An Chomhairle Náisiúnta Eacnamaíoch agus Shóisialta
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NESC Forum: Opportunities & Challenges for Climate Mitigation in the Irish Transport Sector

Discussion Paper: Tuesday 1 Dec 2015

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NESC Forum: Opportunities & Challenges for Climate Mitigation in the Irish Transport Sector

A Discussion Paper Prepared by
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for NESC Forum held on
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in The Morrison Hotel, Dublin.

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Executive Summary

A sustainable transport system is essential if we are to make any meaningful attempts to reduce greenhouse gas (GHG) emissions as part of our overall contribution to tackling climate change. In addition to those international commitments, there are also continuing concerns in relation to security of supply and volatile oil prices, which may have a significant effect on Ireland's entire economic fabric given our almost exclusive reliance on oil imports, as well as obesity issues that have been exacerbated by car dependency and sedentary lifestyles.

Sustainable transport has a number of co-benefits in terms of air pollution, the development of sustainable communities that can enhance public health, quality of life and well-being, and reduced traffic congestion, which can improve economic competitiveness. It is essential to capture the synergies between transport policy and health, land use and fiscal policies to ensure policy integration at vertical and horizontal levels. This will require strong and adaptive institutional structures that can support a robust transport policy with strong linkages with other sectoral policies.

This paper is prepared to stimulate discussion at the National Economic and Social Council (NESC) forum on sustainable transport, which will be held on 1 December 2015. The barriers to sustainable transport and challenges to policy implementation are well recognised (Browne *et al.*, 2011). While it is important to be mindful of these challenges, it is hoped that the forum will stimulate debate and cultivate a constructive discussion among the participants on both realistic and radical solutions in the short term and long term. In particular, delegates are encouraged to think outside the box and propose suggestions that will assist Ireland on a more sustainable transport trajectory.

Introduction

1.1 Objective of Forum

The objective of this paper is to provide a framework for discussion among the participants at the forum entitled *Opportunities and Challenges for Climate Mitigation in the Irish Transport Sector*, which has been organised by the National Economic and Social Council (NESC) for 1 December 2015.

The purpose of the forum is to stimulate debate among relevant senior public and private decision-makers and stakeholders, with an emphasis on the opportunities and potential benefits afforded by sustainable transport. It is anticipated that the forum will provide a 'safe environment' for robust and critical analysis of the key technical, organisational and socio-political challenges in decarbonising the transport sector in Ireland. In particular, the forum will aim to cultivate open discussion and encourage discordant voices that challenge conformist thinking and the prevailing orthodoxy (NESC, 2012a, p. iii).

The forum will involve four panel sessions focusing on the following topics:

i) Reflections on areas of current progress and how to maximise opportunities for further development;

ii) Practical sustainable-transport solutions and the associated national economic, environmental and social benefits;

iii) Low-carbon solutions for both passenger vehicles and freight transport;

iv) Consideration of institutional and policy issues required to implement cross-cutting actions and innovative solutions.

1.2 NESC Principles on Climate Change

NESC has previously outlined five guiding principles supporting its vision that Ireland will be a carbon-neutral society by 2050, including (O'Donnell, 2012):

- Economic prosperity, recovery and social development;
- Incremental and permanent decarbonisation;
- Responsibility, integrity and leadership;
- Reform of public institutions and governance and
- Societal engagement.

To achieve this, it was envisaged that a three-track approach should be adopted. Track 1 involves the strengthening of institutional structures and strategic engagement. Track 2 involves exploration and experimentation in order to drive organisational networks towards decarbonisation. Track 3 requires design and implementation to facilitate progress towards national and international targets. Among the five strategic building blocks identified was a sustainable transport system that serves economic, societal and environmental needs with a particular focus on the Track 2 exploratory project of promoting and incentivising electric vehicles (EVs).

1.3 Scale of the Challenge

The scale of the challenge cannot be underestimated given the dependence on private car transport for personal mobility and the reliance on road freight transport that is critical for moving goods. Given the improving economy, there is an understandable reluctance to propose and implement measures that may be perceived as potentially impacting on national competitiveness or that may be politically unattractive, particularly in light of the public opposition to new taxation that has been evident since the introduction of water charges. Nonetheless, if we are serious about the challenge of delivering a more sustainable transport system, we must adapt radical measures not only in the area of transport but also in terms of housing and land use, the concentration of employment and its spatial relationship with where people live or choose to live, and the need for a balanced suite of fiscal measures.

