NATIONAL POLICY FRAMEWORK

ALTERNATIVE FUELS INFRASTRUCTURE FOR TRANSPORT IN IRELAND

2017 to 2030

An Roinn Iompair Turasóireachta agus Spóirt

Department of Transport, Tourism and Sport

Contents

Section 1

FOREWORD

Ireland has committed to transitioning to a low carbon economy by 2050 and the transport sector has a significant role to play. In Ireland transport is almost entirely dependent on imported oil. Reducing this reliance and switching to alternative fuels and technologies will be essential to decarbonise the sector. Major changes to our conventional fuel choices will be needed.

This *National Policy Framework on Alternative Fuels Infrastructure for Transport* represents the first step in communicating our longer term national vision for decarbonising transport by 2050, the cornerstone of which is our ambition that by 2030 all new cars and vans sold in Ireland will be zero-emissions capable.

By 2030 it is envisaged that the movement in Ireland to electrically-fuelled cars and commuter rail will be well underway, with natural gas and biofuels developing as major alternatives in the freight and bus sectors. In the coming years, as hydrogen use in Europe increases, an emerging market in Ireland is also expected to emerge. Most importantly, it is projected that the use of conventionally fossil fuelled vehicles will rapidly recede as these new technologies develop and consumer confidence increases.

This Framework will ensure that the availability of refuelling stations is not a major obstacle to market penetration. It will also provide a supportive, enabling environment for suppliers and consumers and provide increased confidence and reassurance in our commitment to this emerging market.

Reducing our dependency on oil has significant benefits: increasing fuel diversification improves national energy security; utilising greener alternatives reduces polluting emissions; and promoting renewable fuels can help stimulate our indigenous energy sector.

Although initially investment in alternative infrastructure will be costly, it will yield dividends in the longer term; enabling Ireland to adapt more quickly to the developing market, and actively setting Ireland on the right path to decarbonisation and cleaner air.

Shane Ross TD
Minister for Transport, Tourism and Sport

Section 2

EXECUTIVE SUMMARY

Ireland has expressed its intention, through a national policy position, to transition to a low carbon economy by 2050. The commitment of the energy sector to do the same is reflected in the White Paper on Energy Policy published in 2015. Transport, as part of the energy sector, will make its contribution to this transition.

A low carbon transport sector is underpinned by *Smarter Travel: A New Transport Policy for Ireland 2009–2020,* which was published by the Department of Transport in 2009. This policy set out to achieve five key goals in transport:

- Reduce overall travel demand
- Maximise the efficiency of the transport network
- Reduce reliance on fossil fuels
- Reduce transport emissions
- Improve accessibility to transport

These goals remain the cornerstone of transport policy and are fully aligned to the objectives of this National Policy Framework.

Reducing reliance on fossil fuels and switching to the use of alternatives will be an integral part of the transport sector's efforts to decarbonise, and this will also be reflected in Ireland's first National Mitigation Plan, which is due to be published in 2017. The Framework outlined in this document represents a first step in communicating a longer-term vision for transport to 2050. While a multi-faceted set of measures (energy efficiency, demand management, modal shift, spatial planning, behavioural change and fiscal incentives) will be deployed to help decarbonise transport over this period, this particular Framework will focus exclusively on reducing transport's dependency on oil through the provision of infrastructure and common standards for alternative fuels.

In order to meet climate targets and air quality objectives, the transport sector must transition away from the use of oil over the next two decades, moving predominantly to electricity for passenger cars, taxis and commuter rail in the Greater Dublin Area (GDA) by 2030. Natural gas, along with some electrification, will provide an interim alternative solution for larger vehicles, i.e. freight and buses. Biofuels, including biomethane, will also play a key role over the next ten years or so.

Post-2030, it is likely that hydrogen will increase its penetration across the entire fleet spectrum with a correlated decline in the predominance of vehicles run solely on fossil fuels. It is Ireland's ambition that all new cars and vans sold in this country from 2030 will be zero emission (or zero emission-capable). The freight and bus sectors will continue on a positive trajectory towards full penetration of low emissions vehicles (LEVs).

Section 3

INTRODUCTION

3.1 Why are we developing this Framework?

Arising from policy objectives to decarbonise transport, reduce reliance on oil and promote the use of cleaner fuels, the European Commission developed and published the *Clean Power for Transport: A European Strategy* in 2013. The aim of this document was to establish a long-term policy framework to guide technological development and investment in the deployment of alternative fuels and give confidence to consumers.

Based on this 2013 strategy, the European Parliament and the Council adopted Directive 2014/94/EU on the deployment of alternative fuels infrastructure in October 2014. The directive requires member states to develop national policy frameworks (NPFs) for the market development of alternative fuels and related infrastructure. It also foresees the use of common technical specifications for recharging and refuelling stations.

The directive, when implemented, will help to:

- substitute fossil oil sources in energy supply to transport
- enhance the environmental performance of the transport sector by reducing emissions
- diversify the fuel mix in transport
- improve air quality
- enhance the interoperability of alternative fuelled vehicles across the EU
- achieve EU Climate and Energy Package targets (known as 20-20-20) by 2020 and a low carbon economy by 2050.

3.2 What will be achieved by the Framework?

This Framework will set targets to achieve an appropriate level of alternative fuels infrastructure for transport, which is relative to national policy and Irish market needs. Non-infrastructure-based incentives to support the use of the infrastructure and the uptake of alternative fuels will also be included within the scope of this Framework.

This Framework will not be setting or amending policy on the use of biofuels. Biofuels policy is already addressed through the implementation of the Renewable Energy Directive and the Fuel Quality Directive. A Biofuels Obligation Scheme is in place to oblige all suppliers of road transport fuel to include a proportion of biofuel in their fuel mix. The obligation will be increased on a phased basis until 2020 with a view to contributing towards the mandatory 10% minimum renewable energy target for transport (RES-T) as set out in the Renewable Energy Directive.

This Framework has been developed in parallel with existing national climate and energy policies (for example, the *White Paper on Energy Policy*), as well as those currently under development, such as the *National Mitigation Plan.*

3.3 What Fuels do we currently use?

More than 90% of the energy used in transport within Europe is derived from crude oil, most of which is imported (more than 90%) at a cost of more than one billion euro per day.[1]

In 2013, oil dependency levels in Ireland were the fourth highest in the EU, at 49% of all energy use. All of Ireland's oil is imported, which cost an estimated €4.4 billion in 2014. In that year, 97% of energy used in the transport sector was derived from oil-based products. This near total dependence on a single fuel source is unique to the transport sector.[2]

At the end of 2008, the EU agreed to set a target for each member state, such that renewable energy sources (including biofuels, renewable hydrogen or 'green' electricity) should account for at least 10% of the energy consumed within the transport sector by 2020, known as the RES-T. The average share of renewable energy sources in transport fuel consumption across the 28 EU member states was 5.9% in 2014, ranging from highs of 21.6% in Finland and 19.2% in Sweden to less than 1.0% in Spain and Estonia.[3]

In the same year, final energy consumption in the transport sector in Ireland was dominated by imported fossil fuels (97.4%). Renewable energy sources in transport (RES-T) reached 3.3% in 2015, or 5.7% when weightings are applied to biofuels from waste and second-generation biofuels.[4] Apart from some negligible use of liquefied petroleum gas (LPG) and electricity, petrol and diesel accounted for the remainder of fuel used in road transport in Ireland in 2015.

3.4 What Other Policies and Legislation are Relevant to this Framework?

Setting CO_2 Emissions Performance Standards for Light Duty Vehicles

In 2009, the EU introduced legislation to provide for mandatory emission reduction targets for new cars being sold on the European market. Regulation (EU) No 443/2009 and Regulation (EU) No 510/2011 have become the cornerstone of the EU's strategy to improve the fuel economy of cars. Similar targets have been set for new vans and, this year, the EU has announced plans to introduce the same for trucks. The implementation of these regulations, along with complementary domestic taxation measures (co_2-based motor tax and vehicle registration tax {VRT}), has resulted in a dramatic shift towards the purchase of more fuel-efficient vehicles in Ireland.

Clean Vehicles and Fuel Quality Directives

These Directives, which were both adopted in 2009, have been pivotal in the promotion of cleaner energy use in transport.

Directive 2009/33/EC on the promotion of clean and energy-efficient road vehicles is predominantly a public procurement-related instrument, which requires public bodies to consider certain energy and environmental impacts when purchasing road vehicles. The Commission is currently in the process of undertaking an Impact Assessment of options for a possible revision of this Directive with a public consultation on the Assessment expected to conclude in March 2017. The Fuel Quality Directive 2009/30/EC, which requires a reduction in the greenhouse gas intensity of the fuels used in vehicles by 6% by 2020, also regulates the sustainability of biofuels. This legislation, which amends Directive 98/70/EC, has led to significant reductions in the sulphur content of fuels, enabling the deployment of vehicle technologies to reduce greenhouse gas and air pollutant emissions, thus delivering substantial health and environmental benefits. The Fuel Quality Directive applies to all petrol, diesel and biofuels used in road transport, as well as to gasoil used in non-road-mobile machinery.

[1] European Commission website 'Energy Security Strategy'.
Available from **https://ec.europa.eu/energy/en/topics/energy-strategy/energy-security-strategy**
[2] Energy Security in Ireland – A Statistical Overview, 2016 report
www.seai.ie/Publications/Statistics_Publications/Energy_Security_in_Ireland
[3] Eurostat: **http://ec.europa.eu/eurostat/statistics-explained/index.php/Renewable_energy_statistics#Transport**
[4] Energy in Ireland – Key Statistics 2015
www.seai.ie/Publications/Statistics_Publications/Energy_in_Ireland/Energy_in_Ireland_Key_Statistics

EU White Paper on Transport

The *EU White Paper* on Transport, which was published in 2011, set the scene for achieving a European-wide transformation of the transport sector with a commitment to deliver on the following by 2050:

- no more conventionally fuelled cars in cities
- 40% use of sustainable low carbon fuels in aviation
- at least 40% cut in shipping emissions
- 60% cut in transport emissions by the middle of the century

The paper's roadmap placed a particular emphasis on urban transport and the need to support a shift to cleaner cars and cleaner fuels. It set a goal of achieving a 50% shift away from conventionally fuelled cars by 2030, with a view to phasing them out in cities by 2050. It also seeks to achieve a target of CO_2-free movement of goods in major urban centres by 2030.

Supporting the use of cleaner cars and fuels in urban environments will also integrate with the Commission's Clean Air Policy Package, which includes A Clean Air Programme for Europe and which sets out new interim objectives for reducing health and environmental impacts up to 2030. It also defines the necessary emission reduction requirements for the key pollutants and the policy agenda that will be necessary to achieve the objectives.

European Strategy for Low Emission Mobility

In July 2016, the EU published a new *European Strategy for Low Emission Mobility,* which identifies the key levers that are required, according to the Commission, to tilt the transport sector in the right direction in terms of:

- fuel efficiency
- low emission alternative energy
- greater use of low and zero emission vehicles[5]

The strategy reaffirms the 2011 White Paper's ambition that 'by mid-century, greenhouse gas emissions from transport will need to be at least 60% lower than in 1990 and be firmly on the path towards zero.' It also states that 'emissions from air pollutants from transport that harm our health need to be drastically reduced without delay.'

EU Emissions Policy and COP 21

A key distinction in EU policy is between emissions covered by the EU's Emissions Trading Scheme (ETS) and other emissions (non-ETS emissions). The ETS covers the large energy users, including electricity, commercial airlines, cement, and large food, drink and pharmaceutical plants. The target reduction in emissions for the ETS sector (to be achieved by participating companies) is 21% by 2020.

All other sectors comprise the non-ETS sectors. These include transport, households, industry (excluding energy-intensive industry), agriculture, and private and public services. In the non-ETS sector (where it is the responsibility of member states to achieve the reduction in emissions), the total EU target is a reduction of 10% by 2020, compared to 2005.

[5] A European Strategy for Low Emission Mobility
http://ec.europa.eu/transport/themes/strategies/news/doc/2016-07-20 decarbonisation/com(2016)501_en.pdf

This 10% EU target was allocated across member states through the Effort Sharing Decision, which gave Ireland a target to achieve a 20% reduction in non-ETS emissions by 2020 relative to 2005 (joint highest target reduction among member states with Denmark and Luxembourg). There are also interim annual targets to be achieved over the 2013 to 2020 period.

The 2020 targets are helping to lay the foundations for a large scale transition towards achieving long term climate goals, reflecting the collective ambition that was agreed by 195 nations in Paris in 2016. Recognised as a seminal event in global climate action, the outcome of the United Nations Framework Convention on Climate Change's (UNFCCC) 21st Conference of the Parties (COP 21) was the agreement on a long term temperature goal to limit the temperature rise to well below 2°C above pre-industrial levels, with an ambition to pursue efforts to limit the increase to 1.5°C. This objective will be undertaken on behalf of all European Member States through a climate action plan known as the EU's Nationally Determined Contribution (NDC). The aim of the plan is to reduce overall EU greenhouse gas (GHG) emissions by 40% by 2030 (compared to 1990), based on reductions in the emissions trading system (ETS) sector of 43% and the non-ETS sector of 30%.

Ireland, which ratified the Agreement in November 2016, will contribute to these objectives via the EU's NDC. The specific details of Ireland's contribution to the overall EU 30% reduction in the non-ETS sector, as well as the contributions to be made by other Member States, is currently being negotiated between the EU and its Member States in the context of the European Commission's Effort Sharing Regulation (ESR) Proposal which was published on the 20 July 2016.

Smarter Travel – A New Transport Policy for Ireland 2009–2020

At a national policy level, *Smarter Travel – A New Transport Policy for Ireland 2009–2020* [6] was developed to achieve a number of overarching goals, but addressing Ireland's reliance on fossil fuels, especially through modal shift, was pivotal to the development of this policy. Transport emissions in Ireland had been on a continuous upward trajectory since 1990, peaking to record levels in 2007 just prior to the publication of the policy in 2009.

Between 1990 and 2014, transport emissions in Ireland increased by 121% and the transport share of overall greenhouse gas (GHG) emissions increased from 9.1% to 19.5%. During this period, there was a significant increase in both economic output and car ownership levels – from around 800,000 cars in 1990 to 1.95 million in 2014 (+144%). These trends are reflected in Figure 1.

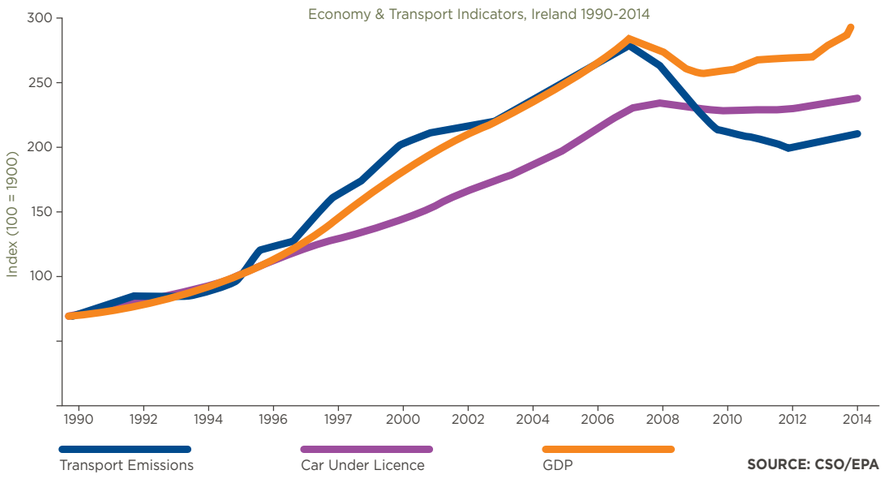


Figure 1 *Economy and transport indictors in Ireland 1990–2014 (CSO/EPA)*

[6] Smarter Travel – A Sustainable Transport Future; A New Transport Policy for Ireland 2009–2020

Transport sector CO_2 emissions in 2015 stood at 11.6 Mt, down 17.9% from a peak of 14.1 Mt in 2007. Despite transport emissions falling 24.8% over the period 2007–2012, private car emissions remained relatively constant, which shows the relative inelasticity of transport demand. The decrease following 2007 can be attributed to the economic downturn, improving vehicle standards and the increased use of biofuels. However, demand for transport is experiencing renewed growth and there has been a steady increase in emissions since 2013.

It is estimated that in 2015 the private car accounted for 52% of transport CO_2 emissions in Ireland. The remaining emissions arose from road freight (24%), fuel tourism (12%), public passengers (4%), domestic aviation and navigation (2%) and rail (1%).

Estimated 2015 transport emissions by sector	Kilotonnes CO_2	% share
Private car	6,044	52.2
Heavy duty vehicle (HDV) road freight	1,849	16.0
Light goods vehicle (LGV) road freight	887	7.7
Fuel tourism	1,397	12.1
Public passenger	403	3.5
Rail	129	1.1
Domestic aviation	10	0.1
Navigation	219	1.9
Unspecified	631	5.5
Total	**11,570**	**100**

Table 1 *Transport CO_2 emissions by mode 2015 (SEAI 2016)*

Transport demand is essentially a derived demand and, as outlined above, is largely dependent on the level of activity within an economy. Population growth, labour force participation rates, settlement patterns and increased affordability of transport all serve to increase demand. Settlement patterns, influenced largely by urban and spatial planning, play a key role in influencing how people travel – both distances and mode choice. In a European context, Ireland has a particular challenge as we are an island nation with a dispersed population and limited numbers of high density urban settlements suitable for the provision of effective public transport systems. Eurostat data indicates Ireland has the highest percentage population living in rural areas of all EU Member States. Key to decarbonising transport will be provision for complementary land use planning that will facilitate the principles of smarter travel and provide access to sustainable, low carbon transport options.

National Policy Position on Climate Action and Low Carbon Development

Within the national context, the extent of the challenge associated with reducing greenhouse gas emissions is reflected in the publication of Ireland's *National Policy Position on Climate Action and Low Carbon Development* in April 2014. This policy commits the non-ETS in Ireland to collectively reduce carbon emissions by 80% by 2050. Transport, as the second largest emitter in the non-ETS, will have a significant role to play in meeting this policy objective.

White Paper on Energy Policy

The goal to decarbonise is also reflected in the *White Paper on Energy Policy*, which was published by the former Department of Communications, Energy and Natural Resources in 2015. The paper commits to transitioning to a low carbon energy future and sets out a framework to guide policy and the actions the Irish Government intends to take in the energy sector from now up to 2030. While reflecting on the roles of renewable energy and improved energy efficiency in reducing emissions, the paper also reinforces the need for greater energy security through the diversification of our energy supplies.

