets and facilitating commercial investment through policy and regulatory certainty (§214-217)
- supporting regional, EU and international cooperation to develop energy security initiatives (§176-185)
- greater deployment of sustainable energy initiatives and technology
- promoting and facilitating interconnection with other countries and regions (§240-243)
- maximising strategic stocks of oil and gas held on the island
- enhancing energy storage (§161-162).

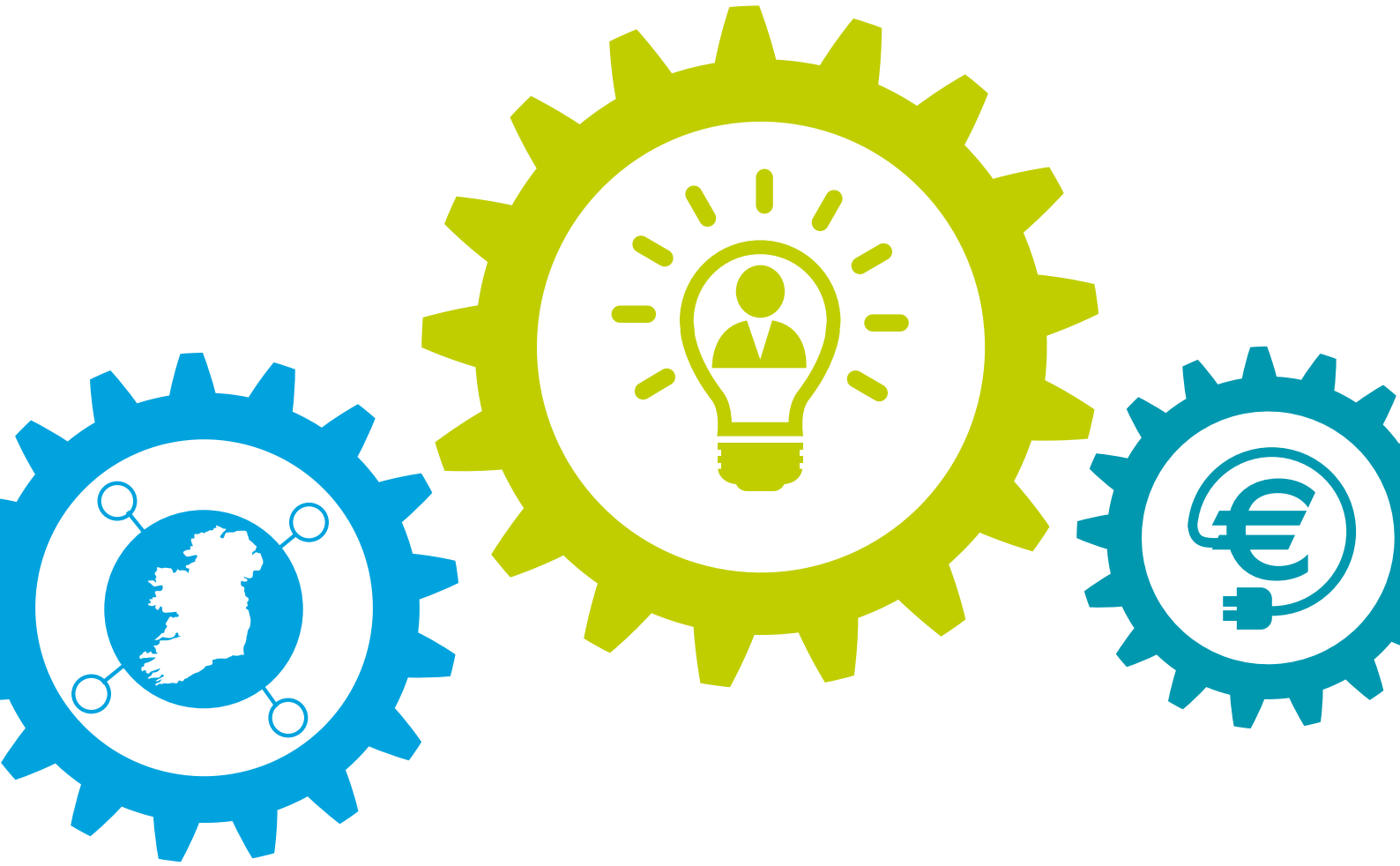
210. To enhance gas and electricity security, we will:

- commission research on future demand for fuel sources and interconnection requirements, including the technical, regulatory and economic aspects
- review the existing primary and secondary fuel obligations in the power generation sector, including cost and infrastructure considerations, to ensure they are optimal for longer term energy security
- conduct a thorough analysis of options for increased gas storage, which will take into account the interdependent nature of gas and electricity systems, interconnection with other jurisdictions where storage exists, and LNG potential
- work with our counterparts in Northern Ireland to monitor and support relevant gas and electricity infrastructure proposals.

211. To strengthen energy emergency management (§197-201), we will:

- co-ordinate the energy sector with other stakeholders to ensure that Ireland fulfils its legal obligations in respect of network and information security and wider cyber security objectives
- develop a framework to strengthen oil, gas and electricity emergency plans in line with the current deliberative work by the Government Task Force on Emergency Planning [48] on drafting a National Strategy/Framework for Emergency Management to be approved in 2016
- review and enhance energy emergency plans on an ongoing basis.

7 Enabling the Transition: Regulation, Markets and Infrastructure



7.1 Introduction

212. The transition to a low carbon energy system will only be successful if government, regulators, the energy industry, businesses and energy citizens fulfil important, complementary roles. Together, we must create and sustain an enabling environment that promotes, stimulates and facilitates the transition.

213. Six factors are necessary to the energy transition, four of which are discussed in this chapter:

- a strong national regulatory framework (section 7.2)
- a strong EU Framework (section 7.2)
- appropriate energy infrastructure, including energy networks and interconnection with other countries' energy systems (section 7.3)
- policy coherence across government departments (section 7.4)
- the participation of energy citizens (chapter 4)
- innovation, globally and in Ireland (chapter 9), to expand and develop the range of technologies available for deployment at different stages of the transition and provide opportunities for new enterprise.

7.2 Regulatory Framework for Electricity and Natural Gas

214. Stable, transparent, evidence-based, independent regulation is essential to facilitate competition, to create a climate for investment and ensure that the cost of capital and network costs are kept as low as possible. It also enables consumers to realise the full benefits from EU market integration and strengthens consumer trust and market engagement. Any perception of regulatory uncertainty or that regulatory decisions are not justified can deter investors and new entrants and negatively impact on the cost of capital.

215. The CER is Ireland's independent national regulatory authority for the economic regulation of the electricity and gas markets[14]. The CER has provided valuable regulatory stability, certainty and predictability through its strong, evidence-based and transparent decision-making.

216. The CER is also responsible for the safety regulation of natural gas supply, transmission, distribution, storage and use; the registration of electrical contractors and gas installers by designated bodies; and the regulation of designated upstream petroleum activities. It undertakes these functions through the development and oversight of a safety case regime. It is important that the CER continues to adopt an approach of continuous improvement to its functions in this area, in cooperation with other relevant public bodies and DCENR, including by promoting relevant safety messages to the general public and by continuing to enforce against non-compliance. We are committed to ensuring that the CER is empowered to carry out its safety functions.

14 The CER was initially established and granted regulatory powers over the electricity market under the Electricity Regulation Act, 1999. The Gas (Interim) (Regulation) Act, 2002 expanded the CER's jurisdiction to include regulation of the natural gas market.

217. In 2013, Government decided to undertake reviews of the mandates of all sectoral economic regulators at least every seven years [51] and, where practical, to co-ordinate these as part of the cycle of major policy reviews.

The Energy Union and Energy Markets

218. One of the objectives of EU energy policy is the establishment of the Internal Energy Market (IEM) in order to achieve better outcomes for EU citizens through economic growth, jobs, secure energy at affordable prices, and sustainable energy use. The IEM should bring Irish wholesale electricity and gas prices closer to those in Europe. The European Commission has prioritised the establishment of the Energy Union [45] which reiterates the goal of greater integration of the European energy markets.

219. One strand of the Energy Union strategy seeks to develop further EU policy on wholesale electricity market design. Legislative provisions may be part of this policy initiative. We wish to see meaningful engagement at EU level with Member States on this strand of the Energy Union. It is important that the policy which emerges from the development process continues to allow for regional and Member State flexibility. Ireland's priorities are that this policy should: assist with cost effective and efficient decarbonisation and integration of renewables; respect fuel mix sovereignty; avoid disruptive costly changes of direction; and ensure generation adequacy for small, peripheral, lightly interconnected Member States like Ireland [53][54]. Further EU policy development on wholesale electricity market design should help Member States like Ireland to deepen market integration under the existing provisions such as the EU's electricity and gas network codes, which are binding on all Member States.

220. The SEM was established in 2007 and is regulated by the SEM Committee, consisting of members from the CER and Northern Ireland Authority for Utility Regulation, together with independent membership. Much has changed since 2007 and future opportunities for interconnection (§240-242), storage (§160-161) and demand side management may introduce further changes to the system. EU guidance on state intervention in energy markets invites Member States to consider these technologies, together with small scale local generation, as options in their electricity systems.

221. The SEM is in the process of being reformed to comply with European rules, to increase the efficiency of trade across interconnectors and to ensure that Ireland benefits from the IEM. The regulators are working to implement the new market, known as I-SEM, by 2017. The SEM has benefited from strong cooperation with the Northern Ireland authorities and this cooperative approach has transferred seamlessly to the I-SEM project. We are fully supportive of the I-SEM project, which is necessary to assist with the achievement of energy policy objectives and we are confident that the SEM Committee will deliver a market within the deadline that provides for the high level principles enshrined in SEM legislation, as already enacted in both jurisdictions in 2007. We recognise that the continuing support of industry, stakeholders and citizens will be essential to delivering this complex project and will move legislation to encompass the I-SEM market as part of its ongoing regulatory legislative programme.