Transport is a complex system and depends on multiple factors, including the pattern of human settlements and consumption, the organisation of production and the availability of infrastructure. It is also characterised by a number of sometimes diametrically competing goals, including increased mobility and accessibility balanced with the need for environmental protection. Policy intervention in the transport sector should: (a) differentiate between structural or long-term demand and discretionary or short-term demand; (b) recognise that different policy options may be required for passenger and freight transport; and (c) acknowledge the potential effects on economic competitiveness and those who are car-dependent, including people living in rural areas and those in lower socio-economic groups.

Profile of the Transport Sector: The 'Why' Question

Transport is the backbone of the European economy and accounts for about 7 per cent of Gross Domestic Product (GDP) and more than 5 per cent of total employment in the EU. A modern economy and society depends on the quality of its transport system and its ability to move people and goods. Transport is responsible for around 25 per cent of EU GHG emissions and is the second-biggest GHG-emitting sector after energy. Road transport alone contributes about one-fifth of the EU's total emissions of CO_2 and more than two-thirds of transport emissions are from road transport.

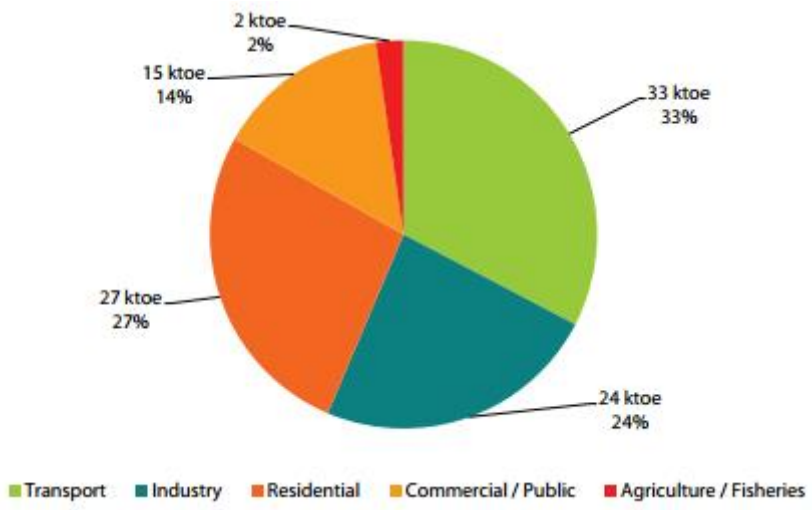
Transport emissions in the EU continued to increase until 2008 when they started to decrease because of the volatility in oil prices, increased efficiency of passenger cars and slower growth in mobility. The European Commission has recognised that significant reductions in GHG emissions from transport are required if the EU is to achieve its long-term goals, and has carried out a study to investigate the policies and technologies that are needed to achieve substantial emission reductions by 2050.[1]

2.1 Energy Consumption and CO_2 Emissions

In 2013, the transport sector in Ireland was responsible for the largest share of energy-related CO_2 emissions of any sector of the economy and accounted for 33 per cent of primary energy demand, 40 per cent of total final consumption and 35 per cent of total CO_2 emissions (12.6 $MtCO_2$). Figure 1 shows the total primary energy demand by sector in 2013. Energy use in the transport sector was 97.5 per cent-dependent on oil products, all of which were imported (see also Kelly *et al.*, 2009). The estimated cost of imports of oil products for the transport sector was €3.5bn, which accounts for just over half of the estimated total cost of fuel imports across the entire economy (Dineen *et al.*, 2014).

[1] The EU Transport GHG: Routes to 2050 Project (http://www.eutransportghg2050.eu/cms/).