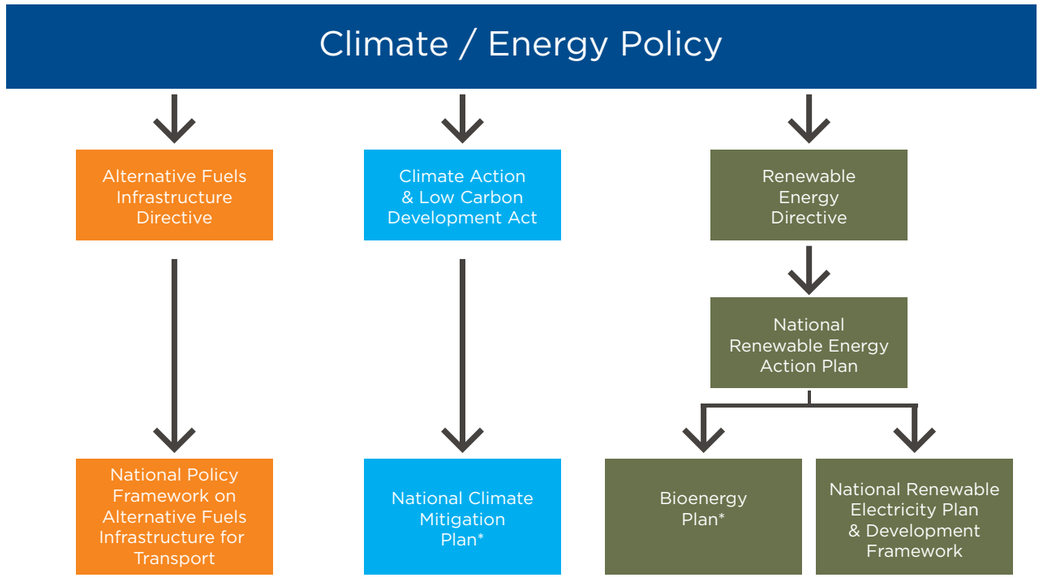
Alternative energy and fuels have many co-benefits, not least for air quality and health. In recent years, policy changes to reduce carbon in transport have contributed to an unintended consequence of increasing the uptake of diesel cars. In 2015, diesel cars outsold petrol at a rate of more than 2.5 to 1. The resulting increase in the number of diesel vehicles, particularly in cities, is giving rise to concerns about the health implications of higher NOx (nitric oxide and nitrogen dioxide), sulphur oxide (SOx) and particulate matter (PM) emissions associated with these vehicles.

National Clean Air Strategy

In order to comply with new and emerging EU legislation on clean air (as referred to above), as well as helping to tackle climate change, the Department of Communications, Climate Action and Environment (DCCAE) is in the process of establishing a *National Clean Air Strategy*. The strategy will consider a wide range of national policies that are relevant to clean air policy, including transport policy.

Key Plans, Policies and Legislation

The following represents an overview of this Framework's position within the overall hierarchy of national climate and energy plans and policies that are of relevance to this Framework.

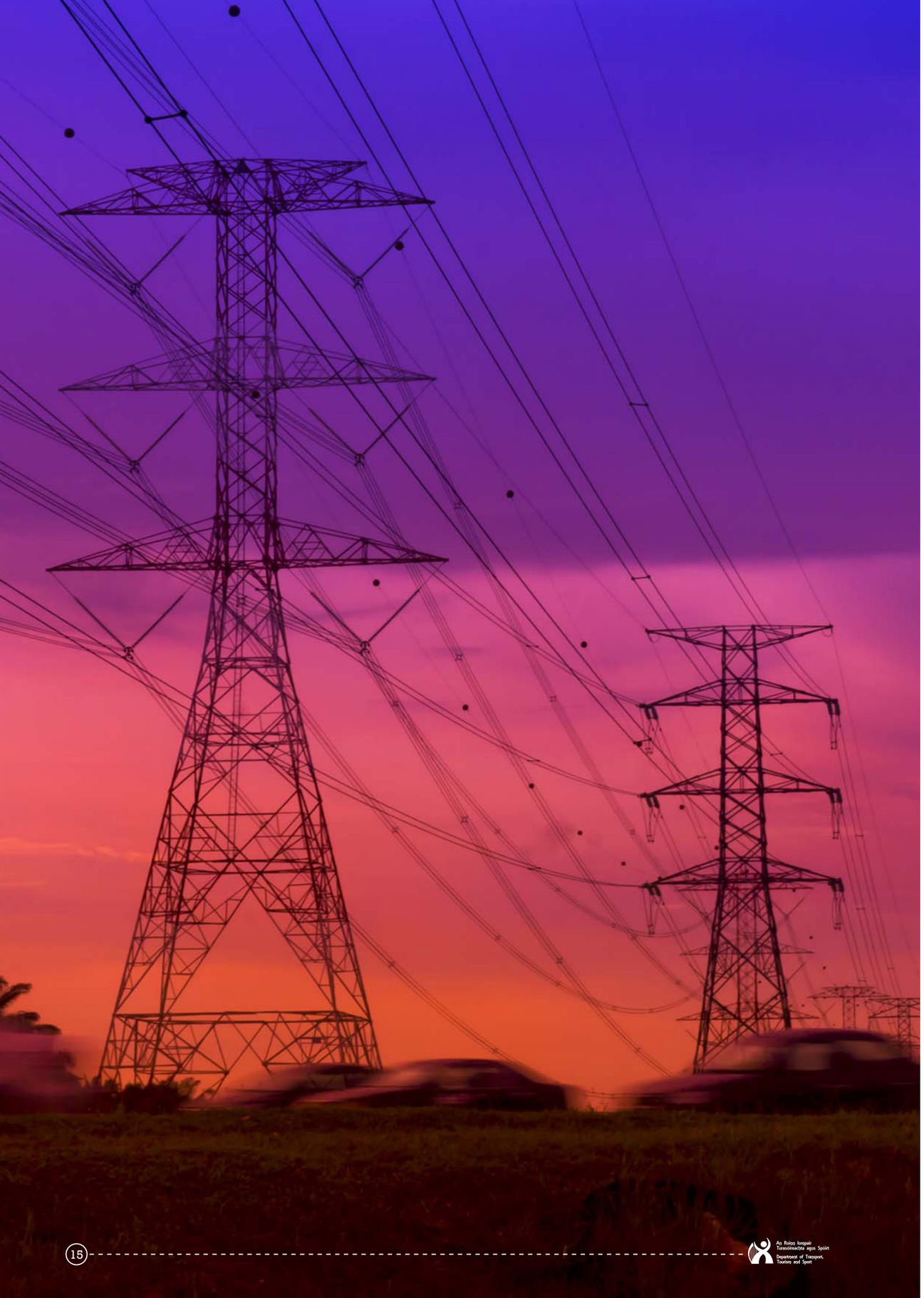


* Plan is currently in development

Figure 2 *Key climate and energy plans and policies*

Policy on climate and energy, which support the development and use of alternative and renewable fuels in transport, will not, in any way, undermine national transport policy goals to promote and facilitate walking and cycling and to reduce dependency on the private car in favour of smarter travel modes, particularly public transport. Such goals are clearly provided for in the Smarter Travel policy, the Strategic Investment Framework for Land Transport [8] and the Transport Strategy for the Greater Dublin Area 2016-2035.[9]

[8] www.dttas.ie/sites/default/files/content/corporate/english/general/sfilt-investing-our-transport-future/investing-our-transport-future.pdf
[9] www.nationaltransport.ie/planning-policy/greater-dublin-areatransport-strategy-2016-2035/



Section 4

Strategic Environmental Assessment and Appropriate Assessment

In accordance with European and national legislation, the Department of Transport, Tourism and Sport (DTTAS) carried out a Strategic Environmental Assessment under the SEA Directive (2001/42/EC) and an Appropriate Assessment under the Habitats Directive (92/42/EEC), which informed the preparation of this Framework.

4.1 Strategic Environmental Assessment (SEA)

SEA is the process by which environmental considerations are integrated into the preparation of plans and programmes.

The European Communities Environmental Assessment of Certain Plans and Programmes Regulations (S.I. 435 of 2004 as amended by S.I. 200 of 2011) stipulate that SEA is mandatory for certain plans/programmes which are prepared in a number of specified areas, including agriculture, energy and transport, and which set the framework for future development consent of projects listed in Annexes I and II to Environmental Impact Assessment Directive 85/337/EEC, or where it has been determined under the Habitats Directive that an assessment is required. A pre-screening check, which was carried out by the DTTAS, determined that the Framework would be considered a plan/programme under the administrative provisions criteria stipulated in Article 9(1) of the aforementioned regulations. Accordingly, SEA as required under the 2004 Regulations (as amended) was carried out as part of the preparation of this Framework.

The results of the SEA process have been fully incorporated into the preparation and making of this Framework. The resulting environmental report has been published as a separate document in conjunction with this Framework.

4.2 Appropriate Assessment (AA)

The EU Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, better known as the Habitats Directive, provides legal protection for habitats and species of European importance, through the establishment and conservation of an EU-wide network of sites known as the Natura 2000 Network. These are Special Areas of Conservation (SAC) designated under the Habitats Directive, and Special Protection Areas (SPAs) designated under the Conservation of Wild Birds Directive (Directive 79/409/EEC as codified by Directive 2009/147/EC), collectively referred to as 'European Sites'. Article 6(3) establishes the requirement for an AA of plans and projects likely to affect European Sites.

Pursuant to Regulation 27 of the European Communities (Birds and Natural Habitats) Regulations S.I. 477 of 2011, all public authorities

> *having or exercising functions, including consent functions, which may or have implications for or effects on nature conservation shall exercise those functions in compliance with and, as appropriate, so as to secure compliance with, the requirements of the Habitats Directive* [10] *and the Birds Directive and these Regulations.*

[10] http://ec.europa.eu/environment/nature/legislation/birdsdirective/index_en.htm

And, among other things,

> *shall take the appropriate steps to avoid in European Sites the deterioration of natural habitats and the habitats of species as well as the disturbance of the species for which the areas have been designated in so far as such disturbance could be significant in relation to the objectives of the Habitats Directive.* [11]

The EU Habitats Directive places strict legal obligations on member states to ensure the protection, conservation and management of the habitats and species of conservation interest in all European Sites. In particular Article 6 of the Directive obliges member states to undertake an 'appropriate assessment' for any plan or project which may have a likely significant effect on any European Site. The outcomes of such AAs fundamentally affect the decisions that may lawfully be made by competent national authorities (including planning authorities and An Bord Pleanála) in relation to the approval of plans or projects.

Plans and projects must be screened for AA and full AA must be carried out unless it can be established through screening that the plan or project in question will not have a likely significant effect on any European Site. Furthermore, unless an AA concludes definitively that a plan or project will not adversely affect the integrity of a European Site(s), approval for the plan or project cannot lawfully be given, other than in the exceptional circumstances provided for in Article 6(4) of the Habitats Directive.

The DTTAS concluded, on completion of the AA screening, that the potential for likely significant effects on European Sites could not be ruled out and the Framework should undergo AA. The AA process has been carried out in parallel with the SEA process and a Natura Impact Statement (NIS) has been published as a separate document in conjunction with this Framework.

Although the requirement for AA is a statutory requirement, it is important to highlight at an early stage that any plans or projects arising from the implementation of the Framework, for example alternative fuel infrastructure development, will be subject to the requirements of the EU Habitats Directive as outlined previously. In order to acknowledge and reinforce the importance of the requirement for AA, the following overarching protective policy measure in relation to AA forms an integral part of this Framework:

> *Ensure that all projects and associated works arising from the Framework are subject to screening for AA and/or full AA, whichever is deemed necessary, to ensure there are no likely significant effects on European Sites and/or no adverse effects to European Site integrity. The requirements of Article 6(3) and, where necessary, Article 6(4) of the EU Habitats Directive must be fully satisfied.*

The DTTAS has anticipated that the statutory requirement for AA may not necessarily be applicable to some aspects of this Framework: namely those aspects that are not subject to a formal consent process. For example, as alternative fuels and infrastructure are in their infancy, feasibility studies will be central to informing future decision-making in relation to the roll-out of alternative fuels infrastructure. With cognisance of the importance of ensuring that protection of the Natura 2000 Network is at the forefront of any future decision-making, the DTTAS acknowledges the fundamental need for consideration of the potential effects on the Natura 2000 Network at the earliest possible stage outside of the statutory process. Therefore the following overarching protective policy measure has been integrated into this Framework:

> *All investigative and feasibility studies to be carried out in relation to alternative fuels and alternative fuels infrastructure must consider potential effects to the Natura 2000 Network.*

[11] http://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

4.3 Integration with Framework

The SEA and AA processes were developed in tandem with Framework, with the corresponding project teams working together to identify potential environmental issues at the earliest possible stage in the plan-making process. The SEA/AA teams were involved in both DTTAS and stakeholder meetings on the development of the Framework in addition to discussions on potential alternatives for the Framework. Likely significant impacts, both positive and negative, were identified and mitigation measures to prevent such impacts have been included in the AA. Following public consultation, updates to the Framework were screened by the SEA/AA team and amendments were made to the Framework as required.

Mitigation measures largely pertained to adopting policies relating to the protection of European sites; the inclusion of and adherence to 'siting criteria' in the Framework; and the development of Key Performance Indicators (KPI's) for monitoring purposes. Further measures included the condition that DTTAS must develop a responsibility matrix and that the Steering Group must periodically review the capacity and availability of infrastructure to support the uptake of alternative fuels. In addition, a commitment has been given to liaise with DCCAE on the roll-out and implementation of the Renewable Electricity Plan and the Steering Group must monitor current research and development of emerging technologies.

Section 5

Assessment of the Current Usage of Alternative Fuels in the Transport Sector in Ireland

5.1 Percentage of use of different fuels in transport (2015)

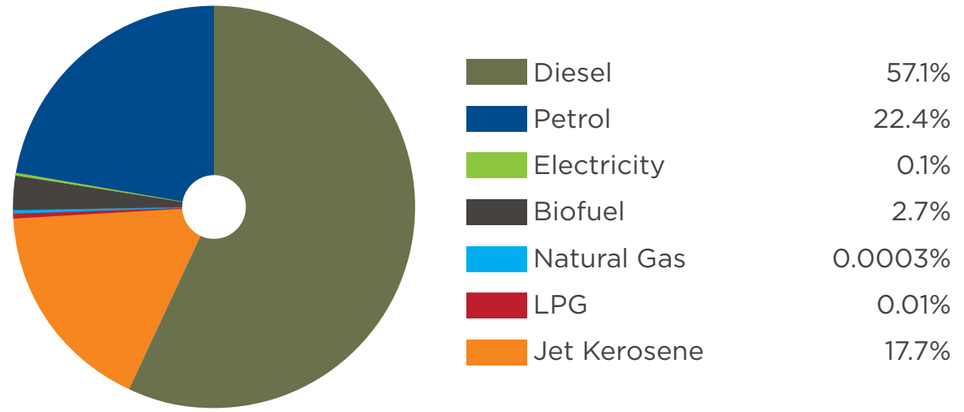


Figure 3 *Percentage of use of different fuels in transport in Ireland 2015 (SEAI)* [12]

As can be seen from Figure 3, diesel has the largest share of fuels used in transport, accounting for more than half of fuel use in the sector in Ireland in 2015. The use of electricity and gas remains negligible. Despite the predominance of diesel across the transport spectrum, petrol remains the most common fuel type in the car stock. However, latest trends suggest that diesel vehicles will surpass their petrol counterparts in the very near future.

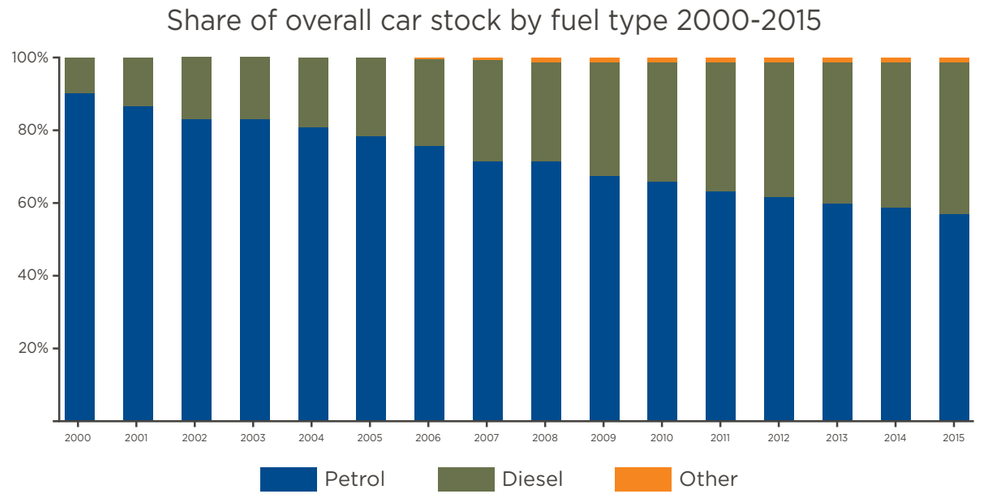


Figure 4 *Share of overall car stock by fuel type 2000–2015*

[12] www.seai.ie/Publications/Statistics_Publications/Energy_Balance/

The increasing share of diesel in transport warrants particular attention. As referred to in Section 3 of this Framework, policy changes to reduce carbon in transport had the unintended consequence of increasing the uptake of diesel cars.

In 2008, VRT and motor tax changes were introduced to support the most energy efficient vehicles entering the fleet. Vehicles were initially categorised in seven graduating bands, A–G, based on CO_2 emission levels. From January 2013, a revised banding structure was introduced for both motor tax and VRT, splitting the lowest CO_2 Band A (1–120 g/km) into four and Band B (121–140 g/km) into two.

In 2009, the first full year of the new emissions based system of charging for motor tax, 12% of new vehicles purchased were in the lowest emitting A band, with 45% in the B band. In 2015, 72% of new purchases were in the A bands and 24% in the B bands.

The average specific emissions from new passenger cars purchased in Ireland in 2015 were 114.9 g CO_2/km, well ahead of the target of 130 g CO_2/km set by the EU Decision (443/2009) for 2015.[13] It is clear that the policy has been very effective in influencing the purchasing decisions of motorists in favour of more fuel-efficient vehicles but it has undoubtedly contributed to a significant transition to diesel-fuelled cars (Figure 3) in Ireland. This trend is replicated across Europe.

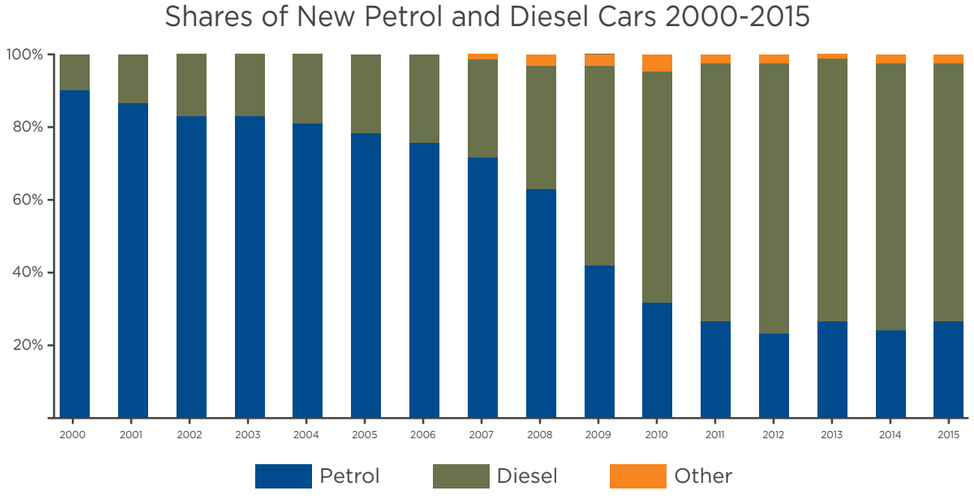


Figure 5 *Shares of new petrol and diesel cars 2000–2015*

[12] www.seai.ie/Publications/Statistics_Publications/Energy_in_Ireland/Energy_in_Ireland_Key_Statistics/Energy-in-Ireland-Key-Statistics-2015.pdf

Alternative Fuel Vehicles	Number Of Vehicles 2015
Electric Passenger Cars (Bevs)	1607 [14]
Electric Passenger Cars (Phevs)	413
Electric Light Duty Vehicles	152
Electric Heavy Duty Vehicles	4
Electric Diesel Hybrid Buses [15]	1
Full Electric Buses	0
Electric Motorcycles and E-Bikes [16]	171
Cng Cars	0
Cng Light Duty Vehicles	5
Cng Heavy Duty Vehicles	2
Cng Articulated Tractor Units	3
Cng Buses	0
Lng Light Duty Vehicles	0
Lng Heavy Duty Vehicles	0
Lng Buses	0
Lpg Vehicles	3000
Hydrogen Cars	0
Hydrogen Light Duty Vehicles	0
Hydrogen Heavy Duty Vehicles	0
Hydrogen Buses	0

Table 2 *Number of AFVs in 2015*

[14] Source: Central Statistics Office (CSO) and the Society of the Irish Motor Industry's (SIMI) website www.beepbeep.ie
[15] This data refers to a hybrid bus trialled by Dublin Bus. Trial concluded in April 2015. No hybrids now in operation.
[16] 171 electric motorcycles were registered between 2007 and 2015 (Source: CSO).