Governance and Regional Market Integration

222. In coming years, integration between the SEM and its neighbouring electricity markets will gradually deepen on a regional basis. This will come about as a result of market design developments, such as I-SEM implementation after 2017 and, over the longer term, with increasing physical electricity interconnection with its neighbours. The existing regional governance arrangements may need to be reviewed to prepare for these more integrated regional energy markets [53]. Given that I-SEM design and preparation is the immediate priority, such a review will only be started as the I-SEM project moves towards go-live and implementation. It will be undertaken in partnership with the France-UK-Ireland grouping (FUI) of Member States.

Market Power

223. Market power in the electricity wholesale market is closely monitored by the regulatory bodies. We support the SEM Committee's development of effective market power mitigation measures as part of the I-SEM. The Committee will, in parallel, continue to keep under review potential market power mitigation options in the wholesale and retail electricity markets.

Electricity and Natural Gas Networks Structural Arrangements

224. As has been outlined above, regulatory stability, certainty and independence are critical to achieving competitive energy outcomes, and a cornerstone of energy policy in the EU and across the Organisation for Economic Cooperation and Development (OECD). There have been profound changes in Ireland's electricity system over the last 15 years, transforming it from a monolithic utility structure that encompassed all aspects of electricity (generation, distribution and retail supply); to a single all island wholesale market, with multiple generators and retailers operating through single transmission and distribution networks.

225. Ireland's electricity and natural gas networks are regulated by CER. These strategic national assets will be retained in State ownership. The electricity transmission system is owned by ESB and operated by EirGrid, the transmission system operator (TSO). The distribution system is owned by ESB and operated by ESB Networks (ESBN), the distribution system operator (DSO). The DSO is responsible for building, operating, maintaining and developing the electricity network and serving all electricity customers. The gas transmission and distribution systems are owned and operated by Gas Networks Ireland (GNI), a fully-owned subsidiary of Ervia. GNI is responsible for developing, maintaining and operating both the transmission and distribution networks.

226. In 2011, to address requirements under EU Directive 2009/72/EC [55], we decided that Ireland would opt for the Article 9.9 derogation and that accordingly the existing electricity transmission asset ownership regime would be the subject of an application under that model[15]. EirGrid obtained EU certification in 2013. The European Commission identified

15 The announcement of the Government decision is *http://www.merrionstreet.ie/en/News-Room/Releases/government-decision-on-electricity-transmission-assets-in-the-context-of-eu-3rd-package-on-energy.html*. The analysis undertaken by consultants for that decision is available at *www.dcenr.gov.ie/energy/en-ie/Electricity/Pages/home.aspx*

three areas for consideration in its certification decision and, taking account of the Green Paper consultation process, work will commence in due course on assessing whether these would improve effective and efficient transmission operations and governance arrangements, in order to inform appropriately the policy decision making process.

227. In accordance with EU obligations, the operator of the East-West Interconnector will apply to the CER to be certified under the full ownership unbundling model and any necessary regulatory, ownership, legislative, structural, and operational changes for the purposes of EU compliance will be implemented.

7.3 Infrastructure

228. Infrastructure will be required to support the energy transition across the transport, heat and electricity sectors.

229. Energy infrastructure comprises linear facilities – such as gas pipelines, electricity interconnectors (§236-239) and roads – as well as point infrastructure, including power stations, electricity switching stations, ports and oil and gas terminals. Enhanced energy infrastructure, including some communications infrastructure, will be essential for economic development, regional development, and the cost efficient and secure provision of energy and other services that citizens need and value.

230. The need for new infrastructure will be assessed through robust analysis. As set out in chapter 4, we are committed to ensuring that the infrastructure development processes and final decisions take account of the views of citizens and consensus on broad energy policy views will be pursued at the National Energy Forum.

231. The July 2012 Government policy statement on the Strategic Importance of Transmission and other Energy Infrastructure [56] reaffirmed the need for the development and renewal of energy networks to meet economic and social goals. It endorsed the strategic programmes of the energy infrastructure providers, subject to their adherence to national and international standards for design and construction, and to community consultation.

Streamlining Delivery

232. It is important that energy infrastructure is delivered in a timely manner because delays in planning add costs to projects and pose risks for the wider energy system. Greater certainty on timelines, transparency and better interaction between stakeholders will reduce delays.

233. Where an application is supported by a national and regional context, solid engagement with community and planning authorities at an early stage, and the relevant supporting documentation (EIA etc.), the planning system can provide an active support to the development process.

234. The updating of planning legislation and the establishment of the Office of the Planning Regulator, which will carry out independent appraisal of all relevant statutory plans (e.g. local area plans, development plans, regional planning guidelines etc.) is a positive development and will help to streamline the planning process.

235. The rules associated with EU PCIs in electricity, gas and oil networks coordinate the planning of transboundary energy infrastructure projects.

Natural Gas and Electricity Network Infrastructure

236. Providing natural gas and electricity network infrastructure is essential for the proper functioning of the markets and for the provision of secure supplies. These networks will play an important role in the transition.

237. EirGrid's Grid25 [57] strategy provides a strategic overview for the development of the electricity transmission system to 2025 and beyond. It is based on a vision of delivering a strong, cost efficient transmission system, which will be essential for facilitating regional economic growth. The implementation of Grid25 will also facilitate the achievement of Ireland's RES-E goals.

238. A review of Grid25 completed in 2015 confirmed inter alia the urgent need for investment and for the implementation of the proposed North-South transmission line. The review also clarified other needs and the overall scale of Grid25 was reduced on foot of reduced projected demand and the availability of new technologies.

239. The adjustment in scale of Grid25 identified new options for various projects. Those options are being discussed with stakeholders through public consultation on individual projects.

Interconnection

240. Ireland has an electricity transmission line to Northern Ireland and an interconnector with Great Britain, known as the east-west interconnector (EWIC). Northern Ireland, which is part of the SEM, also has an electricity interconnector with Scotland.

241. The proposed North-South transmission line, which is currently in the planning process, will improve security of supply and reduce electricity transmission costs across the island.

242. The 2009 All Island Grid Study [31] showed that the current transmission network could safely absorb a level of renewable production generation of up to 42% of total electricity generated without affecting security of supply. Higher penetration levels would require significant additional interconnection or energy storage (§160-161). This continues to be the case and, given the Commission will report regularly to the European Council with the objective of arriving at a 15% target by 2030, further interconnection will be necessary. In addition to the proposed North-South transmission line, there are several initiatives underway which will lay solid analytical foundations for further interconnection:

- a feasibility study on an interconnector with France [58]. The technical analysis commissioned to inform the development of the White Paper [16] suggests that this would enable the reduction of GHG emissions
- the North Seas Countries' Offshore Grid Initiative (NSCOGI) [59]
- the Irish-Scottish Links on Energy Study (ISLES) [60], which explored the potential for cross-border offshore renewable energy production between Northern Ireland, Scotland and Ireland
- decisions on further interconnection would be preceded by a full evaluation, including cost-benefit analysis.

243. The gas networks in Ireland and Northern Ireland are interconnected. Ireland also has two gas interconnectors with Scotland, and the CER has recently decided to approve the financing of a project aimed at increasing the resilience of these by the construction of a new section to the existing gas pipeline from Cluden to Brighouse Bay in south west Scotland which will twin a 50km stretch of pipeline to address Ireland's vulnerability to a single point of failure [46]. The project is an EU PCI and Gas Networks Ireland was successful in its funding application to the Connecting Europe Facility (CEF). Northern Ireland also has a gas interconnector with Scotland.

7.4 Cross-Government Collaboration

244. Aspects of energy policy require cross-government collaboration. Examples include climate change, spatial planning, transport, enterprise, and public expenditure. The energy transition will, therefore, involve close cooperation and coordination between a number of departments to ensure that we meet our policy objectives in the most effective and cost efficient way, and reap the many social and economic opportunities that the transition will provide. The need for cross-Government collaboration of this kind is recognised in a number of public service reform programmes including the Civil Service Renewal Plan [61].

245. There are already structures in place to facilitate cross-departmental work on energy-related issues, both at the political level (e.g. Joint Oireachtas Committees, Cabinet, and Cabinet Committees) and at official level (e.g. senior official and technical working groups).

7.5 Actions

A strong EU Framework producing appropriate energy and carbon pricing

246. We will:

- work with the EU and its partners to ensure the EU framework provides the correct signals to ensure an appropriate transition to a low carbon future throughout Europe.

The participation of energy citizens

247. Actions are covered in chapter 4.

Regulation of Electricity and Natural Gas Markets

248. To ensure a stable, transparent, evidence-based regulatory framework for the transition, we will:
    - review the legal and institutional framework for the regulation of electricity and natural gas markets including the CER's mandate, in line with ongoing government sectoral economic regulation requirements
    - publish, in mid-2016, an overview of the legislative work programme for the regulation of the electricity and gas markets
    - in the meantime, and in parallel with the conduct of the above review, move any necessary regulatory legislation including that already in the legislative programme in respect of the CER administrative sanctions and I-SEM
    - engage with the EU in its review of the wholesale electricity market design, with a view to ensuring alignment with Ireland's energy circumstances and policy goals.

Energy Infrastructure Delivery

249. To streamline the delivery of appropriate infrastructure, we will:
    - improve the experience of citizens and developers that engage with the planning and permitting processes by supporting the effective cross-departmental and cross-agency work initiated under the PCI process
    - promote better engagement with citizens and communities, including by building on the success of SEAI's Better Energy Programmes (chapter 5).