Figure 1: Total Primary Energy Demand by Sector, 2013



The share of energy demand between the different modes of transport in 2013 was private cars (43%), road freight (21%), aviation (14%), public passenger transport (5%) and other (17%). Between 2007 and 2013, CO_2 emissions fell by 26 per cent to 12.6 $MtCO_2$. This reduction in emissions shows a strong correlation with the changes to the taxation of private cars introduced in 2008 together with obligations on car manufacturers to improve the efficiency of their new car fleets. Both of these policy measures have significantly influenced purchasing patterns of new cars. In 2007, 1.5 per cent of all new cars was in the A emissions band and 17.7 per cent was in the combined A & B emissions bands. In the first six months of 2014, 67.2 per cent of all new cars was in the A band and 94.8 per cent was in the combined A & B emissions band. The average specific CO_2 emissions of all new cars purchased in 2013 was 120.7 gCO_2/km (B1 band).

Similarly, between 2007 and 2013 final energy consumption in the transport sector fell by 25 per cent to 4,280ktoe. Despite the reductions in both energy usage and CO_2 emissions in the period 2007 to 2013, the overall trend between 1990 and 2013 has been of exceptionally high growth, and final energy consumption in transport has increased by 112 per cent, which is the largest growth of any sector both in absolute and in percentage terms. CO_2 emissions have also increased by 108 per cent over the same period (Dineen *et al.*, 2014). Although the economic downturn provided some respite from continuing trends, the trends over the wider period from 1990 are anticipated to continue in the event that there is sustained economic growth, unless we can achieve decoupling of economic growth from transport demand.

2.2 Private Car and LDV Stock

The total number of private cars in 2013 was 1.91 million, which was an increase of 140 per cent from 1990 levels. This was down 0.7 per cent from a high of 1.92 million vehicles in 2008. The total number of private cars licensed for the first time in Ireland fell 49 per cent between 2007 and 2013 from 239,473 to 121,516. Of these, the number of new private cars licensed for the first time fell by 61 per cent from 180,754 to 71,348. However, on a per capita basis, car ownership levels in Ireland are still below the EU-15 average. In 2009, there were 430 cars per 1,000 population compared with 486 across the EU-15, which indicates further growth potential. The numbers of light-duty vehicle (LDV) are projected to reach 2.67 million by 2025 (Daly & Ó Gallachóir, 2011).

2.3 EPA Projections

The EPA has proposed two scenarios for transport emissions. In the most recent projections, transport emissions are projected to increase by 19 per cent over the period 2013–2020 to 13.2 Mt CO_2-equivalents under the With Measures scenario. This includes: (a) the impact of VRT and motor tax changes (introduced in 2008), public-transport efficiencies (e.g. integrated ticketing) and the carbon tax imposed on fuels since 2010; (b) improvements to the fuel economy of private cars for new cars to 120g/km in 2015 and 95g/km in 2020; and (c) 6 per cent of transport energy demand from biofuels by 2020.

Under the With Additional Measures scenario, transport emissions are projected to increase by 13 per cent over the period 2013–2020 to 12.5 Mt CO_2-equivalents, returning transport emissions to 2009 levels by 2020. In this scenario, it is assumed that the RES-T target will be met and biofuel use will be 10 per cent of total transport-fuel demand by 2020. This is the main measure assumed to deliver emission reductions in the transport sector. It also assumes that more efficient road-traffic movements such as eco-driving techniques are in place (Environmental Protection Agency, 2015).

Legislative Commitments and Policy Drivers: The 'How Much' Question

Ireland faces a particular challenge to reduce GHG emissions and is subject to binding international and European targets. The obligation to reduce GHG emissions arises because of our international obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol as well as our commitments under the EU Effort Sharing Decision. In addition, sustainable-transport policy is underpinned by the 2009 Smarter Travel Plan and National Cycle Policy Framework (NCPF). Further details are provided in the Appendix A.8 to this paper.

While the debate on the recent Climate Action and Low Carbon Development Bill 2015 has to some degree focused on the question of 'how much', with particular criticism levelled at the failure to include any binding targets for 2050, it is imperative that constructive discourse focuses on an analysis of 'how to' decarbonise the economy and society. In short, it is beyond any reasonable debate that we need to facilitate decarbonisation on a significant scale so that the transport sector can progress along a more sustainable trajectory. This transition to a carbon-neutral society will require serious political and stakeholder action and deep engagement from political and private actors at all levels, which is supported by strong institutional governance.