5.3 Electricity

	Recharging Points 2015
Normal power recharging points (public) 22 kW	628
Normal power recharging points (public) single phase 7 kW	26
High power recharging stations (public) 43–50 kW, many with multiple plugs	71 stations – 110 sockets
Normal power recharging points 3.3 kW (public)	107
Normal power recharging points (private) 3.3 kW	1900
High power recharging points (private)	0
Shore-side electricity supply in maritime and inland ports (terminals)	0
Electricity supply for stationary airplanes	1 [17]

Table 3 *Electric charging points 2015 (ESB, DAA)*

Electric Vehicles (EVs)

The adoption of EVs has been identified as a key strategy in achieving energy efficiency, renewable energy and climate mitigation targets.[18]

The Renewable Energy Directive (2009/28/EC), which forms part of the EU Climate and Energy Package, sets Ireland a binding 10% target for renewable energy in transport by 2020 (RES-T). In order to meet this target, Ireland is implementing a two-pronged approach which combines increases in the use of biofuels with the uptake of EVs.
It is widely recognised that EVs can make a positive contribution across a number of policy goals and can:

- help towards achieving EU 20-20-20[19] targets
- help reduce other emissions and air pollution
- help improve our Balance of Payments by displacing expensive oil imports
- help with the integration of variable renewable energy sources such as wind energy (by in effect acting as storage devices for electricity generated at off-peak times)
- integrate with smart grids
- provide enterprise opportunities for Ireland-based businesses.

Ireland has a number of characteristics which make it a suitable country for the deployment of EVs. As a small island nation, the greatest distance between any of our cities is 265 km (Dublin to Cork). This, combined with a mild climate, makes Ireland eminently suitable for EVs from the perspective of battery performance. Ireland also has a single electricity network company (Electricity Supply Board Networks), which helps to support the development of uniform standards for charging infrastructure. A number of high tech companies located in Ireland, such as IBM, have also helped to develop innovative supporting technologies for EVs. From a policy perspective, Ireland is seeking to achieve high levels of renewable electricity (particularly wind) with a 40% renewable electricity target by 2020.

Battery technology is continuing to improve and the driving range for most full-battery EVs

[17] One high power recharge point at the maintenance base in Dublin Airport. Does not include figures for fixed electrical ground power (FEGP) units.
[18] National Energy Efficiency Action Plan 2014, Department of Communications, Energy and Natural Resources
[19] 20% reduction in EU greenhouse gas emissions from 1990 levels; increasing renewable energy in EU to 20%; 20% improvement in the EU's energy efficiency by 2020.

(depending on the model) is currently between 160 km and 500 km. This level of range is more than sufficient for the majority of journeys taken daily in Ireland. The range for plug-in hybrid electric vehicles (PHEVs) is somewhat lower when running on battery only, but these cars can switch over to a standard engine when the battery is depleted.

How many EVs are Sold in Ireland?

In 2016, the total number of new passenger vehicles registered in Ireland was 146,672, of which 392 were battery electric vehicles (BEVs) and 286 were plug-in hybrid electric vehicles (PHEVs).[20]

By the end of 2016, the total number of EVs (BEVs and PHEVs) circulating in Ireland was in the region of 2,700.

In relation to the vehicles on offer, Table 4 shows the manufacturers that provide EVs for sale in Ireland.

Make	BEV	PHEV	Commercial EV	Models
Nissan	1	0	1	Leaf, eNV-200
Renault	1	0	1	Zoe, Kangoo
Tesla	1	0	0	Model S
Mitsubishi	0	1	0	Outlander
Volkswagen	1	2	0	e-Golf, Golf PHEV Passat Saloon
Mercedes	0	1	0	S Class
Volvo	0	2	0	V60 (Diesel); XC90
Porsche	0	2	0	Cayenne, Panamera
Audi	0	2	0	A3 e-tron; Q7 e-tron (diesel)
Citroen	1	0	0	C Zero
BMW	1	5	0	i3, i3 PHEV, i8, X5, 3 Series, 2 Series
Total	**6**	**15**	**2**	

Table 4 *Electric vehicles by manufacturer for sale in Ireland in 2016*

It is also expected that other vehicle manufacturers will begin to provide EVs into the Irish market in 2017, such as Hyundai.

Is there Infrastructure for EVs in Ireland?

To date, EV infrastructure in Ireland has been installed by ecars, which is a commercial business operated by the Electricity Supply Board (ESB). In 2014, the Commission for Energy Regulation (CER) approved funding[21] for ESB Networks to carry out an R&D pilot trial on the effects of EVs on the distribution system. On 14 October 2016, the CER launched a public consultation on the future ownership of the charging infrastructure installed by ESB for this pilot. A decision is awaited.

In 2013, an EU-funded cross border project was launched to help expand the interoperable EV fast-charge network in the Republic of Ireland and Northern Ireland. The €4.2 million project was a joint initiative between the ESB and the Department for Regional Development Northern Ireland (DRD NI). It was co-funded under the EU Trans-European Transport Network (TEN-T) programme

[20] Source: The official statistics of the Irish motor industry, www.beepbeep.ie
[21] CER/14/057 Decision on ESB Networks Electric Vehicle Pilot

Figure 6 *EV Fast Charge Point*

and was a Europe-wide test bed project. The investment involved the roll-out of 46 new fast (rapid) charge points across Ireland and the development of supporting IT systems. Fast-charge points were installed at service stations and other prime locations along key interurban routes on the E01 linking Belfast, Banbridge, Dublin, Wexford and Rosslare. Fast-charge points were also installed at Cork, Galway, Limerick and Derry. Additionally, seven standard publicly accessible charge points at Irish Rail's Heuston Station, Kent Station Cork, Athlone, Newbridge, Kilkenny, Waterford and Dundalk Stations were installed. The fast chargers typically enable up to an 80% recharge in as little as 20 minutes and are available approximately every 60 km on Ireland's main intercity routes, including the TEN-T core network.

In total, there are almost 900 publicly accessible charge points available in Ireland, which for a country of its size puts it among the more comprehensive charge point networks currently in place across Europe.

Large car manufacturers are also expected to become involved in the provision of high-powered infrastructure. A number of providers are likely to emerge onto the Irish market in the coming years, providing infrastructure at the higher end of the performance capacity scale, i.e. between 120 kW and 350 kW. These chargers will support quicker charge times and longer travelling ranges depending on the model of car, i.e. more cars will be capable of travelling up to 500 km on one charge.

In October 2016, Tesla announced its plans to open a store in Ireland in 2017 along with the development of supercharging stations at three locations in Ireland, most likely Dublin, Cork and Galway. Another station is planned for Belfast. One 30 minute charge at these stations is estimated to provide Tesla cars with a range of more than 270km. On a full charge, Tesla's Model X has a range of more than 542km. [22]

Electric Rail

In relation to rail in Ireland, it is important to highlight the distinction between heavy rail and light rail in terms of electrification. The heavy rail system is operated by Iarnród Éireann and the light rail system is operated by Transport Infrastructure Ireland.

The light rail system (known as the Luas), which operates using an overhead electrical power supply, is based in Dublin and consists of two main lines; the Green Line and the Red Line, both of which began operations in 2004. A new cross city Luas link is expected to open in 2017 and

[22] ww.tesla.com/en_EU/modelx

the Government's Capital Plan 2016 to 2021 provides for the planning, design and construction of significant elements of the new Metro North, which will be an electric light rail line linking Dublin City Centre to Swords via Dublin Airport.

The DART rail system, however, forms part of the heavy rail system and is, for the most part, electrified within the city area of Dublin. The Capital Plan also provides for the commencement of work on the electrification of the northern line to Balbriggan as part of the DART expansion programme, which forms part of the National Transport Authority's (NTA) Transport Strategy for the *Greater Dublin Area* (GDA) 2016-2035 recommendations to increase the capacity of the Northern Rail line through, inter alia, the electrification of the rail line from Malahide to Drogheda. The investment plan also provides for work on the redesign of the DART underground tunnel.

The role of heavy rail, which is operated by Iarnród Éireann (IÉ), in Ireland's transport sector is currently under review. The National Transport Authority (NTA) is currently running a public consultation on rail in Ireland. It was launched in mid-November with the publication of the Rail Review 2016. The purpose of the consultation exercise is to open up a public discussion on the role of rail in Ireland and the funding of the rail network and services. The public consultation process concluded on 18 January 2017 and the NTA are preparing a report for Government based on the findings. Any plans to further electrify the rail network will be informed by the outcome of this report.

Shore-side Electricity

What is shore-side electricity (SSE)?

Shore power or shore-supply is the provision of shore-side electrical power to a ship at berth while its main and auxiliary engines are shut down. If commercial ships could use shore-supplied power for services such as cargo handling, pumping, ventilation and lighting while in port, they would not need to run their own diesel engines, thereby reducing air pollution emissions. While SSE has been successfully adopted in key port areas around the world, a number of barriers such as differing operational standards, electricity transmission issues and outdated port and ship facilities still need to be overcome before the practice is fully mainstreamed globally. [23]

Are there any SSE supply facilities in Irish ports?

There are no shore-side electricity supply facilities at any ports in Ireland, including the three TEN-T core network ports (Port of Cork, Dublin Port and Shannon Foynes) and, as yet, there is no demand from the shipping lines.

Electricity Supply for Stationary Airplanes

What do we mean by electricity supply for stationary airplanes?

This relates to the use of electricity by aircraft while their generators or the auxiliary power units (APUs) are not running. This supply can be utilised during passenger embarking and disembarking when the cabin lighting is required. The electricity can also be used to start the APU, which in turn provides electricity to start the aircraft's engines and generators.

Do Irish airports deploy electricity supply units for stationary airplanes?

Only Dublin Airport, which is Ireland's largest airport, deploys the use of electricity supply units. At Dublin Airport, 27 fixed electrical ground power (FEGP) units have been installed on Pier 4 with 2 new units recently installed on Pier 3 in late 2016. Aircraft that utilise these units do not, in general, use diesel ground units. This is beneficial in terms of lower local emissions, less noise and fewer ground vehicles in the area. In 2015, 1,264,153 kWh of electricity was used by the FEGP units.

[23] Shore-side power: a key role to play in greener shipping
www.ship-technology.com/features/featureshore-side-power-a-key-role-to-play-in-greener-shipping-4750332/

5.4 Natural Gas (CNG and LNG)

Both compressed natural gas (CNG) and liquefied natural gas (LNG) offer an economic and environmentally friendly alternative to oil but these forms of natural gas tend to meet different market needs in the transport sector. CNG is mostly used over short to medium distances (as the fuel is bulkier in gaseous form) while longer distances are better served by LNG.

In Ireland, making a transition to gas would be beneficial for a number of reasons:

- Natural gas vehicles (NGVs) produce up to 20% lower carbon emissions per unit of energy produced than diesel in terms of kilometres travelled.
- Natural gas could provide greater long-term competitiveness in the freight sector. The use of domestically sourced lower price natural gas would be more economically sustainable.
- The price of gas continues to be cheaper than diesel or petrol for similar energy outputs, providing considerable scope for reducing fuel costs and improving transport cost efficiency.
- There is considerable health benefits associated with the use of gas as a propellant through improved air quality and significantly reduced local pollutants (NOx, SOx and PMs) in cities.
- There would be considerable energy security benefits through the use of indigenous gas supplies, particularly biogases.
- The use of natural gas in transport could lead to greater use of the gas network, which could impact positively on gas network charges.

What is CNG?

CNG is natural gas compressed to less than 1% of the volume it occupies at standard atmospheric pressure.

Is CNG already used in transport?

CNG is an established source of transport fuel and is particularly suited to larger vehicles such as trucks and buses. On a global basis, there are approximately 18 million NGVs being served by over 22,000 CNG stations. This trend is replicated in Europe where more than 1.1 million vehicles are served by approximately 3200 CNG stations.

Is CNG in use in Ireland?

In Ireland, CNG in transport is still in demonstration phase. Gas Networks Ireland (GNI) operates one station on their premises in Cork with another temporary station operating in Dublin.

Figure 7 *Gas Networks Ireland fast-fill station, Gasworks Road, Cork*

GNI established an innovation fund to support, promote and accommodate innovation in the gas industry with a key focus on increased utilisation of the network through innovative applications for natural gas, for example in transport. The fund is approved by the CER, under the Price Control 3 Decision (CER\12\196) and has been used to support a wide range of innovation projects from demonstration CNG refuelling projects and renewable natural gas injection projects to research projects on the utilisation of natural gas and renewable natural gas generation from marine and agricultural feedstocks. GNI has been supported in its activities by an advisory group called the Gas Innovation Group, which consists of members from government agencies and departments, research institutes and academia. The Gas Innovation Group reviews projects and advises GNI, providing a wider policy, industry and market view.

GNI is also undertaking a number of trials to demonstrate the suitability of CNG. The trials are being carried out with companies from the target commercial operator market, including the dairy sector, public transport and haulage companies. To support such trialling, GNI installed temporary slow-fill refuelling stations for the purpose of testing the operational performances of CNG.

In addition to the above, GNI has identified a need for quick refuelling of vehicles to service modern day fleets. Currently, there are some privately operated fast-fill stations in Cork and Dublin, which are facilitating trials by allowing access to third parties. However, GNI is also in the process of facilitating the development of additional stations to be strategically established throughout Ireland, with the view to having a baseline network in place by the end of 2017. These will include refuelling points on the M50 motorway, the M7 (Topaz station) motorway and in Shannon, Co Clare.

Natural Gas	Refuelling Stations 2015
CNG refuelling stations (public)	0
CNG refuelling stations (private)	2
LNG refuelling stations for heavy duty vehicles (public)	0
LNG refuelling stations for heavy duty vehicles (private)	0
LNG refuelling points at sea ports	0
LNG refuelling points at inland ports	0

Table 5 *Number of refuelling points 2015*

In 2016, GNI were successful in a bid for funding under the Connecting Europe Facility (CEF) to support a project called The Causeway Study: Impact of CNG on the Irish Gas Network. The study seeks to

- install a pilot network of CNG stations along the TEN-T core network;
- examine the impacts of increased levels of CNG fast-fill units on the gas network;
- focus on the commercial transport market, particularly medium to large goods and public transport vehicles;
- provide supports for CNG vehicles; and
- deploy a biogas injection facility.

In order to advance this project, GNI submitted a funding proposal to the CER for consideration. The proposal outlined GNI's intention to undertake the study, which will include the deployment of 13 CNG refuelling stations in the Republic of Ireland. GNI has secured funding of almost €6m

under the CEF but this funding was conditional on GNI securing an additional amount of almost €13m to complete the study. In November 2016, the CER deemed it appropriate (Decision: CER/16/313) for GNI to be provided with innovation funding of €12.83m as part of Price Control 4 (PC4) and for such funding to be recovered through network tariffs. Over the last three years, GNI has conducted trials with customers with a total fleet size of 4500 vehicles. This experience has assisted in developing a data set of real world CNG application in Ireland. This work is continuing. GNI plans to install and operate fast-fill CNG stations for captive fleets as well as public refuelling stations. New stations are to be installed at Little Island in Cork and at the Topaz service station in Dublin Port, which will serve as an excellent example of the potential role for CNG and will reinforce the benefits of CNG vehicles for use within a public forecourt. Both proposed stations will be capable of refuelling 75 trucks and 38 vans per day.

How can biomethane be used with CNG?

By providing a market for natural gas in transport, an additional pathway is created for migrating Ireland's transport market to renewable energy. Introducing biogas into the national gas grid would provide a renewable source of energy to the transport sector (where a market has been created for natural gas vehicles) and would help to achieve Ireland's RES-T target.

Biogas is a mixture of methane and carbon dioxide and is considered a renewable energy source that is produced during anaerobic digestion of biomass or other organic substrates, such as manure, sewage sludge, organic fractions of household and industry waste, as well as energy crops. Energy generated from biogas is deemed CO_2 neutral, since the CO_2 released by combusting biogas fuel was previously removed from the atmosphere during the generation of biomass through photosynthesis.

Biogas can either be upgraded to biomethane and injected directly into the natural gas grid to substitute natural gas or can be compressed and fuelled via a pumping station at the place of production. Injected biomethane can be used at any ratio with natural gas as a vehicle fuel.[24] Power to Gas (P2G) can also be used to produce synthetic methane, which is a direct substitution for biomethane, and to increase biogas yields.

While biomethane is not currently in use in the transport sector, Ireland has the indigenous resources available to establish a significant renewable gas industry and the potential to use such gas as a vehicle fuel. GNI intends to have the first renewable natural gas injection point complete and operational before the end of 2018, based on P2G technology, thus making it possible for any dedicated CNG vehicle to be carbon neutral and powered by an indigenous, renewable fuel.

An assessment of the costs and benefits of biogas and biomethane is currently being undertaken by the Sustainable Energy Authority of Ireland (SEAI) on behalf of the Department of Communications, Climate Action and Environment. The 2014 Draft Bioenergy Plan first recommended this assessment, which was echoed in the commitments of the 2015 Energy White Paper, *Ireland's Transition to a Low Carbon Energy Future.* This study aims to assess the cost of producing biomethane from various feedstocks and to also assess the optimum energy use pathways for biomethane in heat, electricity and transport. Based on this analysis, and in consultation with relevant stakeholders, appropriate policy options will be developed. These could include, for example, the introduction of a tariff to support the injection of biomethane into the national gas grid, and demonstration projects for the use of biomethane with CNG in the public transport and the freight sector.

What is liquefied natural gas (LNG)?

LNG is natural gas that has been converted to liquid form for ease of storage or transport and takes up about 1/600th of the volume of natural gas in its gaseous state.

[24] European Biogas Association http://european-biogas.eu/wp-content/uploads/files/2013/10/EBA-brochure-2011.pdf

Is LNG in use in Ireland?

Currently, there are no LNG terminals in Ireland and very few commercial organisations have the capability to self-fund a major LNG project. Current market costs for a small liquefaction plant are in excess of approximately €15 to €20 million. One company in Ireland, Shannon LNG, has received planning permission to build an LNG terminal near Ballylongford in Co Kerry and the associated transmission pipeline, which would deliver the gas into the GNI transmission system.

In the absence of a LNG terminal, the alternative is to supply LNG to Ireland by truck or shuttle carrier from a full-scale terminal in a neighbouring member state. The nearest LNG terminal to Ireland is located in Milford Haven in the United Kingdom (UK).

Is LNG used in heavy duty vehicles?

LNG is not used for heavy duty vehicles in Ireland. While CNG is mostly recommended for short to medium driving distances, LNG is ideal for heavy duty trucks and municipal transport vehicles that travel long distances (with minimal stop–starts), particularly transcontinental freight operations. Penetration of LNG into the transport fuels industry would significantly reduce CO_2 emissions, and private companies have indicated a capacity and willingness to invest in infrastructure and vehicles subject to a very favourable policy framework. The cost of an LNG refuelling point to support up to 50 vehicles is estimated at approximately €300,000.

Is LNG used in Irish ports?

Currently LNG is not used at Irish ports. The key driver of LNG terminal development is demand and is generally driven by ship-owners. Due to the high cost of installing LNG facilities, including storage tank, development will most likely arise as a partnership endeavour between ports, private investors and third-party operators, for example bunker suppliers.

At this stage, there are no plans for LNG refuelling projects at any of the three TEN-T core network ports in Ireland (Dublin, Cork and Shannon Foynes). Equally, there are no plans for such development at those ports (Rosslare and Waterford) which are part of the TEN-T comprehensive network. Further market analysis and research will be required.