Innovation and Technological Development

250. Actions relating to innovation are discussed in chapter 9. Technological development is discussed in chapter 5.

8 Energy Costs

8.1 Introduction

251. The energy transition will bring benefits but it will require investment, behavioural change and will also incur costs. These costs will primarily be funded by commercial and household investment and charges on energy use. In some instances, this will be supported by Government initiatives and EU funding. This chapter outlines the key drivers of energy costs, the impacts of costs on the economy and society and Government policies to tackle energy poverty and put downward pressure on prices.

8.2 Drivers of Energy Cost

252. The price of energy is primarily determined by the market. Irish energy prices are also influenced by the country's scale and demography and the fact that we are relatively weakly interconnected.

253. The determinants of energy costs, many of which are beyond the influence of Irish Government policy, are outlined in the paragraphs below.

254. Natural gas, oil products, coal and other fuels are traded commodities with prices determined on competitive international markets, which are generally transparent, liquid, and efficient.

255. Electricity generation costs, which are largely determined by international fuel prices, represent the single biggest component of retail electricity costs. Other cost components include network charges, policy interventions and retail margins.

256. While many of the components of the cost of capital are determined externally, and to a certain extent by general domestic economic conditions, the certainty provided by stable and consistent policymaking and regulation gives assurance to investors and can help to keep capital costs lower. Stable, transparent, cost efficient, evidence-based, independent regulatory environments will facilitate investment and ensure that the cost of capital for new and existing investors is lower, including for network investors.

257. The provision of gas and electricity networks is subject to detailed and thorough economic regulation by CER, whose framework of five year electricity and gas network revenue reviews is regarded as best international practice. The CER ensures that consumers are protected, while offering the regulated network businesses a clear and stable environment to make necessary and cost efficient investments.

258. The cost of carbon is a key component of energy costs. The level of this cost will grow in future as European policy measures drive the market towards low carbon technologies.

259. A price is placed on GHG emissions through the European Union Emission Trading System (EU-ETS) and through domestic carbon taxes. As CO_2 is the most common GHG, the term 'cost of carbon' is commonly used to describe the cost levied on emissions.

260. We have a responsibility to ensure that citizens are protected from unnecessarily high energy prices. Government can influence the cost of energy through regulation and policy including competition policy.

261. The electricity and gas retail markets are fully deregulated and the CER is charged with promoting competition in the generation and supply of electricity and the supply of natural gas. Over time, the energy sector has been increasingly organised along market economy norms. For example, fuels are purchased on internationally traded commodity markets and electricity has been commoditised in the SEM.

262. For the gas and electricity networks, which are natural monopolies, regulation takes the place of competition to protect the interest of consumers and to ensure that only the most efficient costs are incurred.

263. Interventions to implement national and EU policy objectives such as the development of renewable energy sources can result in the imposition of costs. The aim is to achieve these objectives at the lowest possible cost to businesses and consumers and this is reflected in negotiating stances in various EU fora. Government intervention is examined in more detail in Section 8.4.

8.3 Energy Customers

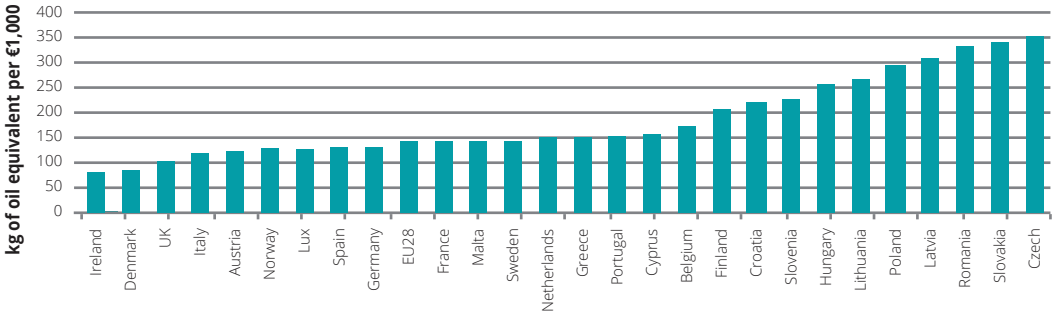
264. Enterprises need competitive energy prices to provide an environment for employment generation, enterprise development and wealth creation.

265. The impact of energy prices on different enterprise sectors is relative to the energy intensity of those sectors. The types of firms located in Ireland tend not to be very energy intensive compared to those in other countries. As Figure 8-1 illustrates, Ireland had the lowest energy intensity in the EU in 2013. However, energy costs do represent a significant proportion of overall costs for certain sectors.

266. Energy prices is not one of the principal factors in attracting investment however, it is considered a significant element of Ireland's cost competitiveness. This is particularly true for highly energy intensive sectors which will be impacted to a greater degree by energy prices.

267. Companies exporting to international markets from Ireland (both foreign owned and Irish owned) compete with those from other countries. Relative cost competitiveness, therefore, plays an important role in determining an enterprise's ability to compete in international markets. Relative cost competitiveness (as distinct from low or affordable cost) also continues to be a key factor for foreign owned entities when making decisions on where to invest – even in circumstances where the primary driver is innovation and/or talent.

Figure 8-1 – European Energy Intensity (Source Eurostat [63])



268. The data in Figure 8-1 relates to averages across the Irish economy. Recognising the importance of energy costs as a factor of production, we will work with the Department of Jobs, Enterprise and Innovation (DJEI) in implementing Enterprise 2025 [64] and in developing an appropriate measure of Ireland's relative cost competiveness that can form part of the monitoring, implementation and review process for this White Paper.

Energy Markets and the Consumer

269. The CER has a statutory responsibility to protect the interests of consumers and ensure that prices are fair and reasonable. Experience from other competitive markets illustrates that customers can make savings if they shop around and actively compare offerings from different suppliers. It is important that information from energy providers facilitates this by being clear, easily understood and comparable. Switching procedures should be straightforward and uncomplicated. Good communications by all stakeholders[16] are important so that consumers can understand energy prices and what influences them in an Irish context.

270. The successful establishment of the SEM in 2007 provided cost reflective wholesale electricity, competition, transparency, greater consumer choice, diversity of generation, security of supply and increased renewable energy penetration. It has exerted downward pressure on electricity prices and has also attracted new market entrants [65][66].

271. The SEM Committee is the regulatory authority for the SEM and consists of members from the CER and Northern Ireland Authority for Utility Regulation, together with independent membership. The SEM Committee has developed a high level design for the new market (the I-SEM (§220) aimed at enhancing benefits to consumers in both the short and long term, while ensuring security of supply and facilitating the transition to a low carbon system. The decisions regarding market design will reflect the statutory duty of the SEM Committee to protect the interests of consumers.

16 Including Government, the CER, energy suppliers and their trade associations.

272. The new arrangements have been assessed as best delivering the benefits of European market integration, by maximising the efficient use of interconnectors and rendering the benefits to the end consumer. The SEM Committee's impact assessment of the new market design indicates that the market will deliver more competition and more efficient prices[17] than would be the case under other market rules.

Energy Poverty

273. A person can be said to be in energy poverty when he/she is unable to afford to adequately heat or power their home [67]. Energy poverty can be correlated with the thermal efficiency of a person's home, the cost of energy and a person's income.

274. Recent research [73] has found that a common set of risks underpins vulnerability to both energy poverty and broader deprivation, linking energy poverty to broader deprivation. This reinforces the importance of continuing the wider economic recovery programme and focusing on energy efficiency as a means of combating energy poverty. Improving the energy efficiency of a home (§113-117) can permanently reduce a household's energy demand, reducing its vulnerability to unexpected falls in income or increases in energy costs. There is also a growing body of research that demonstrates the importance of an adequately heated home for a person's overall health and wellbeing.

275. A new National Affordable Energy strategy will be published in early 2016. This strategy will build on the achievements of the first affordable energy strategy and will focus on a small number of high-priority actions that are achievable over the next three years to improve the lives of those experiencing energy poverty. It will establish a robust framework to ensure that there is proper accountability and co-ordination of Government activity on energy poverty. It will concentrate on building the case for tackling energy poverty as a health and wellbeing issue, as well as seeking to ensure that energy efficiency interventions are correctly targeted at those in most need. It will also seek to ensure that energy market structures are responsive to the needs of those in energy poverty.

276. The National Affordable Energy Strategy will contain:
    - a new methodology for measuring and reporting energy poverty
    - measures to ensure better quality services to energy customers
    - actions to improve energy efficiency in the rental sector
    - a new pilot scheme for deep energy efficiency upgrades for people suffering from certain chronic health conditions that are related to the thermal efficiency of their home. This will include a research project to gather evidence on the impacts of this improved energy efficiency on participants and consequences for the health service.

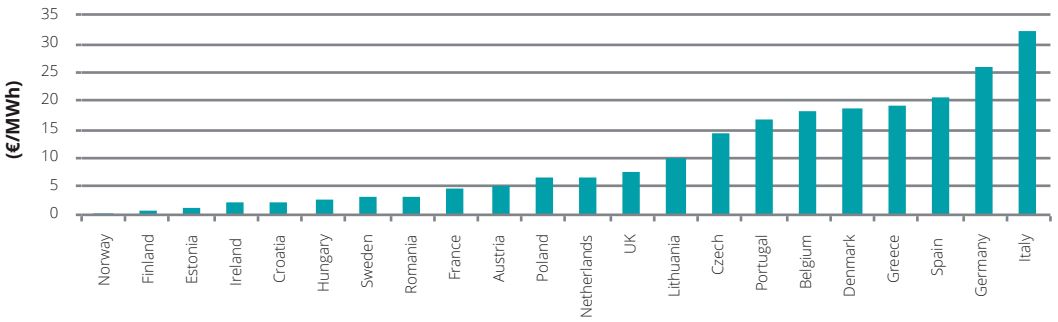
17 Including by reducing curtailment of variable generation and by having more efficient flows across the interconnectors, dictated by price signals.