Discussions on 'how much' will continue to be the focus in 2016 with various EU negotiations and decisions on effort-sharing. However, we must make immediate and sustained progress on the challenge of 'how to' as part of a more effective, multi-level and polycentric approach to tackling climate change at different hierarchical and vertical levels. As noted previously by NESC, climate-change policy is a loop not a line, in which there is a dynamic relation between 'how much' emissions reduction and policy action governments commit to and their understanding of 'how to' achieve decarbonisation (see also Keohane & Victor, 2011). This requires a circular and holistic vision of how to deal with climate change and a shift away from the traditional linear models and framing of the policy challenge. Thus, it is necessary to balance the policy emphasis on 'how much' emissions should be reduced with a sharpened focus on 'how to' decarbonise the economy and society (O'Donnell, 2012, p. iv).

Policy Objectives: The 'How To' Question

This chapter will focus on particular aspects of the national sustainable transport policy and identify where progress has been made and other actions that have yet to be delivered.

4.1 Modal Shift and Public Transport

Barriers to modal shift, including a shift to public transport, cycling and walking, can be considered under three main categories. The first category is 'hard factors', which include cost, car-ownership levels, spatial planning and a perception that public transport is not reliable or inaccessible. This is often dictated by employment and residential constraints or longer-term structural constraints.

The second category is 'soft factors', which include:

- Lack of information about travel choices;
- The need or desire for independence and personal control;
- Dislike of waiting and having to plan behaviour in advance;
- Desire for convenience and variety provided by car travel;
- Higher physical, cognitive or affective effort required to use public transport;
- The ability to express personality and autonomy through driving style and choice of a particular vehicle;
- The desire for privacy and flexibility;
- Employment dependence, and
- The association of public transport with stress, lack of comfort, etc.

The third category is 'complementary' or lifestyle factors, including a perception of the low status of public-transport users, personality characteristics of travellers, limited travel-time budgets, lifestyle issues, the need to carry goods or passengers, inclement weather, inability to use other modes due to health factors or disability, etc.

Public transport has perhaps suffered through 'cognitive dissonance', where drivers adjust their perceptions and attitudes in order to support their current behaviour or because objective measures do not reflect the ways in which consumers perceive the

services offered. Thus, people may have entrenched views on the attractiveness, costs and reliability of public transport that have been shaped by past experiences or anecdotal evidence. Although the image of public transport has improved and its reliability has been enhanced by real-time passenger information (RTPI), it may be necessary to actively promote public transport through, for example, local and national awareness campaigns, market segmentation and/or free travel vouchers.

Furthermore, there is still a residual problem in terms of availability, particularly in rural and less densely populated areas. The Consensus (Consumption, Environment and Sustainability) Project found that rural Ireland is particularly affected by gaps in public-transport provision. Almost half of all rural respondents (44%) reported that there is no public transport for their commute to work, school or college compared to 28 per cent in urban areas. When respondents were asked what would encourage people to reduce their car journeys, 53 per cent stated 'improved, more affordable public transport'. There is no purpose in forcing people from their cars if there are no viable alternatives available (Lavelle *et al.*, 2009).

A significant barrier to modal shift is car dependence, i.e. where there are no other viable alternatives and travel patterns are 'locked-in' in the short to medium term. This should be distinguished from a situation where there are realistic alternatives available and where private car travel is discretionary. Although discretionary demand may be easier to shift in the short term, long-term structural demand will be a more difficult challenge unless there are radical changes in spatial planning policy.

There appears to generally be a willingness to use alternatives to the car if the conditions are right and there is real potential for an increase in cycling and public transport for commuter journeys, particularly if there are significant improvements in the provision of services. However, dislocation of residence and workplace is a major barrier and this severely reduces the potential for cycle commuting and a modal shift to public transport (Kingham *et al.*, 2000). Alternatives do exist to achieve modal shift these depend on cultural values and entrenched existing practices, which may foster an attitude of intransigence and stasis (Button, 2006). While there are real barriers to modal shift away from the car, such as a lack of viable alternatives in rural areas, there are effective strategies to encourage more cycling and walking, often through a combination of increased information, incentives, peer/community support and appreciating the potential co-benefits such as the positive health effects (Moore, 2012).