On occasion where large quantities of bunker supply have been sought, the owner or charterer of a vessel can make arrangements for bunkers to be supplied from a recognised bunker provider via a bunker tanker.

While inland navigation and inland ports do not feature in the transportation system of Ireland, the following represents a comprehensive list of all the ports and harbours outside the TEN-T core and comprehensive network that operate in the Republic of Ireland:

Arklow	Drogheda	Dingle
Wicklow	Dundalk	Fenit
Dún Laoghaire	Greenore	Galway
Howth	Bantry Bay	Killybegs
Kilronan	Kinsale	Youghal
Limerick	Cobh	Dungarvan
Sligo	Ringaskiddy	New Ross
Castletown Berehaven	Tivoli	Dunmore East

There are no LNG facilities at these ports and it is unlikely, given the scale of operations involved, that LNG facilities will be provided over the longer term to support the uptake of this fuel at these smaller ports and harbours.

5.5 Hydrogen

How is hydrogen used in transport?

Hydrogen can either be directly combusted in an internal combustion engine (ICE) analogously to LNG or CNG, or chemically converted to electricity in a Fuel Cell, which is then used to power a vehicle analogously to a BEV.

Hydrogen, which is harnessed for use in transport by fuel cell technology, utilises hydrogen to produce electricity without combustion. Since 2015, a number of major car manufacturers, such as Hyundai and Toyota, have introduced fuel cell electric vehicles (FCEVs) for evaluation purposes in Japan, California and Mainland Europe. While FCEVs produce zero tailpipe emissions, they have most in common with the traditional internal combustion engine in terms of range and refuelling. A tank of hydrogen could support distances of approximately 500 - 600 km with refuelling times in the order of 3–5 minutes.

What are the benefits of hydrogen?

Hydrogen, like electricity, is an energy carrier and can be generated from all available energy resources (including natural gas, petroleum products, coal, solar and wind electrolysis, biomass, and others). When using hydrogen generated from solar or wind electrolysis, total life-cycle CO_2 emissions are completely eliminated.[25] As such, FCEV's could provide the only transport option capable of guaranteeing zero CO_2 emissions from fuel compared with BEVs, which are dependent on the average grid CO_2 intensity. FCEV's have efficiencies between 2 and 3 times higher than ICEs.

Is hydrogen used in the transport sector in Ireland?

Hydrogen is not currently in use in Ireland as a transport fuel, although it is produced for the industrial chemical market. Approximately 40 tonnes of hydrogen is produced in Ireland per year in a plant operated by BOC (Ireland) via a P2G/Electrolysis production process (using grid electricity). This quantity of hydrogen, if used in passenger vehicles (such as the Toyota Mirai) would be sufficient to fuel approximately 200 vehicles per year.

What about hydrogen refuelling infrastructure for transport?

According to the H2REF project,[26] funded by the European Commission H2020, hydrogen refuelling stations cost approximately €800,000 each (excluding fuel production facilities). A single hydrogen refuelling station is capable of accommodating about 10 passenger vehicles per hour. There is no hydrogen refuelling infrastructure in operation in Ireland with few commercial organisations capable of constructing or bearing the cost of a stand-alone hydrogen project. Coupled with the lack of right-hand drive hydrogen vehicles currently available for use on the Irish market, the rate of infrastructure development is expected to remain low up to 2020.

5.6 Biofuels

What are biofuels?

Biofuels are renewable transport fuels produced from biomass material. They are manufactured from a wide range of materials including sugarcane, wheat and corn, and also from waste materials such as used cooking oil and tallow. Types of biofuels available include:

- **biodiesel** - typically deployed blended with mineral diesel & used in diesel-powered vehicles
- **bioethanol** - typically blended with gasoline and used in petrol vehicles
- **hydrotreated vegetable oil (HVO)** - can be used as a direct replacement for diesel
- **biomethane** - can be deployed for use in natural gas vehicles

[25] Fuel Cell and Hydrogen Energy Association http://www.fchea.org/hydrogen/
[26] H2REF Project: http://cordis.europa.eu/project/rcn/198235_en.html

What are the benefits of using biofuels?

In general, biofuels have significantly less CO_2 emissions than the fossil fuels they replace. However, it is vital that biofuels are derived from a sustainable source and do not undermine land use. To ensure that sustainable biofuels are deployed in the EU, member states are prohibited from providing support for biofuels unless they meet strict sustainability criteria as set out in the 2009 Renewable Energy Directive.

Additionally, indigenously produced biofuels can also displace imported fossil fuel, provide increased employment and add to security of energy supply.

Are biofuels used in Ireland?

In the last decade, there has been a steady growth in Ireland's biofuel use due to the combination of excise relief schemes which ran until 2010 and an obligation scheme which has been in place since 2010.

The Biofuels Obligation [27] applies to companies supplying road transport fuels into the Irish market. The scheme is based on tradeable certificates and at the end of each calendar year, each obligated party must hold a certain amount of these certificates in proportion to the petroleum based fuels it has placed on the road transport fuel market. The current obligation rate is 8.695% or 8/92, meaning that for every 92 litres of fossil fuel an obligated party has placed on the market, it must hold 8 certificates or pay a buyout charge of 45 cent for every certificate it is short. Certificates are awarded on the basis of 2 certificates per litre of sustainable biofuel if that biofuel is produced from wastes or residues or 1 cert for all other sustainable biofuels.

In 2015, 184.5 million litres of biofuels were placed on the Irish transport fuel market, of which over 15% were produced indigenously. Of these 184.5 million litres, 59 million litres were bioethanol (which is blended with gasoline in petrol) and 125.5 million litres were biodiesel (blended with mineral diesel). Over 99% of the biodiesel (124.3 million litres) was produced from wastes and residues, which equates to 66.4% of all biofuels placed on the market in 2015.

The average litre of biofuel placed on the market in Ireland in 2015 had a carbon intensity of approximately 18.1 g CO_2-eq/MJ, which represents a 79% reduction in carbon intensity in comparison to road transport fossil fuel. Based on the average biofuel carbon intensity, the substitution of fossil fuel with biofuel resulted in a reduction of approximately 356,000 tonnes of CO_2-eq emissions. This equates to an overall saving of 2.8% in GHG emissions from the road transport sector. [28]

In relation to HVO, the oil refinery in Whitegate, Co. Cork has produced this fuel in the past and continues to retain this capability.

5.7 LPG

What is LPG?

Liquefied petroleum gas (LPG) is the most widely used alternative automotive fuel in Europe, distributed through a network of 17,500 filling stations, which fuel more than 6 million vehicles (mainly passenger cars and buses). LPG is also widely used as a clean fuel for indoor vehicles such as forklift trucks.

[27] www.dcenr.gov.ie/energy/en-ie/Renewable-Energy/Pages/Biofuels.aspx
[28] The Biofuels Obligation Scheme Annual Report 2015 (NORA)

What are the benefits of using LPG?

Due to the flexibility of its supply chain, LPG can be used in remote areas (mountains, islands, etc.) and as a clean back-up energy for intermittent renewables such as photovoltaic, solar-thermal, wind and small hydro.[29]

Tests have shown that LPG produces 20% less in CO_2 emissions when compared with an equivalent petrol vehicle and can have up to a 10% advantage over an equivalent diesel. It is cleaner than diesel from the perspective of particulates, sulphur content and NOx. There is also the potential to produce carbon neutral LPG, which is derived from renewable feedstocks such as plant and vegetable waste. This is known as bio-LPG but is not in widespread use.

What about infrastructure and security of supply?

According to the Irish LPG Association (ILPGA), the production and availability of LPG is increasing around the world and is not limited to any one geographic region. In addition to production facilities, the ILPGA member companies have access to large refrigerated LPG cavern storage facilities in the UK and in Europe. LPG is easily transported by ship and stored in purpose-designed tanks. The LPG industry over the years has invested heavily in the construction of marine importation, distribution and storage facilities at Dublin, Cork, Drogheda and Belfast, as well as in land terminals at Whitegate, Claremorris, Ballyhaunis and Sligo.

What is the storage and delivery capacity of LPG in Ireland?

As LPG does not have to rely on a piped network, it is delivered nationwide, including to rural areas, by more than 100 road tankers across Ireland. It is stored on site in aboveground or underground storage tanks with a total storage capacity in excess of 18,000 metric tonnes. LPG companies have the capacity to supply LPG throughout the island of Ireland with a small increase to their existing tanker fleet and by increasing the delivery operations to a 24-hour operation.

Where is LPG refuelling infrastructure located?

There are currently 78 outlets, mainly on forecourts, retailing LPG across the country, including the TEN-T corridors. A further 500 in-house facilities at commercial/industrial premises are used to service forklift trucks (FLT) and other vehicles. It is estimated that approximately 3000 vehicles run on LPG in Ireland.

There are a number of companies supplying and distributing LPG in Ireland, such as Flogas, Calor Gas and Tervas Gas.

[29] European Liquid Petroleum Gas Association www.primagas.cz/media/tinyManager/files/48.pdf

5.8 Synthetic and Paraffinic Fuels

What are synthetic or paraffinic fuels?

Synthetic and paraffinic fuels can contribute to the improvement of air quality, reduction in CO_2 emissions (depending on fuel type, composition and processing), and improvement in security of supply. These fuels do not need new infrastructure since they are blended (25–100%) with traditional fuels.

Synthetic fuels can be made from a range of resources:

- natural gas
- biomass
- coal
- plastic
- hydrotreated vegetable oil (HVO)

It is expected that worldwide synthetic fuel production will rise to 1.8 million barrels per day in 2030.[30]

The environmental footprint of synthetic diesel fuels greatly depends on the process applied and the feedstock used. In general, due to the high-energy content, high level of purity and lack of contaminants, synthetic fuels significantly reduce SOx, NOx and PM emissions. For example, Fischer–Tropsch jet fuel has been shown in laboratory combustors and engines to reduce PM emissions by 96% at idle and 78% under cruise operation.[31]

Paraffinic fuels are clean, high quality diesel fuels made from a wide variety of feedstocks, namely BTL (biomass to liquid), GTL (gas to liquid) and HVO. Road trials of paraffinic fuels in several European capitals and elsewhere demonstrate that paraffinic fuels provide significant local air quality improvement in urban areas by reducing tailpipe emissions:

- PM reductions up to 40%
- NOx reductions up to 20%
- Hydrocarbons reductions up to 60%
- CO_2 reductions up to 75% [32]

Are synthetic and paraffinic fuels used in Ireland?

Synthetic and paraffinic fuel usage and production is in its infancy in Ireland. One company, Trifol Resources Limited, has plans to establish a number of commodity fuel plants in the Republic of Ireland and Northern Ireland. The company is seeking to use base pyrolysis technology re-designed (originally developed by another company, Cynar plc) and now patented by Trifol to produce ingredients for the production of synthetic lubricants, speciality chemicals and waxes.

Producing synthetic diesel from waste plastics helps to reduce the need for incineration, offering an environmentally friendly and profitable alternative for these end-of-life products. According to Cynar plc, fuel from waste plastic has 20% less tailpipe emissions than conventional fuels.

[30] PBMR Ltd, Willem Kriel, IAEA-CN-152-44 paper
[31] U.S. Environmental Protection Agency, 2009, Technical Support Document, Coal-to-Liquids Products Industry Overview
[32] Alliance for Synthetic Fuels in Europe www.synthetic-fuels.eu/paraffinic-fuels/air-quality

Section 6

National Policy Forecasts and Alternative Fuel Options

6.1 Overview

In relation to carbon emissions and renewable energy, Ireland has several targets:

- 16% of gross final consumption from renewables by 2020 for Ireland
- 10% of gross final consumption from renewables by 2020 for transport specifically
- 20% reduction in carbon emissions by 2020 from four key sectors (including transport)

Ireland also has a national vision to achieve:

- 80% reduction in carbon emissions by 2050 [33]

6.2 Ireland's Emissions Profile

Ireland's emissions profile has changed considerably since 1990, with the contribution from transport increasing by 130% between 1990 and 2015. The transport sector was the fastest growing source of greenhouse gas emissions during that period and represented 27.5% of Ireland's non-ETS emissions in 2015. While transport emissions decreased by 3.4% in 2012, which was the fifth year of reported decreases in a row, following significant growth up to 2007 (see Figure 8), an increase of 2.1% was reported in 2013 with subsequent increases of 2.5% and 4.2% in 2014 and 2015 respectively.

The decrease to 2012 primarily reflected the impact of the economic downturn combined with changes to vehicle registration and motor tax introduced in mid-2008. In addition, the Biofuels Obligation Scheme started operation in mid-2010 with biofuels displacing 6% of the petrol and diesel used.

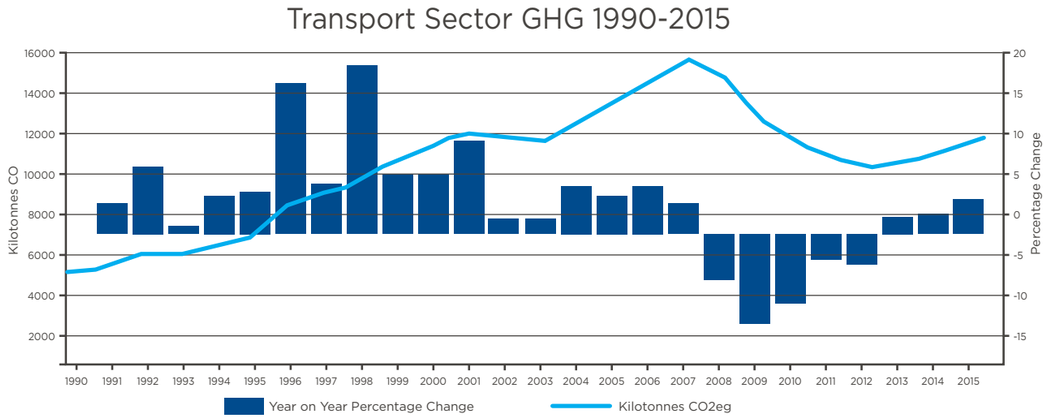


Figure 8 *Transport sector greenhouse gas emissions 1990–2015*

[33] Ireland's national policy position on climate action, published in 2014, provides the commitment to achieve the 80% reduction target. This is echoed in the White Paper on Energy Policy.

The Environmental Protection Agency (EPA) produces greenhouse gas emission projections on an annual basis for all sectors of the economy and the projections referred to in this plan were published by the EPA in March 2016. The EPA projects greenhouse gas emissions to 2020 and 2035 using two scenarios: With Measures and With Additional Measures (or 'best-case scenario'). The With Measures scenario assumes that no additional policies and measures are implemented (beyond those already in place by the end of 2014). The With Additional Measures scenario assumes that government targets for 2020, for example renewables targets, will be fully achieved.

6.3 Projected profile to 2050 on a business-as-usual basis

According to 2016 projections from the EPA, transport emissions are projected to show strong growth over the period to 2020, with a 10–16% increase on current levels depending on the level of policy implementation.

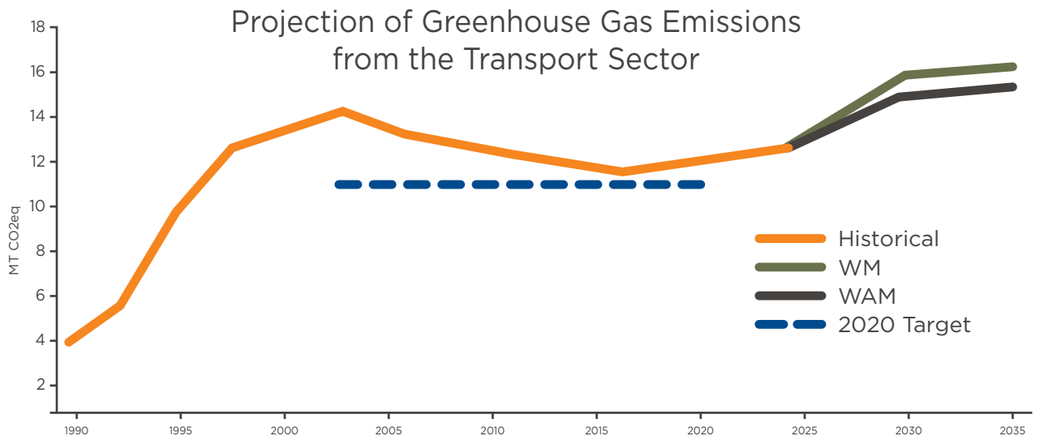


Figure 9 *Projections of greenhouse gas emissions from the transport sector*

Under the With Measures scenario, transport emissions are projected to increase by 16% over the period 2014–2020. The With Measures scenario includes:

- the impact of VRT and motor tax changes (introduced in 2008), public transport efficiencies and the carbon tax imposed on fuel since 2010
- improvements to the fuel economy of private cars, supported by EU regulation which mandates maximum levels of CO_2 for new cars to 120 g/km in 2015 and 95 g/km in 2020
- renewable energy penetration of 6% out to 2020, which is supported by the Biofuel Obligation Scheme 2010.

Under the With Additional Measures scenario, transport emissions are projected to increase by 10% over the period 2014–2020. In this scenario, it is assumed that:

- renewable energy penetration is 10% by 2020. This is the RES-T binding target under the Renewable Energy Directive. The achievement of this target is predicated on meeting objectives associated with the Biofuels Obligation Scheme 2010 and the roll-out of electric vehicles (50,000 EVs deployed by 2020)
- more efficient road traffic movements (for example eco driving techniques) are in place.

Looking to 2035, transport sector emissions are projected to increase by 20% as a result of an increase in the national car fleet to 2.6 million in 2035. This increase is underpinned by a projected increase in population to 5.3 million by 2035 and a sustained 3% annual growth in personal consumption over the period 2020–2035. It is assumed that the renewable energy penetration in both the With Measures and With Additional Measures scenario is maintained at 2020 levels in percentage terms supported by the Biofuel Obligation Scheme 2010. However, it is important to note that these projections are based on the assumption that no further policies and measures are implemented post-2020.

Emissions reductions are also required from the aviation sector, as part of the ETS, and from the international shipping sector led by the International Maritime Organisation (IMO). By 2020, global international aviation emissions are projected to be around 70% higher than in 2005 even if fuel efficiency improves by 2% per year. The International Civil Aviation Organisation (ICAO) forecasts that by 2050, aviation emissions could grow by a further 300-700%. Maritime transport emits around 1000 million tonnes of CO_2 annually and is responsible for about 2.5% of global greenhouse gas emissions.[34] Shipping emissions are predicted to increase between 50% and 250% by 2050 – depending on future economic and energy developments.

It is clear that in order to contribute to national and international climate and energy targets, the transport sector will be required to make significant adjustments over the long term. The mitigation measures will need to be wide ranging with a focus on complementary policymaking, smarter travel and modal shift initiatives and certain fiscal and taxation incentives to target behavioural change. Supporting low carbon technologies and greater uptake of alternative fuels will be but one element of this approach.

6.4 Policy Outlook

This Framework aims to support a transition away from fossil fuels over the next two decades, moving predominantly to electricity for passenger cars, commuter rail and taxis by 2030. Biofuels will continue to play a key role over the coming years and natural gas, along with some electrification, will provide an interim alternative solution for larger vehicles, i.e. freight and buses where significant reductions in CO_2 could be expected from integrating biomethane with CNG/LNG. LNG and methanol are likely to increase their penetration as fuels in the shipping sector. Hydrogen is not expected to deliver mass-market uptake over this term as the costs of the refuelling infrastructure and associated vehicles are likely to remain prohibitive until the middle of the next decade. This Framework covers this 'interim' period (to 2030), which will secure the platform for achieving our longer-term objectives for 2050. Post-2030, it is likely that hydrogen will continue its penetration across the entire fleet spectrum with a correlated decline in the predominance of vehicles being run exclusively on fossil fuels.[35]

However, given the speed of the advance in low carbon technologies, it is not illogical to expect all new cars and vans sold in Ireland to be zero emission (or zero emissions capable) from 2030. By the end of the next decade, low carbon alternative technologies will have matured and become considerably more affordable. This expectation is reflected in recent commitments by a number of countries to introduce or consider introducing a ban on the sale of all new fossil fuelled cars by 2030, or as early as 2025 in the case of Norway.