8.4 Government Interventions

277. Government has intervened in energy markets through a variety of measures to achieve policy objectives and targets, including:
    - biofuels and energy efficiency obligations
    - grants for purchase of electric vehicles and for undertaking energy efficiency works
    - renewable energy feed in tariff (REFIT) for RES-E
    - support for peat-fired electricity generation
    - NORA Levy[18] to fund oil security measures
    - carbon tax
    - priority dispatch for renewable energy in the electricity market.

278. These interventions add costs in various ways. Some incur costs for the Exchequer (e.g. grants), while others impact directly on customers (e.g. public service obligation (PSO)). The Council of European Regulators collates data on renewable energy and energy efficiency support schemes in Europe. Data from its 2015 report [68] demonstrates that per-unit supports for RES-E in Ireland are among the lowest in Europe – see Figure 8.2.

Figure 8.2 – Renewable electricity support per unit of gross electricity produced, 2012



279. The PSO levy is used to enhance security of supply and sustainability by funding measures that support peat, renewable energy and certain types of gas generation in the electricity generation mix. The PSO for peat will cease in 2015 for one of the stations and in 2019 and 2020 for the other two stations. The gas stations will no longer be supported through a PSO after 2016 while the current supports for renewable technologies will cease by the end of 2032.

280. Developing the interconnection infrastructure (§239-242) required to achieve policy goals presents particular challenges because of Ireland's small market size and location as an island on the north-west periphery of Europe. It is essential that the costs associated with this infrastructure continue to be minimised. We will work to unlock EU funding for interconnectivity projects, which are cost efficient for the Irish consumer, including through PCIs[19].

18 A €0.02 per litre levy on the disposal of motor spirit, gasoil, diesel and kerosene (excluding jet fuel) and fuel oils.

19 The 'twinning' works on the gas interconnectors with Scotland is a PCI.

281. Policy-related costs must be minimised as far as possible. Policy choices will be evidenced based ensuring energy sustainability, security and competitiveness. This will include analysis of the distributional burden and benefits of any policy proposals. Moreover, DCENR will review progress on an ongoing basis to ensure the delivery of the promised benefits. For example, if a policy measure is to be funded by means of a PSO levy then this will be preceded by a careful identification and robust analysis of needs, a full evaluation of the various alternatives and careful consideration of impact.

282. Government interventions are subject to European Union State Aid rules.

8.5 Actions

283. The CER will:

- enhance consumer protection and market monitoring and become a more active advocate for energy customers. This will include publishing a consumer focussed assessment of the development of competition in retail markets (and its impact on prices), publishing advice on reducing energy bills, and publishing details of supplier compliance with consumer codes and requirements
- ensure that competitive markets are delivering for all consumers, and consulting on the promotion of active consumer engagement. This will include examination of the structural factors that underpin consumer disengagement (such as the extent to which energy bills are understood by consumers) and will outline remedial solutions
- ensure that energy suppliers include additional information on their customer bills, including information on energy usage and how it compares to that of other customers.

284. We will:

- ensure that adequate safeguards are in place to protect people at risk of energy poverty. Although this is a whole of Government responsibility, DCENR, the CER and the energy industry all have specific roles to play
- introduce any legislative changes required to support the CER in carrying out the actions above
- publish in early 2016 a new National Affordable Energy Strategy and implement it over the subsequent three years
- ensure policy choices are evidence-based (including use of cost-benefit analysis or regulatory impact analysis where appropriate) with a focus on competitiveness, security and sustainability
- review progress on an ongoing basis to ensure the delivery of the promised benefits
- DCENR will work with DJEI in implementing Enterprise 2025 and in developing an appropriate measure of Ireland's relative energy cost competiveness that can form part of the monitoring, implementation and review process for this White Paper.

9 Innovation and Enterprise Opportunity

9.1 Introduction

285. The energy sector is at a point of unprecedented change – driven by the transition to a low carbon future, the development of new energy services based on ICT technologies and EU and national law. This change will bring about a revolution in the energy sector, analogous to and far exceeding the change in the telecommunications sector in the late 1990's.

286. Since 1997, driven by strong EU and national regulation, the telecommunications sector has evolved from a fixed basic telephony service and architecture to one of constant growth – mobile services, broadband services, broadcast services and a mix of all. This growth has brought jobs and economic prosperity.

287. Although the energy sector is more complex, it is likely that it will also undergo transformational change and that the boundary between energy and communications services will blur. We are starting to see this already, for example, with the development of smart energy services and smart metering systems capable of being driven by mobile applications and offering broadband functionality. This offers a new horizon for entrepreneurs, innovators, the research community and for job creation. The pace of change will be led by strong EU and national regulation and by the energy industry.

288. The energy transition will create opportunities in technology and business by encouraging enterprise to innovate and invest in the development of products, services and technologies needed to enable the transition to our low carbon future. Ireland has several advantages in this regard including our open economy, modern infrastructure, creative entrepreneurs, innovative business models, and existing expertise in low carbon technologies. Our single TSO, single DSO, coordinated smart metering programme and high penetration of renewable energy will also help create the conditions for innovation. This chapter discusses the research, enterprise and economic opportunities presented by the transition.

289. The energy transition will have a positive impact on innovation, economic activity and job creation in Ireland. However, enterprises, sectors and localities that depend on more traditional energy activities will need to adapt to the changing environment as our dependence on these activities declines. We will work with national, regional and local economic development agencies to support jobs and local economic activity, including by seeking to attract alternative energy business and by supporting businesses to change and embrace new technologies and developments.

9.2 Energy Innovation

290. Ireland is well placed to participate in the technological innovation that will drive the energy transition. We support the advancement of the EU digital agenda [69], which will converge with the energy system and change it radically at all levels. The National Broadband Plan will assist the energy transition by providing every home, school and business with access to affordable high-speed broadband. With many of the world's leading IT companies located in Ireland, and a growing number of indigenous entrepreneurs developing innovative energy products and services, we can credibly aspire to becoming a European hub for energy innovation by 2020.

291. The transition is creating business opportunities and is contributing to economic recovery and jobs growth. Over recent years innovative Irish firms have moved to the forefront of the low carbon technology industry where they are making an impact at home and across the globe. Approximately 640 Irish companies are working on diverse aspects of energy technology, including offshore renewable technologies, renewable power generation, utility scale energy, marine turbines, converting waste heat to electrical power, energy efficiency, street lighting, and energy storage.

292. Our 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 [37].

293. Analysis carried out by SEAI, IDA Ireland and Enterprise Ireland (EI), along with DCENR and DJEI, found that sustainable energy is already worth €1.5 billion a year to Ireland, and it currently employs 18,000 people. The rapidly growing EU and global markets are much larger.

294. While the portfolio of technologies required for a low carbon energy system by 2050 will continue to evolve, proven, cost efficient options are already available for the next phase of the transition. Further innovation, research and development will facilitate the delivery of solutions that will complete the transition.

295. 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.

296. There is already a vibrant energy research and development environment in Ireland. We will continue to invest in energy research, development, demonstration and deployment (RDD&D) across a wide range of institutions[20] through grant aid, participation in European and international fora to maximise funding opportunities, coordinating energy research in the EU's Horizon 2020 research framework, and engagement in the IEA's Implementing Agreements for collaborative energy RDD&D (Table 9-1).

Table 9-1 – Main agencies involved in energy research and associated responsibilities

Organisation(s)[21]	Responsibilities
SFI & IRC	Oriented basic and applied research in the areas of science, technology, engineering, and mathematics
SEAI	Development and demonstration and overall research coordination
HEA	Education and training
EPA	Climate change research
EI	Commercial development of products and services

20 Including universities, institutes of technology, research institutions, research centres, technology centres, public bodies, state owned companies, and large and small commercial organisations.

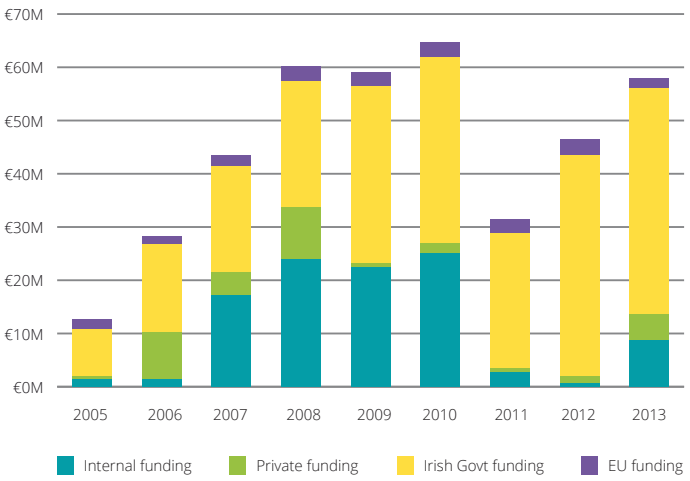
21 Science Foundation Ireland (SFI), Irish Research Council (IRC), Higher Education Authority (HEA), EPA, EI.

297. The EU Strategic Energy Technology (SET) Plan [70] sets the high-level energy research strategy and determines the shape of European funding programmes. Its objective is to develop Europe as a global leader in energy innovation. DCENR is a member of the SET Plan Steering Group. Ireland continues to play a positive role in the EU's goal of achieving global leadership in the production of energy technological solutions.

298. EU funding and research prioritisation is likely to become increasingly important over the coming years under Horizon 2020. The new EU roadmap and action plan is anticipated to accelerate the pace of energy research development in Europe[22].

299. Government funding has been consistently high over the period from 2005 and has increased in recent years with an expenditure increase of c. €15 million from 2011 to 2012. For the 2013 data collection period, reported Government expenditure on RDD&D (including deployment) in Ireland exceeded €40m (Figure 9-1).