Cycling has experienced something of a renaissance in recent years, not least because of the success of the dublinbikes scheme, which was subsequently rolled out to Cork, Limerick and Galway, and the Cycle to Work Scheme, which offered tax incentives for employees looking to purchase new bicycles (Caulfield, 2014). Ireland

has a National Cycling Policy Framework (NCPF) since 2009, which provides a co-ordinated policy for the promotion of cycling. There is a considerable prospect that cycling will continue to experience renewed interest although ways need to be found to sustain this, given the ambitious target in the NCPF. Crucially for the first time, cycling policy was set out in an independent policy framework in recognition that it should be elevated from its traditional 'bridesmaid' role in transport policy. It also recognised that infrastructure design, which perhaps had historically focused on private car use, should be mindful of the needs of cyclists.

One possible way to promote cycling could be through cash incentives to encourage people to cycle to work. The municipal authority for the town of Massarosa in Tuscany has recently announced that it will pay people up to €50 a month to cycle to work based on their mileage. Eligible riders will record their mileage using a smartphone app to record and verify distances and may recover a rate of €0.25 per kilometre. This could conceivably be offered by local authorities or major employers and be funded through cash-out payments by those choosing to drive to work or who pay a premium for a parking space (Watters *et al.*, 2006).

In order to enhance the attractiveness of cycling, improvements will need to be made in the public realm, particularly in major urban areas. This will require traffic-calming measures and reduced speed limits as well as a reduction in overall traffic volumes. Major changes have recently been proposed in the Dublin City Transport Study for the Quays, College Green and Suffolk Street in Dublin, which are expected to be finalised following the public consultation process. Notably the plan for College Green envisages a ban on private cars, the development of a pedestrian plaza and traffic-flow reversal and, if implemented, will accommodate the Luas Cross City line, which will be completed by 2017. The number of buses travelling through the area is expected to double once the Luas is operational and private cars are removed.[2]

In addition, the new National Cycling Training Standard will bring current and future training activity under a best-practice standard. Cycle Right is an initiative of the Department of Transport, Tourism and Sport (DTTAS) in association with Cycling Ireland and other parties such as the Road Safety Authority (RSA), the An Taisce Green Schools Programme, An Garda Síochána, Cyclist.ie, Coaching Ireland and various local authorities and Local Area Sports Partnerships. Cycle Right training aims to give trainees the confidence, skill and road-safety knowledge to use bicycles. This will be delivered by a network of instructors who have attended the Trainers' Course and who are registered on the Cycle Right Trainers' Register, which will be maintained by Cycling Ireland.

[2] http://www.dublincity.ie/major-changes-proposed-dublin-city-transport-study-%E2%80%93-quays-college-green-suffolk-street, and http://www.dublincity.ie/TransportStudy.

The NCPF also identified the need to develop a National Cycle Network (NCN) to support recreational and tourist cycling. The 2010 scoping study identified potential route corridors between urban centres with a population of up to 10,000. The potential network identified in the scoping study is approximately 2,000km in length. Since 2009, funding has been provided for a number of projects that align with the concept of a delivery of a NCN, including a new route section of the Great Southern Trail, a route from Passage West to Douglas, a route section in Dungarvan town and the completion of the 42km Great Western Greenway.

Following a competitive process, funding was announced in June 2012 for 16 separate cycling projects, including on-road routes along rural roads and former national roads and off-road routes along former rail lines and canal towpaths. This phase of the NCN programme expired at the end of 2013 and a further €6.5m has been made available in funding to local authorities to deliver cycle routes under the second tranche of the NCN Local Authority Funding Scheme 2014–2016. Although the NCN is primarily a recreational and tourism facility, it may ultimately link into urban cycle routes and will have positive spillover effects in promoting cycling generally. There is also a need to develop a national walking policy and to promote permeability and walkability, particularly in residential and urban areas in line with the *Best Practice Urban Design Manual*.