A recent report by Bloomberg suggests that EVs will be as affordable as their fossil fuel counterparts by 2022 with a prediction that at least 35% (or as high as 47% where conditions are right) of all new cars worldwide will be electrically powered by 2040.[36]

[34] 3rd IMO GHG study
[35] http://ballard.com/files/PDF/Media/4th_Energy_Wave_2016_FC_and_Hydrogen_Annual.pdf
[36] Bloomberg New Energy Finance 2016, 'Electric vehicles – it's not just about the car'.

While the solutions are not as clear-cut for larger vehicles, it is expected that the freight and bus sectors will also continue on a positive trajectory towards full penetration of low emissions vehicles (LEVs) by 2050.

This Framework is establishing targets for alternative fuels uptake in Ireland. While there is a range of fuel solutions emerging across the fleet spectrum, the associated technologies are continuously evolving. Determining how and when to best utilise these fuels will prove challenging. While we have some degree of insight around the likely contribution of certain fuels (i.e. electricity and CNG), there are still a lot of unknowns. A balance must be struck between supporting ambitious targets and minimising financial risk without undermining consumer confidence.

In addition, other first principles such as energy efficiency and smarter travel should not be undermined in efforts to support greater uptake of alternative fuels. Efficiency must always be at the forefront of climate and energy management. Likewise, policy supports should only seek to support the use of private alternative fuelled vehicles when walking, cycling and public transport services are not feasible options. Again, there is a need for balance, ensuring that the approach to deploying measures and the level of incentivisation provided does not encourage a move away from those first principles.

6.5 Alternative fuels options across fleet spectrum

The following is a summary analysis of potential fuel pathways and solutions for transport (by fleet segment) in Ireland (see also Appendix 2).

Cars/Taxis

EV and battery technology is fast advancing and barriers to market are being slowly eroded as a result. The range of vehicles coming on stream is steadily increasing, for both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). No other technology currently offers an accessible and viable zero emissions or zero emissions capable option for car owners. As distances between all major cities in Ireland are relatively short, range anxiety should abate as confidence in, and awareness of, the battery technology grows.

In Ireland, there already exists a very extensive network of charging infrastructure, which is positioned well ahead of current market demand. Capacity for home charging is greater here than in other countries (approximately 80% of EV owners charge at home) as many households own car spaces adjacent to their dwelling. As a result, EV technology provides a viable and affordable long-term zero emissions (or zero emissions capable) solution for the car fleet in Ireland. Hydrogen will also be available for use in transport by 2020 but we would not expect it to enter the mass market in Ireland until the end of the next decade.

Vans

For light duty vans, electricity is likely to become a mass market option but the range of vans available for sale is currently very limited. Compared with larger commercial vehicles, there is potential for more fuel diversity in this sector with viable low emission options ranging from full electric and hybrid technology to CNG and LPG. However, with a long-term ambition to decarbonise transport, a zero emissions van fleet would be the most attractive. Accordingly, all efforts will be placed on securing the greatest possible low emissions return for this fleet segment. Electric and hydrogen fuelled technologies would appear to offer the most likely long term solution for a low emissions light duty vehicle (LDV) sector.

Buses

The only technologically feasible zero emissions vehicles on the market at present are the full electric bus and the hydrogen fuelled bus. In relation to electric buses, this technology, despite significant advances, remains predominantly in demonstration phase. While likely to become a future option for buses in the medium term, the cost of this technology is currently prohibitive and there is no consensus on the type of infrastructure that may be required to meet the demands of fully transitioning to electric bus fleets. As large bus manufacturers are currently focusing on the delivery to market of a full electric offering, hybrid technology for buses may not emerge as the best long-term low carbon solution, particularly for the public transport fleet. Indications are that a large-scale transition to electric technology for buses may not be feasible from a technical perspective prior to 2020.

In relation to hydrogen, a number of hydrogen fuelled buses have been introduced to European fleets in recent years. While this demonstrates the potential of this technology to meet real-life operation demands, the long term commercial feasibility of such buses is still being examined.

CNG is a mature technology and can offer air quality benefits especially where older buses are being replaced; the reduction in carbon is approximately 20%. It also offers a pathway for the market development of a renewable, indigenous and sustainable energy source. Biomethane, when combined with CNG, has the potential for significant CO_2 reductions when compared to the diesel equivalent. The gas network in Ireland is extensive and can be harnessed to deliver an alternative low cost energy supply for transport.

Rail

In the past number of years, Iarnrod Éireann (IÉ) have made significant gains in the area of energy efficiency, to the extent that IÉ has already passed the target of 30% improvement, set by Government, to be achieved by 2020. It has also reduced its emissions by 22% since 1996, whilst increasing train kilometres operated. While energy efficiency remains a first principle for IÉ, significant emissions reduction in rail is more challenging. There are, however, a number of options for diversifying the fuel mix in rail, including the potential to blend diesel with a higher proportion of renewable, sustainable fuels. Further electrification of the heavy rail system is another option. A move to electrified systems such as that envisaged in the Government's DART Expansion Programme will help to accelerate the use of renewable energy in transport delivery, potentially resulting in up to 75% of all journeys on the Iarnród Éireann network being powered by electricity.

Trucks

The low carbon solutions for heavy goods vehicles are not yet developed. LNG represents a viable option for long distance freight, particularly transcontinental, as it is most energy efficient in such circumstances. It is not suited to stop–start or urban freight operations. There are currently no LNG facilities in Ireland. Taking this into account, and in the absence of demand (and high investment costs), LNG is not likely to form a large part of the fuel mix for road transport in Ireland. As above, CNG, when combined with biomethane, offers a good low carbon alternative for heavy duty vehicles (HDVs), particularly for back-to-depot type arrangements.

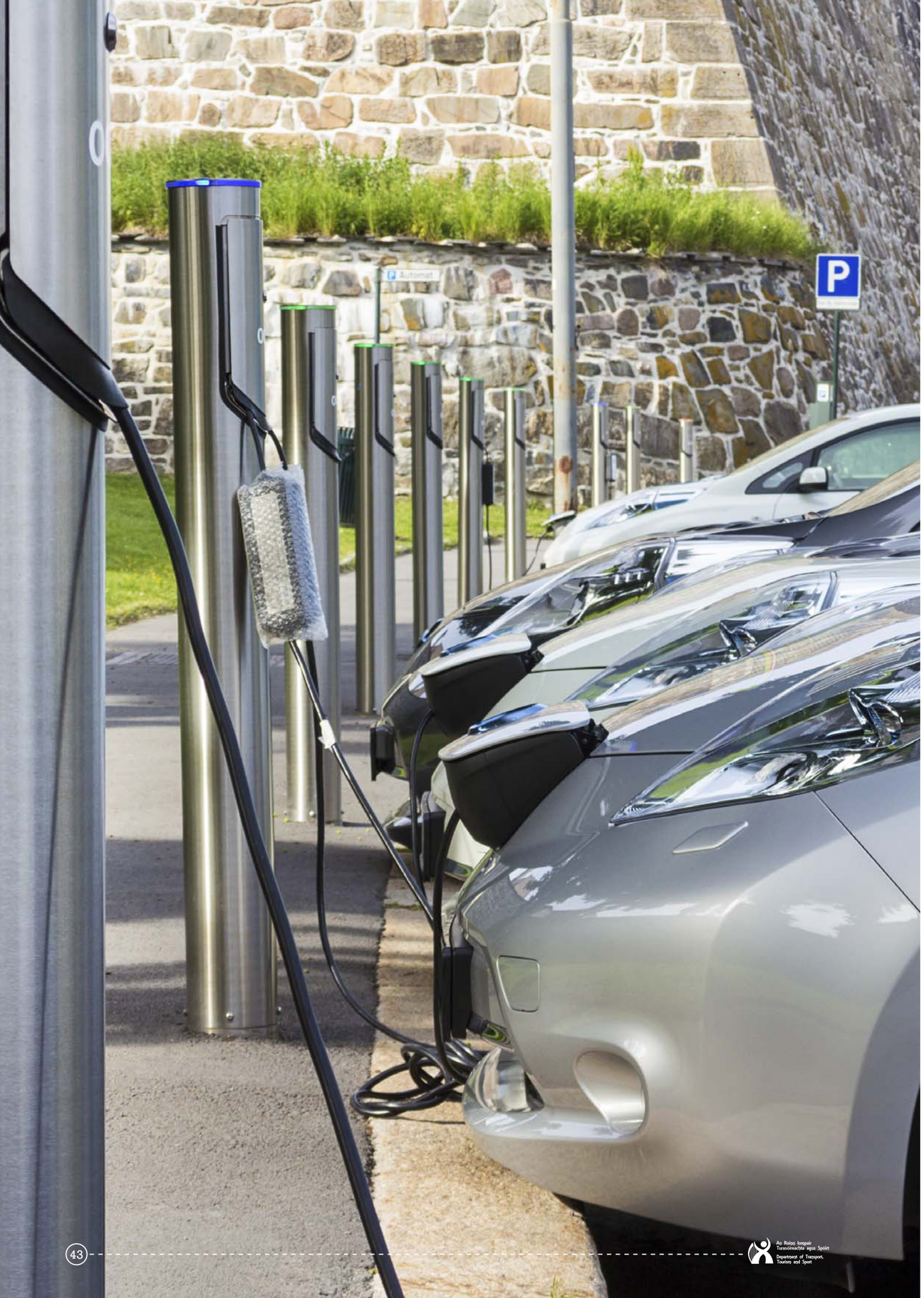
While the Directive 2014/94/EU is not prescriptive on refuelling infrastructure for LPG, it is in wide use in trucks and taxis in Ireland. Although it is defined as an alternative fuel, it does not offer an absolute long-term solution in terms of emissions reduction and decarbonisation. There may be some capacity to use LPG with other emissions reduction devices currently on the market (for example UltimateCell[37]) and with bio-LPG to maximise its decarbonisation potential. Ireland will ensure there are no barriers to the uptake of LPG if the market is strong.

[37] www.ultimatecell.ie

Hydrogen is considered versatile for use in freight and there are strong arguments for further investigation of this fuel despite no current market in Ireland. However, transition to a hydrogen-based transport system would involve massive technological change and economic investment by consumers. We are unlikely to see a range of right-hand drive affordable hydrogen trucks coming onto the Irish market for some years to come. Investing in costly infrastructure too far ahead of the market would be a high risk strategy and could lead to early infrastructure becoming obsolete as the technology advances.

Ships

Fuels like LNG and methanol are the most promising alternatives for the shipping sector, especially if such fuels are used in tandem with a biofuel counterpart, such as biomethane or biomethanol. However, as with hydrogen, investing in costly infrastructure too far ahead of the market would not be considered prudent.



Section 7

Targets for Alternative Fuel Infrastructure

7.1. AFV Forecasts

The following represents an indicative forecast of the numbers of alternative fuelled vehicles that could be circulating at particular milestones up to 2030 based on a policy ambition that all new cars sold in Ireland post-2030 will be zero emissions or zero emissions capable. All other categories of vehicle will continue on a positive trajectory towards greater penetration of LEVs in line with development in technologies.

Alternative Fuel Vehicles	Forecast Number of Vehicles			
	2015	2020	2025	2030
Electric Passenger Cars (BEVS & PHEVS)	2,020	20,000	250,000	800,000[38]
Electric Light Duty Vehicles	152	5,000	12,500	23,000
Electric Heavy Duty Vehicles	4	0	0	5
Electric Diesel Hybrid Buses	1	1	0	0
Full Electric Buses**	0	5	100	450
Electric Motorcycles	171	250	1,000	5,000
Cng Cars	0	3,500	26,000	38,000
Cng Light Duty Vehicles	5	400	3,000	4,500
Cng Heavy Duty Vehicles	2	20	100	150
Cng Articulated Tractor Units	3	130	950	1,400
Cng Buses**	0	150	1,000	1,500
Lng Light Duty Vehicles*	0	0		
Lng Heavy Duty Vehicles*	0	0		
Lng Buses*	0	0		
Lpg Vehicles*	3,000	3,600		
Hydrogen Cars*	0	0		
Hydrogen Light Duty Vehicles*	0	0		
Hydrogen Heavy Duty Vehicles*	0	0		
Hydrogen Buses*	0	0		

Table 6 *AFV forecasts*

* The need to establish forecasts/targets for 2025 and 2030 will be reviewed before the end of 2018

** While the total forecast is 156 for alternative fuelled buses by 2020, the split may be adjusted between electric options and CNG

Achieving a penetration of 800,000 EVs in the national vehicle fleet by 2030 could result in a cumulative reduction in CO_2 emissions from the transport sector of approximately 7 megatonnes (Mt) between 2017 and 2030.

[38] Assumes nearly all new cars sold in Ireland in 2030 are EVs

In order to achieve such an ambitious emissions reduction trajectory, policies relating to the provision of energy, particularly electricity and gas, from renewable sources would need to be fully aligned to the forecasts in this Framework in parallel with the longer term objective to achieve a decarbonised energy sector by 2050.

Targets for infrastructure are underpinned by assumptions on vehicle uptake, through the use of fleet modelling, and assumptions around the development of associated technologies.

7.2 Electricity Targets

	by 2015	by 2020	by 2025	by 2030
Normal power recharging points (public)	761	850	950	1000
High power recharging points (public)	71	100	150	250
Normal power recharging points (private)[39]	1900	18,000	200,000	700,000
High power recharging points (private)	0	20	100	200
Shore-side electricity supply in maritime and inland ports (terminals)	0	0	0	1
Electricity supply for stationary airplanes[40]	1	1	1	1

Table 7 *Electric charging point targets (ESB, DAA)*

Electric Fuelled Vehicles

Ireland set an initial target in 2008 of converting 10% of its passenger and light commercial vehicle stock to electric vehicles by 2020 (roughly equivalent to 230,000 vehicles). As the uptake of EVs was lower than anticipated, this target was revised to 50,000 in the third National Energy Efficiency Action Plan (NEEAP) published in 2014. Despite a range of supports being in place, the uptake remains relatively low.

Responsibility for this can be attributed to a number of barriers, not least, the high cost and limited choice of vehicles on the market as well as low consumer acceptance and awareness.

The total registration of BEVs and PHEVs in 2016 was 678, a growth in sales of 16% when compared to 2015. However, growth from 2014 to 2015 was 114% so this indicates a substantial slowing down of the EV market in Ireland. In fact, sales of BEVs fell by 16% when comparing 2015 with 2016.

Based on 16% growth in 2016 and assuming some recovery back to 40% growth in 2017, the red curve in Figure 10 indicates a cumulative number of 8000 EVs by 2020 (if all current policy measures and incentives remain in place). However, if more substantial measures were implemented and Ireland's growth profile were to match the International Energy Agency's (IEA) Electric Vehicle Initiative (EVI),[41] then the projections indicate that there will be in the region of 20,000 EVs in Ireland by 2020, considerably short of the current Government target contained in the National Energy Efficiency Action Plan.

[39] Assumes 80% of vehicle owners have home charge capability
[40] Does not include figures for fixed electrical ground power (FEGP) units.
[41] International Energy Agency www.iea.org/topics/transport/subtopics/electricvehiclesinitiative/

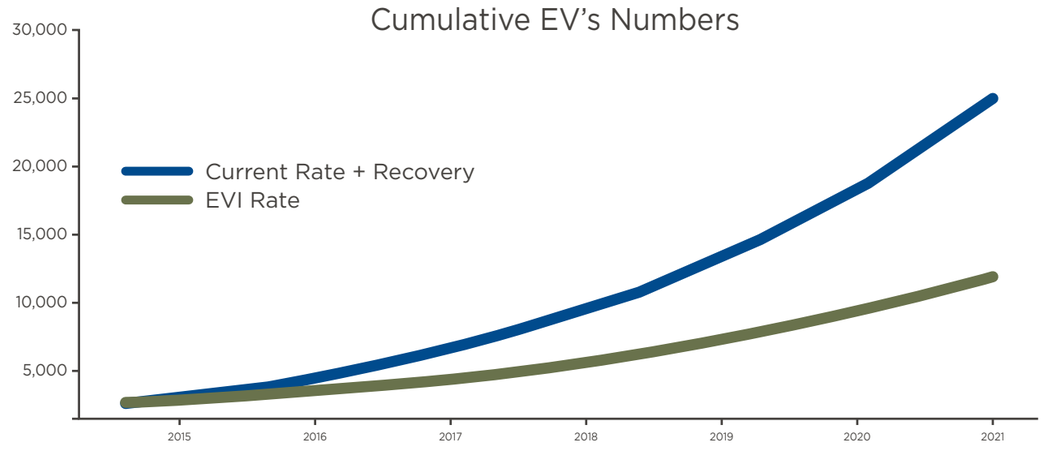


Figure 10 *Cumulative EV Numbers*

The cost of achieving the current 50,000 target could be viewed as prohibitive to the State (estimated to be in excess of €500 million)[42] and would not necessarily help to facilitate the longer-term objective of having no new fossil fuelled cars sold in Ireland post-2030. Technology advancement, affordability and consumer choice will be the greatest levers in triggering large-scale change. Accordingly, it would be more pragmatic to put in place a range of additional policy measures that would seek to achieve a lower, but still ambitious, target (relative to the current base) by 2020.

LEV Taskforce

The current Programme for Government commits to establishing a low emissions vehicle (LEV) Taskforce, which will assess, inter alia, the range of measures and options available to Government to help accelerate the deployment of LEVs. The work of this group, which was established in December 2016, will include an examination, and potential revision, of the current target for EVs. It may also include setting EV targets for future years beyond 2020.

The Taskforce will be co-chaired by the DCCAE and DTTAS. Along with other departments of relevance, the membership of the steering committee will comprise the County and City Managers Association, SEAI, the NTA and Transport Infrastructure Ireland. The various working groups under the umbrella of the Taskforce will include a number of bodies such as GNI and ESB and there will be extensive engagement with a diverse list of stakeholders as the work of the Taskforce evolves.

This Framework does not seek to presuppose the work of the LEV Taskforce or the outcome of the Government's deliberations on its findings and recommendations.

Nevertheless, given the obvious challenges associated with the current target, it would not be considered prudent to use it as a basis for setting targets for infrastructure under this Framework. It is therefore proposed to use the forecast figure of 20,000 EVs by 2020, which is accepted as a more realistic outcome based on current indicators from the market in Ireland.

[42] Amount includes cost of grant, VRT relief and excise foregone (incl. carbon tax).

Number of recharging points

It should be noted that the number of recharging points needed to support 20,000 EVs, particularly those that are publicly accessible, would not differ significantly from the level that would be required to support 50,000 EVs.

While acknowledging Recital (23) of the Directive 2014/94/EU, which recommends that the appropriate average number of recharging points should be equivalent to at least 'one recharging point per 10 cars', this recommendation is considered disproportionate to the needs of the market in Ireland, as home charging is currently the most common mechanism (more than 80%) for EV owners. Unlike many other European countries, a large proportion of residents in Ireland have access to driveways and private car parking spaces in which private chargers could be installed, thus reducing overall demand on the public charging network.

Assuming greater reliance on fast charging in the future as the vehicle driving range develops and more cars are in circulation, it is still unlikely that the ratio of charge points to vehicles suggested in the Directive would ever be warranted in Ireland. PHEVs are also expected to act as a stepping stone in the next few years, which will allow time for the wider issues of charging infrastructure demand and driving range to be addressed.