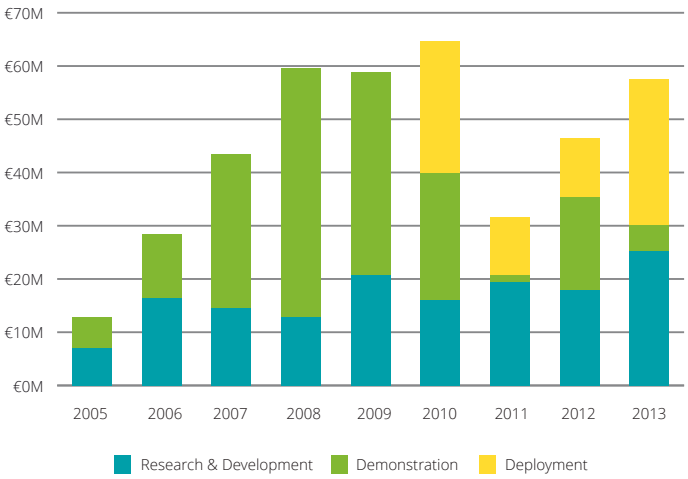
Figure 9-1 – Total RDD&D Funding (2005-2013)



300. Figure 9-2 reports the proportion of expenditure in the three main areas of RDD&D. Some deployment projects, such as the Warmer Homes Scheme, were categorised as 'demonstration' prior to 2009, but have since been classified as 'deployment'.

22 *https://setis.ec.europa.eu/system/files/Towards%20an%20Integrated%20Roadmap_0.pdf*

Figure 9-2 – Historical Expenditure – Research & Development, Demonstration and Deployment (SEAI)



301. Irish organisations have had significant success in EU funding programmes. The EU Seventh Framework Programme (FP7), which ran from 2007 to 2013, saw Ireland drawdown €19m in EU funding for Energy projects. Ireland has a much more ambitious target under the Horizon 2020 programme and for the 2014/2015 work programme Ireland secured funding of €20.3 million for energy related projects, primarily in the areas of biofuels and ocean energy projects.

302. In recognition of the importance of energy research in helping to achieve Ireland's energy policy and in order to inform and drive energy research strategy in Ireland DCENR established an Energy Research Strategy Group (ERSG). The ERSG sets out two high level goals for national energy research:

- to expedite Ireland's transition to a low carbon energy system
- to support Irish-based enterprise to exploit international market opportunities.

303. The ERSG report will be published in Q4 2015. The report includes a roadmap comprising areas of focus to 2050. It also identifies the key elements required for the development of a world class energy research system capable of addressing the challenges of energy security, sustainability and competitiveness.

304. These are ongoing strategic direction and oversight; excellent collaboration/coordination; international partnerships; appropriate funding and internationally bench marked and reviewed research excellence.

305. Table 9-2 sets out the main research areas of focus to 2050.

Table 9-2 – Roadmap – Main Research Areas of focus to 2050

A. Active Consumers at the Centre of the Energy System	A.1 Social and Behavioural Aspects of the Energy Transition including i) energy efficiency; ii) transport; iii) social acceptance of energy infrastructure; and iv) approaches to societal engagement.
B. Demand Focus	B.1 Energy Efficiency
C. System Optimisation	C.1 Electricity C.2 Gas/Water C.3 Smart Cities/Communities C.4 Integrated Energy Systems Modelling
D. Secure, Cost Effective, Clean and Competitive Supply	D.1 Wind/Solar Energy D.2 Bioenergy D.3 Ocean Energy D.4 Sustainable Transport Systems D.5 Sustainable Heating/Cooling

306. The implementation of this strategy will provide policy certainty in energy research. This will allow the research community to continue to address the challenges and reap the benefits of our energy transition.

307. The 2012 National Research Prioritisation Exercise [71] identified two areas of energy research: smart grids/smart cities and ocean energy. Exchequer support for RD&D on ocean energy has increased in recent years with over €26 million allocated for the period 2013-2016.

308. The DJEI has led the development of Ireland's second strategy for science, technology and innovation, "Innovation 2020 – Excellence Talent Impact" [72]. It sets out a vision of Ireland as a global innovation leader in which research and innovation provide the foundation for a strong, sustainable economy and an inclusive, progressive society. DCENR was an active participant in this work which was published in December 2015. In addition to those areas identified by the Research Prioritisation Exercise, further energy-related areas such as bioenergy and geosciences are now identified as important components in such a strategy.

309. The Irish research community is home to several world-class centres of energy research excellence including the Beaufort Centre in Haulbowline, Cork, the International Energy Research Centre at the Tyndall Institute and the Electricity Research Centre at University College Dublin (UCD), which was Ireland's first Science Foundation Ireland (SFI) energy strategic research cluster.

Marine Renewable Energy Ireland (MaREI) at the Beaufort Centre

The SFI MaREI Centre is a cluster of university and industrial partners dedicated to solving the main scientific, technological and socio-economic challenges related to marine renewable energy. MaREI expects to deliver significant economic and societal impacts, leveraging from existing internationally-recognised groups in Irish universities working in the marine renewable energy and maritime sectors. The principal investigator team comprises experts from University College Cork, National University of Ireland Galway, University of Limerick, Maynooth University, University College Dublin and Cork Institute of Technology. The multidisciplinary nature of the team reflects the breadth of expertise required to create a national-scale centre to support the research and development requirements of this emerging industry, both in Ireland and abroad.

Electricity Research Centre, UCD

The Electricity Research Centre (ERC) is a collaborative programme, involving industry and academia, undertakes applied research on areas relating to the development of a sustainable electrical energy system.

Financially supported by SFI, it is a collaborative programme involving research in University College Dublin, Trinity College Dublin, the Economic and Social Research Institute, the University of Limerick and NUI Maynooth. Complementary research initiatives are supported by a range of national and international funding streams.

The ERC is located in UCD's Electrical Engineering department and has an energy economics branch at Trinity College Dublin. The programme currently involves more than 60 people including postdoctoral and industry-experienced researchers, PhD students and a management team. It also includes major players in the Irish electricity industry and large international partners.

The ERC is developing a strong range of international activities in Europe, the US and China. These involve industry, government agencies and research institutions, which are linked to the Centre through formal agreements, joint appointments and the delivery of courses internationally.

The ERC is collaborating with the Danish Technical University in the area of Energy Systems Integration. The collaboration is focused on the development of innovative technology which will help energy systems to ultimately achieve renewable targets at least cost. This work is both ground-breaking and world-leading and involves integrating larger volumes of wind and other renewables onto electricity grids. This collaborative work will be hugely important to the global challenge of achieving deep decarbonisation of energy systems.

9.3 Enterprise in the Energy Technology Sector

310. An interdepartmental committee established under the Action Plan for Jobs is working to position Ireland as Europe's Energy Innovation Hub. Developing an overarching national platform that supports, promotes and incentivises energy innovation across Ireland will provide access to research and innovation supports in a single location. This will include a national web portal that allows access to information and supports through a one-stop-shop, including mapping of energy resource data, relevant supply chains, and research and demonstration projects, trials and case studies.

311. All relevant department and agencies will continue to co-ordinate and share information to identify and pursue enterprise opportunities in all parts of the energy supply chain, with particular emphasis on innovation, services and technology.

Irish Innovation on Micro Combined Heat and Power (Micro-CHP)

Micro-CHP has the potential to increase energy efficiency. Stirling engines are a unique micro-CHP technology because they can use any heat source or fuel and they burn their fuel to completion. This results in lower GHG emissions and virtually no harmful gases or carcinogens. However, current Stirling micro-CHP appliances are extremely expensive.

A project funded by the Irish Research Council is focussing on the computer simulation of Stirling engines for distributed generation and micro-CHP. This project involves collaboration between the National University of Ireland, Galway and an industry partner. The objective is that the simulation model, which will be calibrated and validated based on real data, will satisfy an industrial need for an accurate design tool, thus enabling the optimisation and widespread penetration of Stirling-powered micro-CHP.

9.4 Actions

312. To encourage innovation and maximise its economic and business opportunities, we will:

- actively support Ireland's energy research sector, creating the conditions for entrepreneurs to develop and commercialise business models and technologies and identify new concepts and technologies that will assist the transition
- oversee the implementation of the energy research strategy, aligning energy policy and research strategy with EU energy policy and research strategy and maximise Ireland's potential to secure funding under the EU Horizon 2020 research programme
- work with national, regional and local economic development agencies to support jobs and local economic activity, including by attracting energy business and helping organisations to embrace new technologies

- actively promote a coordinated approach among economic development agencies (IDA Ireland, Enterprise Ireland, Údarás na Gaeltachta, SEAI and others), which identifies and captures enterprise opportunities in the energy transition
- position Ireland as a leading European energy innovation hub to ensure that Irish-based firms benefit from increasing investment in sustainable energy innovation
- liaise with Irish-based high-tech companies to maximise technological synergies that can help deliver the energy transition
- exploit the opportunities created by the implementation of the Government's National Broadband Plan in the energy transition.