4.2 Fiscal Measures

Fiscal measures can be very effective in shifting purchasing patterns towards more fuel-efficient vehicles, particularly if they are coupled with high-profile information-awareness campaigns and fuel-economy labelling. Tax reform can be used to incentivise take-up of best available technology for cars and vans and, as technology develops, for larger freight vehicles. There is a range of policy measures designed to encourage the reduction of CO_2 emissions from new passenger cars (Ryan *et al.*, 2006; Ryan & Turton, 2007). Collectively, these measures have influenced consumer behaviour and have resulted in a significant increase in the demand for low-emission vehicles, not least in Ireland and the Netherlands where the taxation system has changed from engine size to CO_2 emissions.

The changes to the VRT/motor tax system indicate that ecological tax reform, which shifts the taxation burden from income to pollution, can be effective. This change in consumer demand has the potential to drive manufacturers towards investment in R&D in pursuit of more efficient internal combustion engine (ICE) technology, particularly if the scale of consumer changes is significant. While vehicle taxes incentivise consumer change and will encourage consumers to demand more fuel-efficient vehicles, including diesel vehicles, it is not yet clear how the recent

Volkswagen controversy will impact on consumer and market confidence in diesel technology, which is perceived to be more fuel-efficient.

In 2013, revenues from environmental taxes in the EU-28 accounted for 2.5 per cent of GDP and 6.3 per cent of total tax revenues in the EU. The vast majority of energy taxes are levied on transport fuels and transport-fuel taxes amounted to 1.4 per cent of GDP.[3] The vast majority of energy taxes are levied on transport fuels and transport-fuel taxes amounted to 1.5 per cent of GDP. Investment in transport infrastructure is mainly financed by public funds, which often also cover around 50 per cent of operating costs of public-transport services. The use of public funding in addition to 'user-pays' sources is justified on the basis of wider socio-economic benefits. Total infrastructure costs in road transport are estimated at about 1.5 per cent of GDP. The most common external costs reach 2.6 per cent of GDP. These costs are paid by all citizens and are not related to the externalities of transport use. These costs are paid by all citizens and are not related to the externalities of transport use. (EC, 2009). Energy and Transport Europe Digest.[4]

The concept of paying for the externalities of private car use is not a novel idea in political economy or environmental economics literature. In numerous policy documents dating back to at least the early 1990s, the European Commission has emphasised the same messages of 'getting the prices right', 'internalisation of external costs' and, more recently, smarter pricing. However, there is a sense that radical fiscal measures will not be implemented because of a lack of political will and electoral concerns (Victor, 2011).

In the 2009 Smarter Travel Plan, it was recognised that the public consultation process indicated that there was broad agreement with the Government's vision of a sustainable transport system by 2020, including a recognition that fiscal measures will have to be introduced to discourage people from using the car unnecessarily. On congestion charging, most respondents who referred to the concept accepted the idea, at least in principle, but felt it was necessary to ensure that adequate alternative travel options would be in place before introduction of any such arrangement. In relation to road pricing, a charging regime based on use/congestion was seen as an equitable approach.

[3] http://ec.europa.eu/eurostat/statistics-explained/index.php/Environmental_tax_statistics#Environmental_taxes_by_category and http://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/economic_analysis/tax_structures/2014/report.pdf

[4] http://ec.europa.eu/dgs/energy_transport/newsletter/dg/2009/nl325-2009-09-24.html

However, concerns were raised in relation to the privacy of data about personal movement and the possible undue impact on rural dwellers who must rely on the private car to meet their travel needs. Action 11 of the Plan provided that;

> 'In the context of the Commission on Taxation Report due in 2009 we will consider the application of fiscal measures aimed at reducing car use and achieving a shift to alternative modes of transport, which will ease congestion, reduce further transport emissions and take into account economic competitiveness and social inclusion. Where necessary, we will carry out research to ensure effectiveness of this action'.

Although there are a number of potential fiscal measures, including carbon taxes/levies, congestion charges and tolls, parking pricing, nationwide road pricing and cap and share (and its variants), there does not appear to be any national vision for taxation in the transport system by 2020 and beyond, particularly considering the scale of reduction of GHG emissions that is required by binding commitments. It may also be argued that there is no unanimous consensus on what the appropriate mix of fiscal measures might be or whether it is feasible to introduce a nationwide road-user charging system where external costs are fully internalised and offset by reductions in labour and income tax.