In general, the existing capacity of Ireland's electric charging network is higher than current demand; more than 800 publicly accessible charge points, including 71 fast charging points across the country, serve approximately 2700 EVs. Taking into account the current number of EVs and the extent to which the recharging network is ahead of market demand, it is anticipated that the present number of publicly accessible recharging points would be able to serve up to 20,000 EVs (assuming the number of domestic private chargers rises in line with car purchases). The deployment of additional publicly accessible and private charging points will be driven by market demand.

Figure 11 *Electric recharging points in Ireland (ESB)*

Capacity of recharging points

In addition to the above, most charge points in Ireland have, on average, a higher charging capacity than other European countries. This needs to be factored in when considering any additional infrastructural needs to 2020. In Europe, many normal power recharging points have a capacity of 7 kW whereas in Ireland most of the recharging points are 22 kW (i.e. three times the charging capacity). Ireland also has 71 high power recharging points, each with a capacity of 50 kW. Accordingly, the total capacity of the recharging network in Ireland is approximately 20,000 kW.

Taking into account the suggested vehicle to charge point ratio of 10:1 in the Directive, this would infer a need for 2000 publicly accessible charge points based on an EV target of 20,000 vehicles by 2020. Assuming a minimum charge capacity of 7kW per charge point, then it could be construed that the total capacity needed to serve a target of 20,000 vehicles would be 14,000kW. From this perspective, in terms of overall charge capacity, the current level of infrastructure in Ireland is considered sufficient to meet the market needs to 2020.

Shore-side Electricity Supply Facilities

All TEN-T ports in Ireland (Dublin, Cork and Shannon Foynes) have reported no current demand from shipping lines for shore-side electricity supply. While cold ironing[43] is considered feasible, the general consensus by these ports is that the development of such facilities will be demand-led.

In 2011, the Port of Cork Company commissioned Energy Services Group to carry out a Ringaskiddy Shore-Supply Study to investigate the level of works required to make mains electrical shore-supply available to the two main vessels which regularly dock at the port in Ringaskiddy. The study concluded that Port of Cork Company should wait until the international standard was finalised. This would provide certainty to port and vessel operators with regard to the requirements for shore power supply. The study also concluded that there were an insufficient number of vessels to justify the capital investment.

In relation to Dublin Port, the Dublin Port Company did test the market with one major customer in the period 2014–2015 by proposing to provide shore-side electric supply. However, it found little or no appetite to participate in funding such facilities.

Nevertheless, Dublin Port Company is seeking to future-proof the port with respect to cold ironing. As part of the Alexander Basin Redevelopment project, ducting is being put in place to provide for the future provision of these facilities, if and when market demand arises.

Taking the above into account, it would seem prudent to review market needs by the end of 2018 with a view to setting targets for 2025. No targets will be set, in the interim, in the absence of any market demand. However, subject to the outcome of the review, Ireland will commit to setting targets for shore-side electricity facilities at the three TEN-T ports in 2019 (to adhere to the requirements of the Directive).

Electricity Supply for Stationary Airplanes

Dublin Airport, the only airport using electricity supply, is currently undertaking a study to assess feasibility of installing fixed electrical ground power (FEGP) units on Pier 100. The output of the study will define any further developments. Pier 4 (which already has 27 FEGP units) and Pier 100 serve the majority of aircrafts at Dublin. The Dublin Airport Authority (DAA) also installed 2 new FEGP units in Pier 3 in late 2016.

[43] Cold ironing is the process whereby shore-side electrical power is provided to a ship at berth while its main and auxiliary engines are turned off.

All new aircraft stands constructed in the period covered by DAA's Capital Investment Programme (CIP) i.e. 2015 to 2019 inclusive will facilitate the future installation of FEGP. However, it is not envisaged that FEGP rollout will be expanded further until 2020.

For the next CIP period i.e. 2020 to 2024, daa intend discussing a mechanism for the recovery of the capital costs of FEGB, and any plans to expand FEGB provision, with the Commission for Aviation Regulation. As with all such requests, CAR will consult all airport users on any daa FEGP proposal.

From a policy perspective, daa supports the move towards FEGP as long as it is cost effective. FEGP and energy efficiency is in line with daa's overall approach to minimising ground emissions and optimising reductions in carbon emissions. It is also in line with many of daa's airline customer policies in relation to environmental performance and fuel efficiency.

For future investment in electricity supply it must be recognised that FEGP may not provide value for money in all cases. This is particularly true with very old infrastructure and the replacement/ upgrading costs to such equipment. It may also be the case at smaller airports, where the infrastructure required to install FEGP may be disproportionate to the environmental benefits. A life-cycle cost assessment for such projects would be required before investment could be justified.

7.3 Natural Gas (CNG, LNG) Targets

Natural Gas Refuelling	Refuelling Stations			
	2015	2020	2025	2030
CNG refuelling stations (public)	0	13	27	49
CNG refuelling stations (private)	2	6	43	53
LNG refuelling stations for heavy duty vehicles (public)*	0	0		
LNG refuelling stations for heavy duty vehicles (private)*	0	0		
LNG refuelling points for sea ports*	0	0		

Table 8 *Refuelling stations (2015 data: GNI*

* The need to establish targets for 2025 and 2030 will be reviewed before the end of 2018

CNG

The proximity of our large urban centres, relative to other European countries, will enable Ireland to achieve the coverage required under the Alternative Fuels Infrastructure Directive in a quick and efficient manner. A minimum initial network of fast-fill CNG stations is critical to the development of a 'network effect' for potential CNG vehicle operators. A CNG truck, bus or van must be refuelled in a similar time to that of a diesel or petrol vehicle using a network of fast-fill high-capacity stations accessible at public forecourts.

This initial stage should establish a skeleton refuelling network to provide confidence to vehicle users that a sufficient refuelling infrastructure exists to meet their requirements. An increased presence of CNG at public stations will also highlight the alternative to diesel and petrol, further encouraging transport users to transition to CNG. Such a network will also provide additional infrastructural support to local private stations, thereby reducing initial set-up costs for larger fleet operators who wish to transition to CNG.

In addition to the existing demonstration CNG refuelling stations, construction of three new stations were advanced by Gas Networks Ireland in 2016 as part of a CER-supported innovation initiative. Recital (41) of Directive 2014/94/EU recommends that member states take account of the minimum range of CNG motor vehicles when determining the appropriate number of CNG stations to be delivered, suggesting that the average distance between stations should be approximately 150 km. It is the responsibility of each member state to determine what minimum level of infrastructure is required to ensure that CNG vehicles can circulate in urban/suburban agglomerations and other densely populated areas.

In line with the requirement of the Directive, Ireland expects to develop 19 CNG stations by 2020 and a total of 70 stations by 2025, all located in strategic urban and suburban locations. In the first phase, the fast-fill stations will be deployed along the main transport corridors, which cover the elements of the TEN-T core and comprehensive network, and key transport hubs. By the end of 2025, the ambition is to have 70 fast-fill stations deployed nationwide. This network will also help to support uptake of CNG in public transport.

LNG at Maritime Ports

This Framework assesses the need for LNG infrastructure at maritime ports only, as Ireland does not have any inland ports. As indicated already, there are no LNG projects planned at the TEN-T core and comprehensive network ports in Ireland. Further market analysis will be required. Development will be demand-driven and there is no customer demand at this stage. The ports have advised that a common set of regulations and safety procedures would also need to be developed to give appropriate assurances to the port companies.

However, for sea transport within the Sulphur Emission Control Areas there is a requirement from 1 January 2015 to reduce SOx emissions from 1% to 0.1%. This measure will require significant adjustments by shipping lines, either in vessels or fuels or both, and ports will have to provide access to cleaner fuels sources.

In the absence of a LNG terminal in Ireland, supply by carrier from the UK is considered feasible. Currently, some ships, such as cruise ships and seatruck vessels, bunker[44] by carrier from the UK for their ordinary fuel requirements. This could also be done for LNG in the future. Appropriate procedures would have to be agreed with the relevant harbour masters.

Taking the above into account, it would seem prudent to review market needs (similar to shore-side electricity) by the end of 2018 with a view to setting targets for 2025. In the absence of any current market demand, Ireland does not plan to set targets in the interim. However, subject to the outcome of the review, Ireland will commit to setting targets for LNG facilities at the three TEN-T ports in 2019, thus adhering to the requirements of the Directive. In the meantime, any demand can potentially be serviced by bunkering from the UK.

LNG for Heavy Duty Vehicles (HDVs)

Directive 2014/94/EU recommends the TEN-T core network as the basis for the deployment of LNG infrastructure for HDVs. Recital (46) suggests that the necessary average distance between refuelling points should be approximately 400 km. The core TEN-T corridor in Ireland extends from the border with Northern Ireland along the M1 motorway (from Belfast) through Dublin to the city of Cork (and Ringaskiddy Port). The total distance between the cities of Belfast and Cork is just over 400 km, while the distance of the corridor in the Republic of Ireland is approximately 360 km. The core network also consists of a national road connection to the TEN-T port of Shannon Foynes. Given the size of our TEN-T core network, the inherent suitability of LNG for long distance journeys and the lack of demand from domestic or international hauliers to provide LNG for HDVs in Ireland, it is not proposed to set targets for LNG infrastructure in this Framework. However, there is merit in reviewing market need for HDVs in line with the proposed review for LNG at ports (as above). Depending on future demand, policy alignment with Northern Ireland would be advantageous in the development of LNG refuelling points given our shared responsibility for meeting user needs on our respective parts of the TEN-T corridor across the island.

[44] Bunker' is the term generally applied to the storage of petroleum products in tanks, and the practice of refuelling ships

7.4 Hydrogen Targets

According to the Directive 2014/94/EU, member states have discretion in relation to the consideration of targets for hydrogen refuelling points in the NPFs. Ireland has no immediate plans to establish a hydrogen refuelling network, as the cost of the infrastructure is massively disproportionate to current demand. However, Ireland is willing to support trials relating to hydrogen fuelled vehicles, and the feasibility of establishing a hydrogen refuelling network will be regularly assessed to take account of changes in technological development and market uptake.

7.5 Biofuels Targets

Policy on biofuels is already addressed through the implementation of the Renewable Energy Directive and the Fuel Quality Directive. The Biofuels Obligation Scheme is in place to oblige all suppliers of road transport fuel to include a proportion of biofuel in the fuel mix. The obligation will be increased on a phased basis until 2020 with a view to contributing towards the mandatory 10% minimum renewable energy target for transport (RES-T), as set out in the Renewable Energy Directive.

7.6 LPG Targets

The objective of this Framework is to consider supports for infrastructure and vehicles using LPG. However, the Directive does not require infrastructural targets to be put in place for LPG.

7.7 Synthetic and Paraffinic Fuels Targets

This Framework aims to support the use of synthetic and paraffinic fuels but no infrastructure will be required because such fuels are most commonly blended into diesel supplies. Market forces and regulation will largely determine the demand for synthetic fuels.

Section 8

Measures Necessary to Ensure National Targets and Objectives are Reached

8.1 Policy measures aimed at supporting uptake of alternative fuels

In line with Directive 2014/94/EU, all support measures for alternative fuels infrastructure shall be implemented in compliance with the State aid rules contained in the Treaty on the Functioning of the European Union (TFEU).

Electricity

Prior and existing supports

In 2010, the Sustainable Energy Authority of Ireland (SEAI) provided 45% support to a number of private and public sector bodies to test electric vehicles in a commercial or operational environment (Dún Laoghaire-Rathdown County Council, Office of Public Works, Celtic Linen, etc.). Tests concluded that commercial EVs save fuel costs, reduce emissions and have sufficient range for typical daily trips.

Since 2011, SEAI has been providing grants of up to €5000 to consumers who purchase a battery electric vehicle (BEV) or a plug-in hybrid electric vehicle (PHEV). In addition to the grant scheme, a BEV will qualify for vehicle registration tax (VRT) relief of up to €5000, whereas a PHEV qualifies for up to €2500 VRT relief. This provides a maximum combined subsidy (grant plus VRT relief) of €10,000 in the case of a BEV and €7500 for a PHEV. While the grant scheme is subject to ongoing review, it will continue in 2017. As announced in Budget 2017, VRT relief on BEVs will continue until end 2021 with reliefs also continuing up to end 2018 for PHEVs.

In addition, a tax incentive for companies paying corporation tax is in place in the form of Accelerated Capital Allowances for Energy Efficient Equipment. Since 2008, this attractive scheme has allowed companies to write off 100% of the purchase value of qualifying energy efficient equipment against their profit in the year of purchase. The scheme supports the purchase of BEVs, PHEVs, hybrid vehicles and the associated charging equipment.

As part of an EV R&D pilot funded through electricity network tariffs, ESB eCars has also provided free home charge points for the first 2,000 people to register a new electric vehicle in Ireland and who qualify for the SEAI Grant Scheme. This means that EV drivers can conveniently charge from the comfort of their homes or workplaces and also have access to a nationwide network of publicly accessible charge points.

The Commission for Energy Regulation (CER) in Ireland is to make a decision on the future of these infrastructural assets and the outcome of this decision will determine the funding arrangements for the charge points i.e. whether the assets will be sold or become part of the Regulated Asset Base (RAB). As a general principle, it would be preferable if future charging systems were independent from state subsidies and were capable of operating on a commercial basis.

Future policy on the provision of infrastructure will take account of CER's decision and the direction of the emerging market on alternative fuels in transport. In line with Section 11 and the

provisions of Directive 2014/94/EU, the effectiveness of policy on alternative fuels infrastructure will be reviewed on a regular basis and will be revised as necessary. It is likely that future policy will be more prescriptive around the funding and ownership models that will need to be supported in order to best facilitate the development of alternative fuels infrastructure (not only for electricity) on a commercial basis, ensuring that the market can offer optimum outcomes for the consumer in terms of choice and service.

Ireland is also participating in several national and international projects aimed at accelerating the market uptake of EVs:

- ESB ecars trial
- Green eMotion
- Europe Network of Electric Vehicles and Transferring Expertise (ENEVATE)
- R&D alliance of ESB and the Electric Power Research Institute (EPRI)
- Future INternet Smart ENergY (FINSENY)
- Mobile Energy Resources in Grids of Electricity (MERGE)

Measures to be implemented by end of 2017

- Implement regulations as required in relation to data provision and technical specifications for normal and high power recharging points and shore-side electricity supplies in line with the development of new EU standards and/or any further changes to Annex II of Directive 2014/94/EU
- The current Programme for Government includes a commitment to establish a Taskforce to consider the range of measures and options available to Government for the purpose of accelerating the deployment of low carbon technologies, especially EVs. Environmental and air quality issues will underpin the deliberations of the Taskforce.

The work of this LEV taskforce, which was established in December 2016, will be divided into three areas:

- market growth stimuli and visibility
- infrastructure, energy regulation and pricing
- planning legislation, building regulations and public leadership

While the taskforce will also consider other low carbon technologies and fuels, the following reflects some of the market stimulus options to be considered in respect of EVs, including electric powered two-wheeled (ePTW) vehicles:

- Grant and VRT levels (methods, duration and cost)
- Tolls (reduced charges or exemptions)
- Benefit-in-kind (BIK) relief
- Motor tax rates
- Public parking charges
- Supports for leasing arrangements
- Supports for car-sharing EVs
- Potential access to bus lanes
- Scrappage scheme
- Energy credits and obligation schemes
- Low emissions zones
- VAT on purchase of vehicle/VAT Refund Scheme

These options would seek to increase consumer confidence and bridge the differential between the cost of EV technology and its fossil fuelled equivalent. As well as market stimulus options, the LEV taskforce will consider issues concerning the charging infrastructure including, amongst others, ownership models, customer pricing options, maintenance issues associated with existing services and incentives for the provision of private and domestic chargers. Infrastructure readiness with regard to market size, battery size and future domestic demand will also be considered.

With regard to legislation and planning, a review of local authority measures will be undertaken. Consideration will be given to a package of measures that could be deployed by local authorities for the purposes of developing a more consistent cross regional approach to the promotion of EVs.

- Establish a Green Bus Fund, which would support the uptake of electrically powered buses, either hybrids or full electric (as well as other technologies)

Measures to be implemented by end of 2018

- Implement any measures recommended by the LEV Taskforce and approved by Government
- Assess the need for an action package aimed at removing any administrative obstacles related to the deployment of public and private recharging points
- In line with the White Paper on Energy Policy, establish a Government-backed scrappage scheme for taxis aged seven years or older where the car is being replaced by an EV
- Consider contribution of building and planning regulations in supporting market uptake of EVs. Revised regulations would ideally provide for the setting of minimum requirements on the number of electric recharging points to be established at new residential or commercial developments (where car parking is being provided). Regulations would need to provide for more challenging apartment complex arrangements and multi-occupancy buildings. In this context, it will also be necessary to keep abreast of proposals to amend Directive 2010/31/EU on the energy performance of buildings.
- Address the issue of misuse or 'icing'[45] of charge point spaces through parking and/or road traffic regulations

Measures to be considered by end of 2018

- In order to monitor and evaluate the operation of the charging points and to estimate the future load on the electricity grid, an assessment methodology and reporting system should be established. Eirgrid are in the process of developing modelling scenarios in this context, which will be informed by the ambition of this Framework. Onshore and offshore interconnectivity should be considered in this regard.
- Participation in the development and research of new technologies, trials, technical specifications and standards at EU and international level
- Undertake a life-cycle cost analysis of rolling out FEGP units at all airports not currently using electricity supply for stationary aircraft
- Develop a feasibility study of shore-side electricity supply for seagoing ships in TEN-T ports (Dublin, Cork and Shannon Foynes) taking into account demands, cost benefit analysis (CBA), environmental effects and the level of financial support that may be required to make the delivery of the infrastructure feasible. Based on the results of the study, targets for shore-side electricity supply should be established, as required, with a view to the deployment of any related infrastructure at these core TEN-T ports initially, subject to the requirements of the relevant environmental legislation, including Article 6 of the Habitats Directive

[45] 'Icing' is the term used to refer to either 'non-charging' EVs or regular combustion engine cars parking in EV charging spaces.

- The study on shore-side electricity supply should also investigate the possibility for reducing the rate of electricity tax for shore-side electricity in the short term to stimulate demand. If the reduced rate was below the rate set by the Energy Taxation Directive, authorisation would be required from the EU.
- Subject to the findings of the Rail Review 2016, consideration will be given to the feasibility of electrifying further elements of the heavy rail system including inter-city routes.

Measures (general) by end of 2020

- Develop, if required, regulatory measures to facilitate the deployment of home/private chargers
- Assess the implementation of regulations in relation to user information associated with this Directive 2014/94/EU
- Assess and amend, if necessary, regulations and standards in order to ensure appropriate level and use of recharging infrastructure at apartment blocks, parking lots, office and business locations, for example Building Control Act, 1990 (3 of 1190); Building Control Act, 2007; Building Control Regulations 1994–2014; Building Regulations 1994–2014; Road Traffic (Traffic and Parking) Regulations, 1997 (S.I. No. 182/1997); and Road Traffic (Traffic and Parking) (Car Clubs And Electrically Powered Vehicles) Regulations 2014 (S.I. No. 325 of 2014).
- Consider the inclusion in any amended regulations, a requirement for recharging points to incorporate, where feasible, renewable sources of energy, i.e. solar photovoltaic panels.
- Ensure the development of the new National Planning Framework takes account of this Framework
- Continue to support and foster research on future technologies (for example wireless charging and battery swapping)
- Establish partnerships with public entities and private companies in order to facilitate trials of EVs in public sector and public transport fleets

Natural Gas (CNG, LNG) and Biomethane

Existing Supports

Budget 2017 restated the commitment to retain favourable excise duty rates for natural gas as a vehicle propellant. The Government has committed to maintaining duty levels introduced in Budget 2015 at the minimum rate (in line with the Energy Tax Directive) for a period of eight years.