Annexes

Abbreviations

AA	Appropriate Assessments
CCS	Carbon Capture & Storage
CER	Commission For Energy Regulation
CNG	Compressed Natural Gas
COP	Conference Of Parties
CO_2	Carbon Dioxide
DAFM	Department Of Agriculture, Food And The Marine
DCENR	Department Of Communications, Energy And Natural Resources
DECLG	Department Of Environment, Community And Local Government
DPER	Department Of Public Expenditure And Reform
DJEI	Department Of Jobs, Enterprise And Innovation
DSO	Distribution System Operator
DS3	Delivering A Secure, Sustainable Electricity System
DTTAS	Department Of Transport, Tourism And Sport
EC	European Council
EESO	Energy Efficiency Supplier Obligation
EPA	Environmental Protection Agency
EPC	Energy Performance Contracting
ESB	Electricity Supply Board
EU	European Union
EWIC	East-West Interconnector
ESRI	Economic And Social Research Institute
ETS	Emissions Trading Scheme
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GNI	Gas Networks Ireland
IDA	Industrial Development Authority
IEA	International Energy Agency
IIEA	Institute Of International And European Affairs
IPCC	Intergovernmental Panel On Climate Change
I-SEM	Integrated Single Electricity Market

ISLES	Irish-Scottish Links On Energy Study
ktoe	Kilotonne Of Oil Equivalent
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
Mtoe	Megatonne Of Oil Equivalent
NESC	National Economic And Social Council
NORA	National Oil Reserves Agency
OECD	Organisation For Economic Co-Operation And Development
OREDP	Offshore Renewable Energy Development Plan
PCI	Projects Of Common Interest
PSO	Public Service Obligation
PV	Photovoltaic
R&D	Research And Development
REFIT	Renewable Energy Feed-In Tariff
RHI	Renewable Heat Incentive
SEA	Strategic Environmental Assessment
SEAI	Sustainable Energy Authority Of Ireland
SEM	Single Electricity Market
SFI	Science Foundation Ireland
TSO	Transmission System Operator
UCC	University College Cork
UCD	University College Dublin
UGEE	Unconventional Gas Exploration & Extraction
UNFCCC	United Nations Framework Convention On Climate Change

Glossary

An Bord Pleanála: An Bord Pleanála was established in 1977 under the Local Government (Planning and Development) Act, 1976 and is responsible for the determination of appeals and certain other matters under the Planning and Development Acts, 2000 to 2015 and determination of applications for strategic infrastructure development including major road and railway cases. It is also responsible for dealing with proposals for the compulsory acquisition of land by local authorities and others under various enactments. The Board also has functions to determine appeals under Water and Air Pollution Acts and the Building Control Act.

Better Energy Programme: The Better Energy Programme is administered by the Sustainable Energy Authority of Ireland (SEAI). This includes the Better Energy Homes scheme, the Better Energy Warmer Homes scheme, the Better Energy Warmer Homes Area based programme and the Better Energy Communities programme. Further information on these schemes is available at *www.seai.ie*.

Bioenergy: Bioenergy is the general term for energy derived from solid, liquid and gaseous biomass

Biofuel: Biofuels are liquid or gaseous fuels for transport produced from biomass.

Biomass: Biomass is the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste.

Carbon capture & storage (CCS): CCS is a set of technologies that can be used in combination to reduce CO_2 emissions from large point sources, such as coal and gas fired power stations, cement works and other industrial processes. In a power station setting, CO_2 is captured either at pre-combustion or post-combustion stage, compressed to a liquid or liquid-like state, then transported to a suitable storage site and injected into a deep geological formation.

Carbon dioxide (CO_2): CO_2 is a compound of carbon and oxygen formed when carbon is burned, including when fossil fuels are used for heating, transport and electricity generation. It is one of the main greenhouse gases (GHGs).

Commission for Energy Regulation (CER): The CER is Ireland's independent energy regulator with a range of economic, customer and safety functions. The CER was initially established and granted regulatory powers over the electricity market under the Electricity Regulation Act, 1999. The Gas (Interim) (Regulation) Act, 2002 expanded the CER's jurisdiction to include regulation of the natural gas market.

Co-firing: Co-firing refers to burning biomass or waste material along with fossil fuels in power station boilers.

Critical energy infrastructure: An asset or system which is essential for the maintenance of vital societal functions. A developed society depends on a complex range of services and utilities in order to facilitate the efficient functioning of its economy and the daily lives of the citizens. Much of the infrastructure required for these services is interconnected and interdependent, and failure of one asset (e.g. gas, electricity) may affect the continued functioning of other assets and services.

Cyber Security: Commonly refers to the safeguards and actions that can be used to protect the cyber domain, both in the civilian and military fields, from those threats that are associated with or that may harm its interdependent networks and information infrastructure. Cyber-security strives to preserve the availability and integrity of the networks and infrastructure and the confidentiality of the information contained therein.

Deep Retrofitting: is an extensive package of building energy efficiency improvements that have a high upfront cost, but can lead to significant energy savings. Examples include external insulation, installation of heat pumps, and installation of triple glazed windows.

Delivering a Secure, Sustainable Electricity System (DS3): The System Operators have established a programme of work entitled: Delivering a Secure Sustainable Electricity System (DS3) to achieve its targets in relation to renewable energy generation. This work programme includes enhancing generation portfolio performance, developing new operational policies and system tools to efficiently use the generation portfolio to the best of its capabilities, and regularly reviewing the needs of the system as the portfolio capability evolves.

Demand side management: Demand side management encompasses technical and behavioural measures that reduce consumer energy demand, when required.

District heating: District heating refers to heating systems that produce heat energy centrally and supply that energy through a distribution network to more than one end user that is located in a different building or facility.

East West Interconnector (EWIC): The East West Interconnector is a 500 MW High Voltage Direct Current (HVDC) link between the electricity transmission grids of Ireland and Great Britain. It is one of the largest voltage source conversion HVDC links in operation worldwide.

Eco-driving: Eco-driving is a driving style that reduces fuel consumption, greenhouse gas emissions, noise pollution and accident rates. It involves using smart, smooth and safe driving techniques that lead to an average fuel saving of 5-10%.

Economic and Social Research Institute (ESRI): The ESRI produces research that contributes to understanding economic and social change in the new international context and that informs public policymaking and civil society in Ireland.

Electricity Distribution System: An electricity distribution system consists of the lines, cables, etc. which deliver electricity from the transmission system to customer premises.

Electricity Transmission System: An electricity transmission system consists of the overhead lines, pylons, etc., which convey electricity across the country from generating stations to load centres.

Energy demand: Energy demand refers to the sum of the energy requirements of customers at the point of use.

Energy Infrastructure: Energy infrastructure refers to the equipment or 'hardware' needed to convey energy from points of origin to points of use.

Energy intensity: Energy intensity refers to the amount of energy needed for one unit of economic activity, e.g. kg of oil per €GDP.

Energy Performance Contracting (EPC): An energy performance contract is an agreement between a non-domestic energy consumer and a vendor whereby the vendor implements energy efficiency improvements and guarantees the energy savings. An EPC can overcome the need for upfront capital investment by the host organisation, as the investment is paid for over time by the value of the energy savings achieved. The capital investment is often financed by a third party financier.

Energy poverty: A person can be said to be in energy poverty when he/she is unable to adequately heat or power their home. It is a function of the thermal efficiency of a person's home, the cost of energy and his/her income.

Energy system: The sectors, processes, technologies and consumers of energy. The Total Primary Energy Requirement is the input to the Energy System.

EU Electricity and Gas Network Codes: The Third Energy Package, specifically Regulations (EC) 714/2009 and 715/2009, creates the legal basis for electricity and gas network codes. A network code is a set of rights and obligations that apply to parties operating in the European energy sector. Currently at the drafting and scrutiny phase of the EU legislative process, the codes will eventually apply directly across Europe in the same way as an EU Regulation. The objective of the network codes is to have a harmonised set of rules for cross-border electricity and gas trade. The codes should promote increased trading across Europe; make it easier for companies to enter the market; enhance cooperation and security of supply; and allow more renewable generation to be safely integrated into the energy mix. By creating standard rules for the operation of the gas and electricity sector, the network codes will provide the foundation for a reliable, sustainable and connected pan-European energy market.

EU emissions trading scheme (ETS): The EU ETS is a key element of the European Union's policy to combat climate change and is an important tool for reducing industrial GHG emissions cost efficiently. It operates on a 'cap and trade' principle and is by far the biggest international system for trading GHG allowances. Caps are imposed on individual industrial emitters. Each participant can trade emission allowances and must surrender enough allowances each year to cover all of its emissions; otherwise fines are applied.

Environmental Protection Agency (EPA): The EPA is responsible for protecting and improving the environment as a valuable asset for the people of Ireland. Since August 2014, the EPA has also been responsible for ensuring that the people of Ireland are protected from the harmful effects of radiation.

It is an independent public body established under the Environmental Protection Agency Act, 1992. The other main instruments from which the EPA derives their mandate are the Waste Management Act, 1996, and the Protection of the Environment Act, 2003 and Radiological Protection (Miscellaneous Provisions) Act 2014.

Ervia: Ervia is a commercial semi-state company with responsibility for the delivery of gas and water infrastructure and services in Ireland. It is the parent company to Gas Networks Ireland and Irish Water.

Forest-based-biomass: Biomass derived from forest harvest, and residues arising from sawmilling and boardmilling processing.

France-United Kingdom-Ireland (FUI) Regional Initiative: This initiative or grouping is one of a number of EU electricity regional initiatives set up to accelerate the completion of the EU Internal Energy Market. The Regional Initiatives were a project of the European energy regulators to speed up the integration of Europe's national energy markets. Launched with the support of the European Commission

(in Spring 2006), the Regional Initiatives created 7 electricity and 3 gas regional markets as a staging post towards a single-EU energy market. The France, Ireland and UK electricity regional initiative is led by the British Energy Regulator (Ofgem) and aims to integrate the national markets in the three countries.

Gas Networks Ireland (GNI): Gas Networks Ireland owns, operates, builds and maintains the natural gas network in Ireland.

Greenhouse gases (GHGs): Greenhouse gases refer to a wide range of gases that contribute to climate change. These include carbon dioxide, methane, nitrous oxide and a group of gases known as F-gases. The energy system is a significant emitter of carbon dioxide.

GRID 25: Grid25 is EirGrid's plan to develop and upgrade the electricity transmission network in the period to 2025.