4.3 Low-Carbon Technical Solutions

There are a number of low-carbon technical solutions that might be considered as alternative fuels and vehicles (AFVs), including biofuels and biogas, battery electric vehicles, plug-in hybrid electric vehicles (PHEVs), conventional hybrids, natural-gas vehicles (NGVs) and hydrogen or fuel-cell vehicles. Before examining each of these options, it is important to recognise that there has been considerable historic investment and sunk costs in conventional fuel infrastructure that lead to 'lock-in', particularly where new charging and fuelling infrastructure is required. Furthermore, the roll-out of new infrastructure on charging and refuelling may be hindered by the classic 'chicken and egg' dilemma, which is characteristic of a nascent market dependent on fixed costs (Browne *et al.*, 2012).

4.3.1 Infrastructure for Alternative Fuels and Vehicles

The Clean Power for Transport package aims to facilitate the development of a single market for alternative fuels for transport in Europe, and the Commission has produced a Communication laying out a comprehensive European alternative fuels strategy[5] for the long-term substitution of oil as an energy source in all modes of transport as well as a proposal for a Directive on the deployment of alternative-fuels

[5] COM(2013)17.

recharging and refuelling infrastructure.[6] The final Directive, which was adopted by the European Parliament and the Council in September 2014, requires Member States to develop national policy frameworks for the market development of alternative fuels and infrastructure and anticipates the use of common technical specifications for recharging and refuelling stations and the setting up of appropriate consumer information on alternative fuels.

Directive 2014/94/EU aims to develop an EU-wide network of recharging and refuelling points for alternative fuels with common standards for their design and use, including electricity, hydrogen, liquid biofuels, synthetic and paraffin fuels, liquefied petroleum gas and natural gas, including biomethane and compressed natural gas (CNG), as well as the development of harmonised EU-wide standards and common technical specifications (interoperability) and relevant, consistent and clear consumer information.[7]

The Directive requires alternative-fuels infrastructure to be implemented through Member States' national policy frameworks. This allows for a degree of flexibility. Member States must adopt national policy frameworks and notify them to the Commission within two years after the entry into force of the Directive. The frameworks should include an assessment of the state and future development of the alternative-fuels market in the transport sector as well as the national targets, objectives and supporting measures for the deployment of alternative fuels, including a minimum level of infrastructure to be put in place.

Article 3 requires the Commission to facilitate the development and implementation of the frameworks through the exchange of information and best practice. The Commission is also required to assist Member States in reporting on the frameworks and to report on the co-ordination and coherence of the frameworks. Member States must ensure that an appropriate number of electric vehicle (EV) charging points accessible to the public are in place by December 2020 in order to ensure that EVs can circulate in urban/suburban agglomerations. The number of charging points to be installed depends on the number of EVs estimated for 2020.

Recital 23 in the Preamble to the Directive suggests that, as an indication, the appropriate average number of recharging points should be equivalent to at least one recharging point per ten cars, taking into consideration the type of cars, charging technology and available private recharging points. Member States must also decide to include hydrogen refuelling points to ensure that there are an appropriate number

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6 COM(2013)18.

7 Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative-fuels infrastructure.

of points available for the circulation of hydrogen vehicles. This must be done by December 2025 at the latest. There are similar requirements for natural gas supply for transport, including fuelling points for CNG in urban and suburban areas, which should be installed by the end of 2020.

Member States are required to bring the Directive into force and prepare their national frameworks by 18 November 2016. DTTAS is responsible for implementing Directive 2014/94/EU in conjunction with the Department of Energy, Communications and Natural Resources (DCENR) and a public consultation process was undertaken in October–November 2015. In the policy considerations in the published Issues Paper, it was noted that there is a minimum requirement to establish adequate coverage of alternative-fuel infrastructure across the EU.