As mentioned previously, an innovation fund was established by GNI, which has supported a wide range of innovation projects including demonstration refuelling projects for CNG and injection projects for renewable natural gas. GNI has been supported by the Gas Innovation Group which consists of members from government agencies and departments (including the Department of Transport, Tourism and Sport and SEAI), research institutes and academia.

Measures to be implemented by end of 2017

- Installation of 5 CNG publicly accessible fast-fill stations at strategic locations, including Dublin Port
- Complete the assessment on biogas and biomethane, which is currently being undertaken by SEAI and develop appropriate policy options to support the use of biomethane, particularly in the public transport and freight sectors
- Introduce a new accelerated capital allowance (ACA) tax incentive for companies, with the aim of encouraging investment in refuelling infrastructure and equipment for natural gas, both CNG and LNG. The ACA would allow companies to write off 100% of the purchase value of qualifying vehicles and refuelling equipment, including CNG compression equipment, against their profit in the year of purchase. It is anticipated that qualifying vehicles will need to demonstrate compliance with, at least, the Euro 6/VI emission standards
- Make and revise regulations, as required, in relation to data provision and technical specifications for refuelling points in line with the development of new EU standards and/or any further changes to Annex II of Directive 2014/94/EU
- Utilise the Green Bus Fund to support demonstration projects in public transport fleets. Only vehicles that demonstrate compliance with the Euro 6/VI emission standards will be supported through this Fund
- LEV Taskforce to consider range of measures and options available to Government for the purpose of accelerating the deployment of natural gas in transport. As above, environmental and air quality issues will be central to the deliberations of the Taskforce.

Measures to be considered by end of 2018

- A low carbon vehicle fund to provide first mover[46] backing in commercial fleets
- VRT and motor tax treatment to recognise low emission HDVs
- Funding for innovation within the Irish transport sector
- A Green Transport Certificate for goods transported using low carbon and air pollution technology and consideration of potential within existing industry accreditation programmes (e.g. FTA Ireland Accreditation Programme) to support alternative fuels such as CNG and LNG
- Support measures to encourage captive fleets maintained by local authorities and public bodies to move to CNG vehicles, if suitable, by 2030
- Market analysis will be undertaken in relation to demand for LNG (and related refuelling infrastructure) along the TEN-T corridor, to include the motorway between Dublin and Cork and the associated ports of Dublin, Cork and Shannon Foynes. Market analysis of demand for LNG at TEN-T comprehensive ports should also be included

[46] 'A marketing term used to describe the advantages that can accrue from being the first to enter a market segment. It can also apply to early adopters of technology, i.e. showing technological leadership.

Hydrogen

Ireland is not currently planning to establish a hydrogen refuelling network. However, trials on fuel cell propelled vehicles should be encouraged and the need to establish a hydrogen refuelling network should be regularly assessed based on technological development and market uptake.

Measures to be considered by end of 2020

- LEV Taskforce to consider the range of measures and options available to Government for the purpose of accelerating the deployment of low carbon technologies, including hydrogen. Environmental and air quality issues will be taken into account in any measures proposed by the Taskforce
- Facilitate trials, if considered appropriate, on fuel cell propelled vehicles (particularly buses) through the support of the Green Bus Fund
- Assess the feasibility, at a national strategic level, of establishing a hydrogen refuelling network based on technological development and market uptake. The feasibility study should consider what government supports, if any, and environmental assessments are required to promote hydrogen. The potential for deploying the use of hydrogen fuelled LDVs and trucks by 2025 should also be considered
- Consider incentives for uptake of hydrogen, including accelerated capital allowances, to support investment in refuelling infrastructure

Biofuels

Existing Supports

The Biofuels Obligation Scheme is the mechanism which will be used to progressively increase the use of biofuel to assist in meeting the renewable energy target in transport of 10% by 2020. Policy on biofuels is already addressed through the implementation of the Renewable Energy Directive and the Fuel Quality Directive.

Measures to be considered by end 2017

- DCCAE will examine whether other incentives/supports will be required in order to meet 2020 renewable energy and greenhouse gas reduction targets as set out in the Renewable Energy and Fuel Quality Directives.

Measures to be considered by end 2018

- Consideration will be given to the need for renewable jet fuel refuelling points in airports within the TEN-T Core Network

LPG

Existing supports

LPG currently derives benefit from a favourable excise duty rate of €96.45 per 1000 litres, which helps to keep the cost of the fuel competitive in the Irish market.

Measures to be considered by end of 2018

- Secure commitment to maintain or reduce excise duty rates for a prolonged period (minimum eight years), taking account of excise levels on other alternative fuels, providing certainty to the market for LPG
- Introduce an ACA tax incentive for companies with the aim of encouraging investment in refuelling infrastructure and equipment for LPG. The ACA would allow companies to write off 100% of the purchase value of qualifying refuelling equipment against their profit in the year of purchase
- Examine VRT rates on factory fitted LPG fuelled vehicles and/or all new cars that are fitted with LPG conversions from an approved LPG Conversion Centre
- LEV Taskforce to consider the range of measures and options available to Government for the purpose of accelerating the deployment of low emissions technologies and fuels, including LPG, in order to help reduce emissions and improve air quality

Synthetic and Paraffinic Fuels

Synthetic and paraffinic fuel usage and production is at an early stage in Ireland.

Measures to be considered by end of 2020

- Consider synthetic and paraffinic fuels in the provision of any future regulation on low emissions fuels
- Facilitate trials as required on synthetic fuels in public transport vehicles (bus and rail)
- Analyse need for financial incentive to support greater use of synthetic and paraffinic fuels

8.2 Other Policy Measures Aimed at Accelerating the Move to Low Emissions Vehicles (LEVs)

The measures proposed here are framed within the overarching objective to transition the Irish vehicle fleet away from petrol and diesel vehicles to alternative fuel sources over the medium term, i.e. to low emissions vehicles (LEVs).

Taxation measures to be implemented by end 2017

- Commitment made in Budget 2017 to retain the preferential VRT rates for EVs for a period of 5 years and for PHEVs for 2 years.

Possible taxation measures by end 2020

The taxation measures to be considered, and which could play a key role in supporting the transition to a low carbon transport system, include:

- retention of a preferential VRT and motor tax regime for the lowest carbon vehicles
- reviewing the VRT and motor tax regime for LGVs
- updating and implementing benefit-in-kind taxation for LEVs
- considering and reviewing the overall tax treatment of vehicles and fuels

Possible promotional campaigns by end 2020

The promotional campaigns to be considered include:

Advertising

- Develop a media campaign that will reflect the benefits of alternative fuels (for example smoother drive, low noise, improved air quality, positive image)
- Develop a media campaign that will provide information on the vehicles, infrastructure and incentives available

Information

- Review user-friendliness of existing online data on recharging infrastructure, such as the ecar interactive mapping tool, within the wider context of data provision and the requirements of Article 7 of Directive 2014/94/EU
- Develop online tool for accessing information on refuelling stations for CNG in line with Article 7 provisions.
- Develop a cost comparator that will provide the capability to examine the total cost of vehicle ownership across a range of alternative fuels (from 2020 onwards)
- Develop a campaign targeted at dealerships
- Awareness raising, targeted at fleet managers (private and public), for example through workshops

Regulation

- Keep abreast of international developments in regulation aimed at curbing emissions in national vehicle fleets, particularly any proposals aimed at limiting the sale of vehicles which are not zero emissions capable. Review any emerging regulations for application in Irish context.

8.3 Environmental Policy and Monitoring Measures

Ongoing measures

- Ensure all plans and projects [as defined under Part 1 of the Birds and Natural Habitats Regulations 2011, as amended] arising from the Framework are subject to Screening for Appropriate Assessment and/or Appropriate Assessment, whichever is deemed necessary, to ensure there are no likely significant effects on European Sites and/or no adverse effects to European Site integrity. The requirements of Article 6(3) and, where necessary, Article 6(4) of the Habitats Directive must be fully satisfied.
- All investigative and feasibility studies to be carried out in relation to alternative fuels and alternative fuels infrastructure must include an environmental appraisal which considers the potential effects on the Natura 2000 Network.
- All infrastructural development arising from the implementation of this policy must adhere to the 'Siting Criteria' included in Section 9 of this Framework.
- Key Performance Indicators (KPIs) will be developed by DTTAS to monitor the implementation and effectiveness of the Framework.
- To facilitate implementation of the policy and to ensure transparency, a responsibility matrix will be developed by the DTTAS for the measures included in the Framework.

8.4. Governance Arrangements

Measure to be implemented by end 2017

Establish a steering group to oversee the implementation of the Framework. This group will, inter alia,

- review ongoing progress on measures
- take into account related research and emerging technologies
- liaise, as necessary, with key stakeholders and interested parties on issues relating to the implementation of the framework
- formally liaise with other departments on complementary policies, for example, the development of renewable electricity
- periodic reviews of the capacity and availability of infrastructure to support the uptake of alternative fuels
- implement the monitoring plan outlined in section 11
- submit reports, as required, to the Commission

8.5 Cooperation with Neighbouring States

The development of alternative fuel use in Ireland has already benefited from close cooperation with neighbouring states, specifically Northern Ireland. Facilitated by support from EU funding programmes, the interoperability of infrastructure has been central to developments across the island of Ireland. As referred to previously, an EU-funded cross border project in 2013 helped to extend the EV fast-charge network in the Republic of Ireland and Northern Ireland. The investment involved the roll-out of new fast (rapid) charge points, which were installed at service stations and other prime locations along key interurban routes, including a section of the TEN-T core network corridor between Belfast and Dublin.

It is hoped that this level of cooperation will continue to grow in advance of and beyond Brexit, ensuring that all future infrastructure will be interoperable across our shared border and that the range and availability of alternative fuels will continue to increase its penetration across the island.

Section 9

Designated of Densley Populated Areas to be Equipped with Publicly Accessible Electric Chaging Points and CNG Refulling Points

Based on the requirements of the Directive, Ireland is focusing on the TEN-T corridors and the most densely populated areas along the TEN-T corridors for the purposes of providing adequate coverage of recharging and refuelling points.

However, the existing EV charging network is already extensive and covers the whole country, including all densely populated areas as well as some rural ones. Due to the relatively limited number of CNG refuelling points currently available, the designation will initially focus on the Dublin and Cork areas and the TEN-T corridor between them. As the market take-up for CNG evolves and the use of natural gas vehicles (NGVs) becomes more widespread, the designated areas will be regularly revised and extended as appropriate, taking into account demand, travel patterns and technological developments.

9.1 Designation of Areas

Initially, two areas are designated to be equipped with publicly accessible electric charging points and CNG refuelling points under the Framework: the cities and counties of Dublin and Cork. The population of these two areas account for approximately 40% of the total population of the State. Population growth trends envisage that this ratio will remain the same until 2021.

Area	Population	
	2016	2021 (M2F2)[47]
Dublin	1,345,402	1,373,000
Cork	542,196	620,000
State	4,757,976	4,876,000

Table 9 *2016 population and projected population of Dublin City and County, Cork City & County and the State (Census 2016, Regional Population Projections 2016–2031, Cork City Development Plan 2015- 2021, Cork County Development Plan 2014*

The long-term objective (post-2025) of this Framework is to equip all key urban areas in Ireland with the required level of recharging and refuelling infrastructure necessary to support continuing uptake of alternative fuels usage while taking account of any future policy set by the National Planning Framework.[48]

[47] M2F2 - Traditional scenario Regional Population Forecasts (www.cso.ie/px/pxeirestat/Statire/SelectVarVal/Define.asp?maintable=PEB01&PLanguage=0)
[48] http://www.housing.gov.ie/planning/policy/national-planning-framework

Proposed Locations of Refuelling Infrastructure for CNG

Location	CNG Refuelling Stations		
	By 2020	By 2025	By 2030
Dublin	4	10	17
Cork	2	5	7
Limerick	0	3	4
Galway	0	0	2
Waterford	0	0	2

Table 10 *Planned number of recharging and refuelling points in urban/suburban agglomerations or densely populated areas*

Core Network	2020			2025			2030		
	No.	Max. Distance Km	% Completed	No.	Max. Distance Km	% Completed	No.	Max. Distance Km	% Completed
CNG Stations	13	150	100	13	150	100	24	150	100
Comprehensive Network[49]	**2020**			**2025**			**2030**		
	No.	Max. Distance Km	% Completed	No.	Max. Distance Km	% Completed	No.	Max. Distance Km	% Completed
CNG Stations	0	0	0	10	150	100	18	150	100

Table 11 *Planned number of natural gas refuelling points along the TEN-T network*

Comprehensive Network[49]	2020			2025			2030		
	No.	Max. Distance Km	% Completed	No.	Max. Distance Km	% Completed	No.	Max. Distance Km	% Completed
CNG Stations	0	0	0	10	150	100	7	150	100

Table 12 *Planned number of natural gas refuelling points on other roads*

2020	High power recharging points	Normal power recharging points
Dublin	14	40
Cork	5	25
State	10	24

Table 13 *Indicative distribution of new publicly accessible recharging points in urban/suburban agglomerations and densely populated areas – 2020*

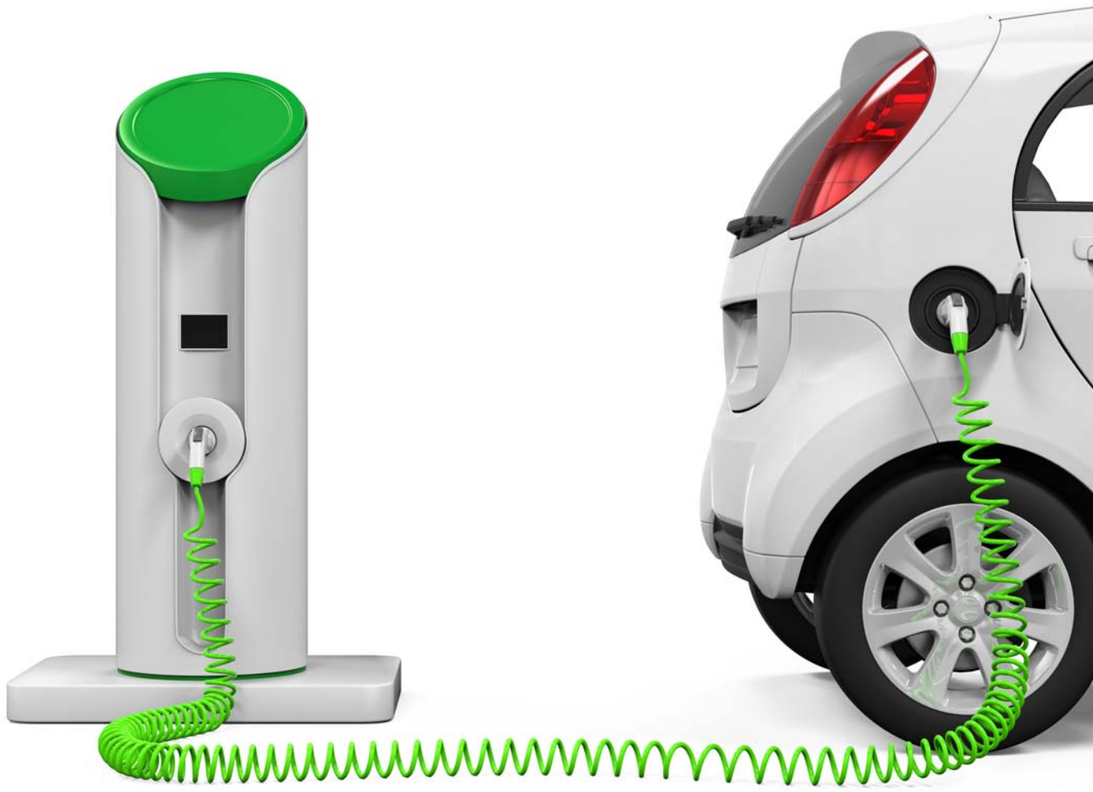
[49] Station numbers above assumed as public stations not on the core network.

2025	High Power Recharging Points	Normal Power Recharging Points
Dublin	30	80
Cork	15	45
Limerick	5	5
Other	29	59

Table 14 *Indicative distribution of new publicly accessible recharging points in urban/suburban agglomerations and densely populated areas – 2025*

2030	High Power Recharging Points	Normal Power Recharging Points
Dublin	70	90
Cork	40	50
Limerick	15	25
Galway	10	20
Waterford	5	15
Other	39	39

Table 15 *Indicative distribution of new publicly accessible recharging points in urban/suburban agglomerations and densely populated areas – 2030*



9.2 Siting Criteria for Future Development

As can be seen from the above, this Framework is not specific in relation to the location of the infrastructure that may be developed as a result of the policy measures and the development of new infrastructure could have negative impacts on the environment depending on its location. Therefore the inclusion of siting criteria will assist in the proper planning and development of future infrastructure for alternative fuels. The proper siting of alternative fuel infrastructure will ensure the impact on communities, the environment and important habitats can be minimised, managed and mitigated.

- Existing sites (where appropriate) and brownfield sites should be considered in the first instance for any infrastructural development or expansions.
- Avoid siting alternative fuel infrastructure immediately adjacent to or adjoining European Sites in order to limit the potential impacts and disturbance to habitats and species therein during construction and/or operation. Where this is unavoidable, all development proposals should be accompanied by an Appropriate Assessment Screening Report and/or Natura Impact Statement, whichever is deemed necessary, which should include, but not be limited to assessing construction related impacts (e.g. water quality), operational related impact (e.g. such as disturbance from noise and water quality) and ex-situ impacts (e.g. roosting/feeding grounds for SPA birds outside of the SPA).
- In the case of shore side electricity or LNG facilities, which may be located within or immediately adjacent to an SAC/SPA, infrastructure should be located on existing built ground/structures where possible. This is to limit the potential impacts and disturbance to habitats and species during construction and/or operation. All shore side electricity infrastructure development proposals should be accompanied by an Appropriate Assessment Screening Report and/or Natura Impact Statement, whichever is deemed necessary, which should be informed by detailed ecological survey data related to the European Sites concerned. It should include, but not be limited to assessing construction/operational related impacts (e.g. habitat loss, water quality) and disturbance related impacts (e.g. noise impacts to birds or increased footfall of ships/people in a certain location).
- Avoid siting alternative fuel infrastructure in proposed Natural Heritage Areas (pNHAs), Natural Heritage Areas (NHAs), Statutory Nature Reserves, Refuges for Fauna and Annex I Habitats occurring outside of European Sites, but which provide a supporting role to European Sites. Where this is unavoidable, all development proposals should be accompanied by an Appropriate Assessment Screening Report and/or Natura Impact Statement, whichever is deemed necessary.
- In order to protect habitats which, by virtue of their linear and continuous structure (e.g. rivers and their banks, hedgerows) or their contribution as stepping stones (e.g. ponds or small woods), are essential for the migration, dispersal and genetic exchange of wild species, these features will be protected as far as possible from loss or disruption through good site layout and design.
- To protect river habitats and water quality (including physical habitat and hydrological processes/regimes), ensure that no alternative fuel facilities takes place within a minimum distance of 25 m measured from each bank of any river, stream or watercourse.
- To protect river habitats, species and water quality ensure that no infrastructure, including clearance and storage of materials, takes place within a minimum distance of 25m measured from each bank of any river, stream or watercourse. • To protect water quality, where alternative fuel infrastructure is being developed at existing refuelling infrastructure, ensure that the appropriate tests for contaminated land are carried out and the appropriate mitigation measures are developed prior to the construction of alternative fuel infrastructure.
- To protect water quality, ensure Sustainable Drainage Systems (SuDS) is applied to any new facility and that site-specific solutions to surface water drainage systems are developed taking account of the alternative fuel type(s) being deployed on the site, and which meet the requirements of the Water Framework Directive and associated River Basin Management Plans.
- Avoid development of infrastructure in flood risk areas. Reference should be made to the Planning System and Flood Risk Management for Planning Authorities (DECLG/OPW 2009) and the National Flood Hazard Mapping (OPW) while referring to the relevant Flood Risk Management Plan (FRMP).
- Ensure sites for alternative fuel infrastructure are surveyed for the presence of invasive species (as listed in the Third Schedule of the Birds and Natural Habitats Regulations) prior to infrastructural development, and that strict protocols are applied to prevent the spread of invasive species.
- Avoid, as far as possible, siting alternative fuel infrastructure in areas protected for landscape and visual amenity, geological heritage and/or cultural heritage value. Where this is unavoidable, an impact assessment should be carried out by a suitably qualified practitioner and appropriate mitigation and/or alternatives must be provided.
- Avoid geologically unsuitable areas including karst where practicable, and areas susceptible to subsidence or landslides.
- Impact from a transport perspective to be assessed including road access, network, safety and traffic patterns to and from the proposed facility in accordance with road design guidelines and/or relevant local authority guidelines in relation to roads.