Gross Final Consumption (GFC): GFC is similar to total final consumption (TFC) but also includes the consumption of electricity and heat as part of electricity and heat production and losses of electricity and heat in distribution.

HORIZON 2020: The Europe 2020 strategy identified research and innovation as being central to smart, sustainable and inclusive growth.

Running from 2014 to 2020 with a budget of just over €70 billion, Horizon 2020 is the EU's new programme for research and innovation and is part of the drive to create new growth and jobs in Europe.

Hydraulic Fracturing (Fracking): Hydraulic fracturing is a method for exploring and extracting natural gas. It differs from more traditional processes in a number of ways so it is also referred to as unconventional gas exploration and extraction (UGEE).

Hydrocarbons: Fossil fuels which consist primarily of carbon and hydrogen, such as oil, coal, peat and gas, are often referred to as hydrocarbons.

Industrial Development Authority Ireland (IDA Ireland): IDA Ireland is a non-commercial, semi-state body responsible for the attraction and development of foreign direct investment in Ireland. The agency partners with potential and existing investors to help them establish or expand their operations in Ireland.

Interconnection: Interconnection is the linkage of the electricity or gas transmission networks of adjacent systems.

International Energy Agency (IEA): The IEA was founded in 1974 to help countries co-ordinate a collective response to major disruptions in the supply of oil. While this remains an important aspect of its work, the IEA has evolved and expanded. It is at the heart of global dialogue on energy, providing authoritative statistics and analysis.

The IEA is an autonomous organisation which works to ensure reliable, affordable and clean energy for its 29 member countries and beyond. The IEA has four main areas of focus: energy security, economic development, environmental awareness and engagement worldwide.

Intergovernmental Panel on Climate Change (IPCC): The IPCC is the international body for assessing the science related to climate change. The IPCC works by assessing published literature. It does not conduct its own scientific research. IPCC assessments point to areas of well-established knowledge and of evolving understanding, as well as where multiple perspectives exist in the literature.

Ireland Energy Efficiency Fund (IEEF): The IEEF was launched in March 2014, with a capital injection from the Government and private sector capital from London & Regional Properties and Glen Dimplex Group of up to €70m. Sustainable Development Capital LLP (SDCL) was selected to manage the Fund.

ISLES project: The Irish-Scottish Links on Energy Study (ISLES) is 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. ISLES is designed to smooth the pathway to future development of high-quality, efficient, renewable energy developments.

DCENR is lead administrative partner for ISLES in collaboration with the Scottish Government and the Department of Enterprise, Trade and Investment (DETI) in Northern Ireland. The project is part financed under the EU's INTERREG IVA Programme for Northern Ireland, the Border Region of Ireland and Western Scotland with the partners providing the match-funding.

The ISLES objectives align closely with the EU ambition of increasing renewable energy generation capacity and interconnection. In October 2013, the ISLES Zone was approved as a Project of Common Interest (PCI) by the European Commission.

Kyoto Protocol: The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its parties to internationally binding emission reduction targets.

It was adopted on 11 December 1997 and entered into force on 16 February 2005. Its first commitment period started in 2008 and ended in 2012, and was followed by a second commitment period which runs until the end of 2020.

Low carbon: In the context of this document, low carbon refers to an energy type, an energy system, the use of energy and/or an activity that gives rise to zero or low emissions of carbon dioxide.

Market power: Market power refers to the ability of a firm (or group of firms) to raise and maintain price above the level that would prevail under competition is referred to as market or monopoly power. The exercise of market power leads to reduced output and loss of economic welfare. Regulators can seek to reduce market power of market participants through measures known as market power mitigation measures. These can include vigorous market monitoring to ensure dominant players do not abuse their power, enforcing bidding rules in markets, and forcing dominant players to sell a proportion of their output to competitors.

National Economic and Social Council (NESC): NESC was established in 1973 and advises the Taoiseach on strategic policy issues relating to sustainable economic, social and environmental development in Ireland.

In January 2012, the sustainable development role performed by Comhár, the Sustainable Development Council (SDC), was integrated into the work of the NESC. NESC has since developed its work in a way that integrates sustainable development issues into its analysis of significant national challenges.

National Oil Reserves Agency (NORA): NORA is responsible for ensuring that Ireland meets its obligations under EU legislation and IEA rules to maintain a minimum of 90 days stocks of oil for use in the event of a physical shortage of supplies. NORA is also responsible for administering Ireland's Biofuels Obligation Scheme.

Ocean Energy: Ocean energy refers to energy generated from waves, marine currents or offshore wind.

Primary Energy: Primary energy is the total energy content of the fuels and other energy sources required to be utilised to meet the energy requirements of consumers (energy demand).

Projects of Common Interest (PCIs): PCIs must have a significant impact on the energy markets of at least two EU countries; increase competition in energy markets; enhance the EU's security of supply and contribute towards the EU's energy and climate goals, for example by facilitating the integration of renewable energy into the grid.

Public Service Obligation (PSO) Levy: The PSO levy has been in place since 2001. It is overall financial support mechanism for electricity generation constructed for security of supply purposes, including peat generation, and for the development of renewable electricity. It is a charge on all customers and is designed to compensate electricity suppliers for the additional costs they incur by purchasing electricity generated by these producers. The legal basis and method of calculation for the PSO levy are set out in the Electricity Regulation Act 1999 (Section 39) and its operation is outlined in S.I. 217 of 2002. The PSO levy is vital to enable Ireland to meet its 40% target for electricity generated from renewable sources by 2020, which in turn is important for the achievement of Ireland's 16% renewable energy target.

Renewable: Renewable means something is not depleted through constant use or can be replenished within a relatively short period of time (generally taken to be a human lifespan). Renewable energy is often referred to as 'renewables'.

Renewable Energy Feed In Tariff (REFIT): REFIT is a feed-in-tariff support scheme that operates by guaranteeing new renewable generation a minimum price for electricity exported to the grid over a 15 year period.

Secondary Fuel: A secondary fuel is a fuel that can be used by an electricity generator to generate electricity in the event of an interruption to its primary fuel supply. A secondary fuel (or fuels) is registered in accordance with the Grid Code as the secondary or back-up fuel(s) authorised for energy production by the generator (generation unit).

Strategic Energy Technology (SET) PLAN: The SET-Plan is the main decision-making support tool for European energy policy, with a goal of accelerating knowledge development, technology transfer and up-take of low carbon energy technologies in order to achieve the E.U's 2030 energy and climate change goals and enable the transition to a low carbon economy by 2050. In essence, the SET-Plan is the overarching energy technology framework. Most funding programmes are driven through it e.g. Horizon 2020.

Implementation occurs through instruments including technology roadmaps the European Industrial Initiatives and the European Energy Research Alliance. Ireland (DCENR) is a member of the Steering Group of the SET-Plan.

Single Electricity Market (SEM): The SEM is the wholesale electricity market operating in Ireland and Northern Ireland. It is a gross mandatory pool market and is operated by the Single Electricity Market Operator (SEMO), which is a joint venture between EirGrid and SONI (the transmission system operator in Northern Ireland).

Single Electricity Market (SEM) Committee: The SEM Committee is the regulatory authority on SEM matters. The Committee consists of three Utility Regulator representatives, three CER representatives, an independent member and a deputy independent member.

Sustainable Energy: Sustainable energy refers to the harnessing and use of those energy sources:

- that are not substantially depleted by continued use
- the use of which does not entail the emission of pollutants or other hazards to the environment on a substantial scale
- the use of which does not involve the perpetuation of substantial health hazards or social injustices

Sustainable energy encompasses both energy efficiency and renewable energy, but is a broader concept than both.

TEN-T Core Network Corridors: "Core network corridors" were introduced to facilitate the coordinated implementation of the core network. They bring together public and private resources and concentrate EU support from the Connecting Europe Facility, particularly to: remove bottlenecks; build missing cross-border connections and promote modal integration and interoperability.

Total Final Consumption (TFC): The energy used by the final consumers (e.g. of industry, transport, residential, agriculture and services). It specifically excludes use by the energy sector (such as electricity generation and oil refining). The most significant differences between the total primary energy requirement (TPER) and TFC are that primary energy includes energy used for the generation and transmission of electricity.

Total Primary Energy Requirement (TPER): TPER is the total requirement for all uses of energy. This includes the energy used to transform one energy form to another (e.g. burning fossil fuel to generate electricity) and energy used by the final consumer.

UN Framework Convention on Climate Change (UNFCCC): The United Nations Framework Convention on Climate Change is an international environmental treaty that was opened for signature at the Earth Summit held in Rio de Janeiro in 1992 and came into force in 1994. The ultimate objective of the Convention is to 'stabilise greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system.' It states that 'such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner.' 194 countries signed the UNFCCC, including Ireland.