In addition to the foregoing, the development of any future refuelling and recharging infrastructure should assess the potential vulnerability of new infrastructure to the likely impacts of climate change.

9.3 Safety Aspects

Public safety is of paramount importance in the development of alternative fuels infrastructure, particularly in relation to the specific targets for CNG in this Framework. In this context, all CNG suppliers will be required to apply and be issued with a Supply Licence by the CER as per CER Decision Paper Compressed Natural Gas (CNG) for Vehicular Transport: Licensing Arrangements (CER/16/154). As part of that Licence application, a safety case will be required to be submitted by the applicant. The CER Energy Safety Division will assess safety cases received from undertakings wishing to act as CNG suppliers against the requirements of the Safety Case Guidelines (CER/16/101) and following issuance of a licence, the CER will audit and inspect these undertakings against their safety cases.

Furthermore, the CER will also assess material changes to the Transmission and Distribution System Operators' safety cases to incorporate CNG and, if accepted, will audit and inspect these against their safety cases.

The CER have also committed to developing Safety Case Guidelines for the CNG suppliers for vehicular transport to assist these undertakings in developing their safety cases.
The development of future recharging and refuelling infrastructure, both the siting and operation, will need to take into account all public and/or occupational safety concerns. In addition, the development of such infrastructure will need to adhere to existing safety standards and to adapt to future specifications as they are developed and agreed by the European Standards Organisations.

Section 10

Summary of Implementation Plan For 2017

No.	Measure	Deadline	Responsibility
1	Establish steering group to oversee the implementation of the Framework	End April 2017	DTTAS/DCCAE
2	Implement regulations in respect of technical specifications, as adopted, for recharging and refuelling points in line with Annex II of Directive 2014/94/EU	End October 2017	DTTAS
3	LEV Taskforce to make recommendations to Government on EVs	End June 2017	DTTAS/DCCAE
4	Establish Green Bus Fund	End March 2017	DTTAS
5	Installation of 5 CNG publicly accessible fast-fill stations at strategic locations, including Dublin Port	End December 2017	Gas Networks Ireland
6	Complete assessment on biogas and biomethane	End December 2017	DCCAE/SEAI
7	Introduce new accelerated capital allowance (ACA) tax incentive for companies, to encourage investment in refuelling infrastructure and equipment for CNG, LNG and LPG	End December 2017	DCCAE/SEAI
8	Examine incentives/supports required for biofuels to meet targets under Renewable Energy and Fuel Quality Directives	End December 2017	DCCAE
9	Adhere to environmental policy measures set out in section 8.3	Ongoing	DTTAS/DCCAE
10	Adhere to siting criteria as set out in section 9.2		Relevant Planning Authority/ Infrastructure Owner
11	Develop KPIs to monitor the implementation and effectiveness of Framework	End September 2017	DTTAS/DCCAE
12	LEV taskforce to make progress on recommendations to Government on a range of alternative technologies including natural gas, hydrogen and LPG	End December 2017	DTTAS/DCCAE
13	Develop implementation plan for 2018 based on the outcome of 2017 plan and measures outlined in Section 8	End December 2017	DTTAS/DCCAE

Table 16 *Implementation plan timeline*

Section 11

Review Provisions

Article 10 of Directive 2014/94/EU provides for a reporting and review structure in relation to this Framework. Ireland will be required to report to the European Commission on the implementation of its Framework by 18 November 2019 and every three years thereafter. The report must contain a list of measures that Ireland has taken in support of alternative fuels infrastructure build-up. Annex 1 of the Directive prescribes what must, at a minimum, be included in the report.

DTTAS will monitor progress on the measures contained with reference to any implementation plans developed under this Framework, such as the plan for 2017 set out in Section 10.
It is within this context that the approach to policy on alternative fuels will be reviewed and revised, as appropriate, going forward. As the medium term potential of technologies becomes clearer, incentives will be reviewed, ensuring that the most suitable options are pursued at the most appropriate time along the pathway to full decarbonisation. Close cooperation between key stakeholders and relevant Government departments and agencies will continue as part of this Framework's review process.

Environmental Monitoring

Article 10 of the SEA Directive (2001/42/EEC) requires Member States to monitor the significant environmental effects of the implementation of plans "in order, inter alia, to identify at an early stage unforeseen adverse effects to be able to undertake appropriate remedial action". The primary purpose of monitoring is to cross-check significant environmental effects which arise during the implementation stage against those predicted during the preparation stage of this Framework. A monitoring programme is developed based on the indicators selected to track progress towards reaching the targets paired with each SEO, thereby enabling positive and negative impacts on the environment to be measured. The environmental indicators have been developed to show changes that would be attributable to implementation of the Framework.

Accordingly, DTTAS is proposing to put in place the following environmental monitoring programme (see Table 17) to comply with the recommendations of the SEA. This programme will help to track progress towards achieving SEOs and reaching targets, and includes sources of relevant information. It can be seen that the majority of the information required is already being actively collected (by NPWS, SEAI, CSO and other programmes).

Environmental Component	Key Effects Identified	Strategic Environmental Objectives (Seos)	SEO Targets	SEA Indicators	Responsibility/ Review Timescale
Biodiversity, flora and fauna (BFF)	– infrastructural development – emissions from CO_2, NOx and particulate matter	Preserve, protect and maintain the terrestrial, aquatic and soil biodiversity, particularly EU and nationally designated sites and protected species	Majority of habitats or species in, or moving towards, favourable conservation status by 2020. (Based on national Target 17 of Ireland's Action Plan for Biodiversity 2011–2016)	The status of protected habitats and species as reported to the EU (report due every six years, first report in 2007)	National Parks & Wildlife Service (NPWS) (every 6 years)
			Preserve and protect habitat and species from transport related air emissions	Annual percentage reduction in national combustion gases as per EPA monitoring	EPA (yearly)
Population and human health (PHH)	– emissions from CO_2, NOx and particulate matter – lack of uptake in zero emission cars and low emission vehicles	Contribute to sustainable development while protecting population and human health	Zero emission cars and vans sold in Ireland from 2030	Annual percentage increase in zero emission cars and vans sold in Ireland compared with petrol/diesel cars	SEAI (yearly)
Soil and land use (SL)	– land use change – infrastructural development	Avoid damage to soils and the environment from land use change for alternative fuel use	Ensure the requirements in the ILUC Directive, 2015 to cap the contribution of biofuels from food crops at 7% are adhered to and implemented	Percentage of biofuels derived from food crops grown in Ireland	Teagasc/ DAFM/SEAI (yearly)
Water (W)	- infrastructural development	Protect the quality and management of watercourses and groundwater, in compliance with the requirements of the Water Framework Directive and associated River Basin Management Plans	Comply with the Water Framework Directive to prevent any deterioration of quality status of water bodies currently with high or 'good status'	The application of the Siting Criteria to all infrastructure developments associated with the Framework	EPA/DTTAS/ relevant planning Authority (every 3 years)

Environmental Component	Key Effects Identified	Strategic Environmental Objectives (Seos)	SEO Targets	SEA Indicators	Responsibility/ Review Timescale
Air quality (AQ)	– emissions from CO_2, NOx and particulate matter	Minimise emissions of NOx and particulates and other pollutants to atmosphere from transport combustion	Review of vehicle and fuel taxation	Percentage reduction in the national share of diesel car stock as reported by SEAI	SEAI (yearly)
Climatic factors (CF)	– increased GHG emissions	Minimise emissions of greenhouse gases	A net reduction in the GHG emissions from transport as outlined in the Greenhouse Gas Emissions Inventory. (Inventory for 2014 reported a 2.5% increase in carbon dioxide equivalent emissions)	Percentage reduction in carbon dioxide equivalent emissions for transport as reported in the EPA National Annual Inventory	EPA (yearly)
			The Renewable Energy Directive (2009/28/EC) set a target for all member states to reach a 10% share of renewable energy in transport by 2020	Share of renewable energy in transport consumption (REST)	SEAI (yearly)
Material assets (MA)	– lack of uptake in zero emission cars and low emission vehicles – emissions from CO_2, NOx and particulate matter	Support an increased role of alternative fuels and associated infrastructure without conflicting with environmental protection objectives	Develop key performance indicators (KPIs) on the alternative fuel policy measures	KPIs to be developed within 1 year of adoption of the Framework	DTTAS (every 3 years)
			Report annually on the KPIs for the alternative fuel policy measures	Overall achievement of the Framework in relation to its vision of 'zero emission cars and vans sold in Ireland from 2030'	~~DTTAS~~ DTTAS (yearly)

Environmental Component	Key Effects Identified	Strategic Environmental Objectives (Seos)	SEO Targets	SEA Indicators	Responsibility/ Review Timescale
			DTTAS to undertake meetings twice a year with the Department of Communications, Climate Action and Environment to ensure that there is coordination between the National Renewable Electricity Policy and Development Framework and the Framework on electricity supply from renewable sources. The meetings will focus on progress made on implementing the National Renewable Electricity Policy and Development Framework	Number of meetings undertaken with the DCCAE and percentage increase in renewable electricity generated in Ireland and distribution allocated to electricity for transport	DTTAS (yearly)
Cultural heritage (CH)	infrastructural development	Protect places, features, buildings and landscapes of cultural, archaeological or architectural heritage	More appropriately dealt with at project (EIA) level	More appropriately dealt with at project level	n/a
Landscape (L)	infrastructural development	Protect and maintain the national landscape character	More appropriately dealt with at project (EIA) level	More appropriately dealt with at project level	n/a

Table 17 *SEA Monitoring Programme*

Section 12

Appendices

Appendix 1: Definitions

Alternative fuels: fuels or power sources which serve, at least partly, as a substitute for fossil oil sources in the energy supply to transport and which have the potential to contribute to its decarbonisation and enhance the environmental performance of the transport sector. They include, inter alia:

- Electricity
- Hydrogen
- Biofuels as defined in point (i) of Article 2 of Directive 2009/28/EC
- Synthetic and paraffinic fuels
- Natural gas, including biomethane, in gaseous form (CNG) and liquefied form (LNG)
- Liquefied petroleum gas (LPG)

Electric vehicle: a motor vehicle equipped with a powertrain containing at least one non-peripheral electric machine as energy converter with an electric rechargeable energy storage system, which can be recharged externally

BEV: battery electric vehicle is an electric vehicle powered entirely by batteries

PHEV: plug-in hybrid electric vehicle is a vehicle which contains an internal combustion engine and an electric motor. The batteries in a PHEV can be charged externally

High power recharging point: a recharging point that allows for a transfer of electricity to an electric vehicle with a power of more than 22 kW

Normal power recharging point: a recharging point that allows for a transfer of electricity to an electric vehicle with a power less than or equal to 22 kW, excluding devices with a power less than or equal to 3.7 kW, which are installed in private households or the primary purpose of which is not recharging electric vehicles, and which are not accessible to the public

Recharging or refuelling point accessible to the public: means a recharging or refuelling point to supply an alternative fuel which provides Union-wide non-discriminatory access to users. Non-discriminatory access may include different terms of authentication, use and payment

Recharging point: an interface that is capable of charging one electric vehicle at a time or exchanging a battery of one electric vehicle at a time

Refuelling point: a refuelling facility for the provision of any fuel with the exception of LNG, through a fixed or a mobile installation
Refuelling point for LNG: a refuelling facility for the provision of LNG, consisting of either a fixed or mobile facility, offshore facility, or other system

Shore-side electricity supply: the provision of shore-side electrical power through a standardised interface to seagoing ships or inland waterway vessels at berth

Trans-European Transport Network (TEN-T) in Ireland: Ireland has one Core Network Corridor crossing its country: the North Sea–Mediterranean Corridor stretches from Belfast to the Irish ports of Cork and Dublin, as well as from the northern UK ports of Glasgow and Edinburgh through Belgium, with a branch from Amsterdam and Rotterdam, via Luxembourg to Strasbourg and Basel and via Lyon to the southern French port of Marseille Fos. It covers rail, road, airports, ports and the Dutch–Belgian inland waterway system, as well as the Rhône River [50]

Elements of the TEN-T core corridor in Ireland

- M1 Motorway (Dublin–Dundalk)
- M50 Motorway
- N7 National Road (Dublin–Naas)
- M7 Motorway (Naas–M7/M8 junction)
- M8 Motorway (M7/M8 junction–Cork)
- Cork–Dublin–Belfast Rail Line
- Port of Dublin
- Port of Cork
- Port of Shannon Foynes
- Dublin Airport
- Cork Airport

[50] 'http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/doc/ten-t-country-fiches/merged-files/ie.pdf

Appendix 2: Fuel Types Across Fleet Spectrum

Fleet Spectrum							
Fuels Types	Motorcycles	Cars/Taxis	LGVs	Buses	HDVs	Trains	Ships
Petrol	To be phased out	To be phased out except in PHEVs	To be phased out	Not used	Not used	Not used	Not used
Diesel	Not used	Diesel to be phased out	Diesel to be phased out	Phased out as technology matures	Penetration lessens as technology matures	Diesel to be phased out in commuter rail in favour of electrification	Ships use diesel oil, low sulphur oil and heavy fuel oil. LNG best current alternative
Electricity	Electricity best current zero emissions solution	Electricity best current zero emissions solution	Electricity viable option for van fleet	Fully electric buses in development and trialling phase. Costly to support immature technology in the short term	Developments suggest that electricity will eventually form part of the fuel mix in freight. Not currently an option	Increasing electrification of commuter rail	Potential use while ships are shore-side.
Hydrogen	Hydrogen fuel cell could be part of a future fuel mix for motorcycles	Hydrogen promising long-term solution. Costly to support infrastructure in absence of market and technology choice	Same as cars	Current cost of hydrogen fuelled buses and infrastructure is obstructive	Hydrogen most promising long-term solution for freight	Hydrogen powered locomotives are likely to be a future solution but technology not mature	Likely future options are hydrogen fuelled ships power-assisted by an electric motor that gets its electricity from a fuel cell
CNG	Not viable	Preference for zero emissions vehicles over CNG	CNG could form part of fuel mix in the short to medium term	CNG with biomethane provides a viable low emissions option in the short to medium term	CNG with biomethane provides a viable low emissions option in the short to medium term	Gas fuelled trains not in common use but could be future low emissions alternative to diesel where electricity not viable	Not suitable for shipping.
LNG	Not viable	Best suited to long distance journeys, i.e. transatlantic freight and shipping	Not energy efficient in stop–start type operations	Not energy efficient in stop–start type operations	Not energy efficient in stop–start type operations	Gas fuelled trains not in common use but could be future low emissions alternative to diesel	LNG considered better alternative
Biomethane	Not viable	Likely to be used in conjunction with CNG	Likely to be used in conjunction with CNG	Likely to be used in conjunction with CNG	Likely to be used in conjunction with CNG	Likely to be used in conjunction with CNG	LNG strong candidate for alternative shipping fuel. No market currently in Ireland. Costly infrastructure
LPG	Not used	Currently in use in taxis but not long-term solution	Offers another interim alternative solution especially with bio-LPG	Offers another interim alternative solution	Offers another interim alternative solution	Not a likely long-term solution	If liquefied, could be used in conjunction with LNG

Fleet Spectrum							
Fuels Types	Motorcycles	Cars/Taxis	LGVs	Buses	HDVs	Trains	Ships
Biofuel	Used as drop-in fuel or blended with petrol	Used as drop-in fuel or blended with petrol and diesel	Used as drop-in fuel with or blended petrol and diesel	Used as drop-in fuel or blended with diesel	Used as drop-in fuel or blended with diesel	Used as drop-in fuel or blended with diesel	Not commonly used
Synthetic Fuels	Potential to be used as drop-in fuel or blended with petrol	Potential to be used as drop-in fuel or blended with petrol and diesel	Potential to be used as drop-in fuel or blended with petrol and diesel	Potential to be used as drop-in fuel or blended with diesel	Potential to be used as drop-in fuel or blended with diesel	Potential to be used as drop-in or blended fuel with diesel	Not commonly used

Table 18 *Fuel types across the fleet spectrum*

Appendix 3: Abbreviations

AA Appropriate Assessment
ACA Accelerated Capital Allowance
AFV Alternative Fuel Vehicles
APUS Auxiliary Power Units
AQ Air Quality
BEVS Battery Electric Vehicles
BFF Biodiversity, Flora and Fauna
BTL Biomass to Liquid
CBA Cost Benefit Analysis
CEF Connecting Europe Facility
CER Commission for Energy Regulation
CF Climatic Factors
CH Cultural Heritage
CNG Compressed Natural Gas
CO_2 Chemical Name for Carbon Dioxide
CSO Central Statistics Office
DAA Dublin Airport Authority
DAFM Department of Agriculture, Food and The Marine
DCCAE Department of Communications, Climate Action and Environment
DRD NI Department for Regional Development Northern Ireland
DTTAS Department for Transport, Tourism and Sport
ENEVATE Europe Network of Electric Vehicles and Transferring Expertise
EPOS Environmental Protection Objectives
EPRI Electric Power Research Institute
ESB Electricity Supply Board
ETS Emission Trading System
EU European Union
EVI Electric Vehicle Initiative
FCEV Fuel Cell Electric Vehicles
FEGP Fixed Electrical Ground Power
FINSENY Future Internet Smart Energy
FLT Fork Lift Trucks
FRMP Flood Risk Management Plan
GHG Greenhouse Gas
GLT Gas To Liquid
GNI Gas Networks Ireland
GWH Gigawatt Hour
HC Hydrocarbons
HDVS Heavy Duty Vehicles
HVO Hydrotreated Vegetable Oil
IEA International Energy Agency
ILPGA Irish Lpg Association
ILUC Indirect Land Use Change
KPI Key Performance Indicator
LDV Light Duty Vehicles
LEVS Low Emission Vehicles
LGVS Light Goods Vehicles
LNG Liquefied Natural Gas
LPG Liquefied Petroleum Gas
MA Material Assets
MERGE Mobile Energy Resources in Grids of Electricity
MT Metric Ton
NEEAP National Energy Efficiency Action Plan
NGVS Natural Gas Vehicles
NHAS Natural Heritage Areas
NI Northern Ireland
NIS Natura Impact Statement
NOX Nitric Oxide and Nitrogen Dioxide
NPF National Policy Framework
OPW Office of Public Works
PHEV Plug-In Hybrid Electric Vehicles
PM Particle Matter
R&D Research and Development
RAB Regulated Asset Base
RES-T Renewable Energy Target for Transport
SAC Special Areas of Conservation
SEA Strategic Environmental Assessment
SEAI Sustainable Energy Authority of Ireland
SEO Strategic Environmental Objective
SIMI Society of the Irish Motor Industry
SL Soil and Land Use
SOX Sulphur Oxide
SPAS Special Protection Areas
SSE Shore-Side Electricity
SUDS Sustainable Drainage Systems
TEN-T Trans-European Transport Networks
VRT Vehicle Registration Tax