The treaty itself is not legally binding as it does not set mandatory limits on GHG emissions for individual countries and does not contain any enforcement mechanisms

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Annex A
5 Year Outlook – Existing and Planned Work Programmes

White Paper Section	Action Area	Main Output/Report
Energy Policy	Energy Policy Framework	National Energy Plan
Energy Future	Oil and Gas	Review of national oil & gas exploration and production policy
Empowering Energy Citizens	Citizen and Community Energy Policy	New structures and processes to enhance citizen and community participation National Energy Forum: The first National Energy Forum will take place in Q3 2016
Energy Efficiency	Homes	Enhance Role of SEAI Better Energy Programme redesign Update Building Regulations Community Better Energy Programme New Affordable Energy Strategy in early 2016 Consumer information campaign Ireland Energy Efficiency Fund
	Enterprise	Enhanced role of SEAI Energy Efficiency Obligation Scheme Establish Market Surveillance Authority
	Public Sector	Public Sector Energy Efficiency Action Plan
	Education	SEAI Schools Programme
Renewable Energy	RES-E	New support scheme Update Existing Schemes New Renewable Electricity Policy and Development Framework CHP Policy Framework Bioenergy Plan Offshore Renewable Energy Development Plan (OREDP)
	RES-H	New RHI District heating strategy Update Building Regulations Heating strategy (Beyond 2020) Regulatory framework – geothermal energy
Renewable Energy	RES-T	Scrappage scheme for public service passenger cars National Smart-drive Programme Framework for alternative Fuel Infrastructure Development Economic Assessment of biogas in transport sector Biofuels Obligation Scheme Green bus fund Initiatives to improve energy efficiency in transport sector

White Paper Section	Action Area	Main Output/Report
Energy Security	Energy Emergency Management	Energy Emergency Framework
Regulation of Electricity and Natural Gas Markets	Regulation	Review of legal and institutional framework for the regulation of electricity and natural gas markets including the CER's mandate and resourcing Overview of the legislative work programme for the regulation of electricity and gas markets Legislation
Energy Customers	Energy Market and the Customer	Enhance Role of the CER
	Energy Poverty	National Affordable Energy Strategy
Energy Innovation	Innovation	Establish Ireland as Europe's Energy Innovation Hub Implementation of Energy Research Strategy

Annex B
Recent and Forthcoming Publications

Published

Title	Date
2007 White Paper	March 2007
National Energy Efficiency Action Plan 1	May 2009
National Renewable Energy Action Plan	July 2010
National Energy Efficiency Action Plan 2	December 2012
Renewable Energy Strategy	May 2012
Policy Statement on Energy Infrastructure	July 2012
National Risk Assessment for Ireland	October 2013
National Energy Services Framework (NESF)	January 2014
Offshore Renewable Energy Development Plan (OREDP)	February 2014
National Energy Efficiency Action Plan 3	June 2014
European Union Energy Union Strategy	February 2015
Irish Scottish Links on Energy Study (ISLES) II Project Reports	September 2015
Storage Platform for the Integration of Renewable Energy (SPIRE) Report	September 2015
European Union's Strategic Energy Technology (SET) Plan	2015
National Risk Assessment 2015: Overview of Strategic Risks	2015

Work in Progress

Title	Expected
Renewable Electricity Planning & Development Framework (REPDF)	Q4 2015
Energy Research Strategy Group Report	Q1 2016
Public Sector Energy Efficiency Action Plan	Q1 2016
National Renewable Energy Action Plan Third Progress Report	Q1 2016
European Union(Cion) Feedback on European Union Regulation 994/2010	Q1 2016
Affordable Energy Strategy	Q1 2016
Bioenergy Plan	Q1 2016
New Support Scheme for Renewable Electricity	2016
Renewable Heat Incentive Consultation	2016
Quadrilateral Study on the Costs of Renewable Energy	2016
Draft National Strategy/Framework for Emergency Management (sig, input)	2016
National Energy Efficiency Action Plan Progress Report IV	2017
Contribution to the National Mitigation Plan	2017
European Union's F2030	2017
2030 Technical Research Analysis & Modelling (TRAM) Report	Ongoing

Annex C
2007 White Paper Milestones and Policy Achievements

The time since the publication of the 2007 Energy Policy Paper has been transformational for the Irish and the all island energy market. The EU and international energy landscape have also undergone profound change as new technologies unlock new sources of fossil fuels as well as low-carbon alternatives, and the global economy regains positive momentum.

Policy Achievements

2007 witnessed the establishment of the **all-island Single Electricity Market (SEM)**, which has been hailed as an exemplar of regional co operation by the EU.

In 2012, construction finished on the **East West Electricity Interconnector (EWIC)**, a strategically vital energy project for the island of Ireland, linking it with the UK and broader European energy markets. It was delivered on-time and within budget by EirGrid and financially supported by an EU grant of €110m.

Increasing renewable energy supplies have helped decarbonise the Irish economy and provided new opportunities for jobs and growth. At the end of 2012, Ireland had achieved 19.6% of electricity generation from renewable energy sources, 5.2% in renewable heat, and 2.3% in renewable transport. A new biofuels obligation of 6% set for 2013 has seen further increases in renewable fuels in transport in 2013.

The **National Energy Efficiency Action Plan** was established in 2009 and has resulted in energy efficiency enhancements underpinned by a wide range of programmes and measures, delivering carbon and energy cost savings for Irish energy consumers and the economy. Following on from this, in 2011, the Government launched a number of initiatives in relation to energy efficiency including **Better Energy: the National Upgrade Programme**.

In 2013, Ireland submitted its second **National Energy Efficiency Action Plan** to 2020. The second Action Plan identifies actions across six areas: Public Sector, Residential, Business, Transport, Energy Supply, and Cross Sectoral. In 2014, Ireland invested €35m as a cornerstone investor in an energy efficiency fund for the non-residential sector.

In line with EU network unbundling requirements in the Third Energy Package, in 2013, the EU Commission certified the Irish arrangements for electricity transmission system ownership and operation in accordance with the relevant option applied for under the Third Package electricity directive. Also in 2013, BGE's application for the Independent Transmission Operator (ITO) model was certified by the CER taking utmost account of the EU Commission's opinion on the application, in line with the relevant provisions in the Third Package gas directive.

In 2013, the Government published a report on the **Strategic Case for Oil Refining Requirements on the Island of Ireland**, which highlighted the additional security benefits that an operational refinery may offer and underlined that existing oil import facilities on the island of Ireland offer a robust infrastructure that would provide comfortable alternatives in the event of a serious disruption at any of the six principal oil ports.

Ireland's Strategy for Renewable Energy sets out five strategic goals – increasing onshore and offshore wind; building a sustainable bioenergy sector; fostering R&D in renewables such as wave and tidal; growing sustainable transport and building out robust and efficient networks.

To support this strategy, Ireland adopted two **Renewable Energy Feed In Tariff (REFIT)** schemes, extending supports to include new onshore wind and biomass capacity. Ireland also published a comprehensive **National Renewable Energy Action Plan (NREAP)** to demonstrate how EU renewable targets for electricity, transport and heating will be met.

In accordance with the EU objective of reducing greenhouse gas emissions by 80-95% by 2050, Ireland has developing a **National Low-Carbon Roadmap**, which sets out the strategy to be employed to meet these targets.

International Developments

Unconventional Methods of Extraction

The 2012 International Energy Agency's (IEA) World Energy Outlook highlighted a significant change in the global energy landscape due to increased deployment of hydraulic fracturing (fracking) and horizontal drilling. US unconventional oil and gas production is having a profound impact on international energy markets and prices and is likely to have significant implications for EU competitiveness, and geopolitics generally.

Notwithstanding these new oil and gas resources, oil prices have remained at a high level for the past two years, affecting the global economic recovery.

Nuclear

Following the accident in Fukushima in March 2011, stress tests were carried out on existing EU nuclear power plants to ensure they could withstand severe natural disasters. Some states are continuing their nuclear programmes (for example, the UK's Hinkley Point C plans), while others are phasing out theirs. Ireland has maintained its stance that nuclear installations should meet the highest international standards.

IEA Developments

The IEA continues to play an important role in Irish energy policy by contributing to a better understanding of global energy developments, international oil market dynamics and options to meet climate change targets. Two IEA in-depth reviews of Ireland's energy policy were published in 2007 and 2011, with each making a number of recommendations to improve the Irish energy landscape.

EU Developments

In 2007, the European Union agreed a **Renewable Energy Directive** with new climate and energy targets: 20% reduction in greenhouse gas emissions, 20% improvement in energy efficiency, and 20% of the EU's energy demand to be from renewable sources by 2020.

In 2011, the EU Commission published an **Energy 2050 Roadmap** which sets out a number of different scenarios for developing a decarbonised energy sector over the coming decades.

Of these scenarios, there will be a significant increase required in renewable energy deployment in Europe.

In May 2013, the **EU Regulation on Guidelines for Trans-European Energy Infrastructure** came into force. These guidelines aim to ensure that major EU energy infrastructure of strategic importance to Europe, including networks and storage facilities, are in place by 2020.

In January 2014, the European Commission published a Communication on the **policy framework for climate and energy in the period from 2020 to 2030**, which will guide discussion on energy and climate policy at EU level during 2014.

Energy Use

Since 2007, overall primary energy use has decreased by 19%, driven largely by the downturn in economic activity and by gains in energy efficiency.

With the exception of coal and renewables, all energy sources have decreased. Use of renewable energy has increased considerably in the same period. In 2012, it grew by 11% from 2011, to represent 7.1% of final energy use.

Investment

It is estimated that between €1.4bn and €1.6bn is being invested in sustainable energy technologies and services in Ireland annually.

At the national level, the total estimated expenditure from 2014 to 2020 across the range of technologies considered in the study could amount to between €2.2 billion and €2.9 billion per year. Around 45% of the total investment is anticipated to be in energy efficiency technologies and associated services, 40% in renewables and the remainder in electricity transmission. This average annual level of investment represents an increase on current levels of expenditure estimated at between €1.4 billion and €1.6 billion.

Exports of renewable energy technologies more than trebled between 2010 and 2012 to over €100 million. Most of the growth was associated with wind-turbine products and services, while biomass services also grew.

Exports of energy efficiency-related products increased from around €100 million in 2010 to over €170 million in 2012 (66% increase). This growth was focused on thermal insulation products and energy-efficient lighting.

Data collected in 2012 reported expenditure on energy research, development and demonstration (including deployment) in Ireland of almost €47 million.

In 2013 the Irish Government committed €200 million towards seven world-class Science Foundation Ireland (SFI) Research Centres.

Between 2009 and 2014, Better Energy: the National Upgrade Programme resulted in an average investment in energy efficiency-related construction of around €230m a year.

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