However, Ireland must be mindful of the proportionality and cost-effectiveness of the measures proposed and careful analysis will be required when establishing 'appropriate numbers' of such infrastructure. It is also suggested that there are currently no liquefied natural gas facilities in Ireland, which may necessitate co-operation with neighbouring Member States in the absence of high demand. Furthermore, it acknowledged that the Directive is not prescriptive on refuelling infrastructure for LPG and the extent to which Ireland will rely on LPG in the transport sector in the future will need to be examined. Critically, it noted that there are strong arguments for further investigation of hydrogen vehicles, despite no current market in Ireland. However, it acknowledged that the transition to a hydrogen-based transport system would involve radical changes to infrastructure and fuelling as well as major economic investment.[8]

4.3.2 Biofuels: Bioliquids and Biogas

As noted earlier, there are various options for AFVs that are available in the short term and longer term. Biofuels are renewable fuels produced from biomass and are recognised as an important means to address the challenges posed by emissions in the transport sector. They include biodiesel, bioethanol and pure plant oil (PPO). In the near term the use of PPO, which requires ICE modification, is expected to have limited potential due to its incompatibility with standard engine design and fuel distribution infrastructure. Blended alternatives such as biodiesel and bioethanol, which can be used as a fuel in conventional ICE vehicles, are expected to make a more significant contribution towards the national 2020 target (Ryan *et al.*, 2006).

[8] http://www.smartertravel.ie/sites/default/files/uploads/Consultation%20on%20development%20of%20NPF%20-%20Issues%20Paper.pdf.

In July 2010, DCENR introduced the Biofuels Obligation Scheme, which is the principal support for the uptake of biofuels in Ireland. The scheme is certificate-based and is administered by the National Oil Reserves Agency. Since January 2013, an obligated road-transport fuel supplier must hold six biofuel obligation certificates for every 94 litres (6.383%) of petroleum-based fuel it has placed on the road-transport market.[9] Prior to that, the obligation was 4.166 per cent. Under the terms of the National Oil Reserves Agency Act 2007 (Returns and Biofuel Levy) Regulations 2010 (S.I. No. 356 of 2010), a Biofuel Levy of 2.00 cent per litre is payable on sales of all biofuels into the market with effect from 1 July 2010.[10]

Biofuels sold in the State must comply with the European Union (Renewable Energy) Regulations 2014 (S.I. No. 483 of 2014)—which transpose Directive 2009/28/EC—and be identified by guarantees of origin. The Regulations set out sustainability criteria that biofuels and bioliquids must meet as well as requirements for verification, information from participants and independent audit of records.[11] It is intended that the biofuel obligation will be incrementally increased over the period to 2020 to meet the 10 per cent renewable-transport target. However, it is recognised that the incremental increases will need to be in line with technical and other developments. Currently, biofuels are promoted for all modes of transport. However, in future they may be most valuable in road freight and air transport, where the length of journey will require higher-density fuels.

Although biofuels produce lower CO_2 emissions compared to diesel and petrol, they also have higher production costs and intervention is required to assist the development of these alternative fuels. Furthermore, there are continuing concerns about increased air pollutants and marginal (or indeed) reductions in GHG emissions, particularly if one adopts a life-cycle analysis perspective (Searchinger *et al.*, 2008). One particularly controversial aspect of the commitments set out in biofuel mandates is competition for land (the 'food v fuel' debate). In 2013, a report by the UN Special Rapporteur on the Right to Food expressed deep concern in regard to European Union biofuels policy and the considerable negative impacts this policy is having on the enjoyment of the right to food in a number of developing countries as well as ancillary impacts on the interests of smallholder farming and local food security (FAO *et al.*, 2011).

[9] http://www.dcenr.gov.ie/energy/en-ie/Renewable-Energy/Pages/Biofuels.aspx.

[10] See also the National Oil Reserves Agency Act (Biofuel Obligation Rate) Order 2012 (S.I. No. 562 of 2012).

[11] See arts.17–20 of S.I. No. 483 of 2014; see also the European Union (Biofuel Sustainability Criteria) Regulations 2012 (S.I. No. 33 of 2012).

4.3.3 Electric Vehicles

EVs will also have an important role in achieving both energy efficiency and renewable-energy targets. The original 2020 target required the conversion of 10 per cent of the passenger and light commercial-vehicle stock to EVs in Ireland (roughly equivalent to 230,000 vehicles). However, there has been a lower than anticipated uptake of EVs to date and this has led to a downward revision of the estimated number of EVs in the fleet by 2020. It is now projected that the adoption rate of EVs will rise steadily from 0.5 per cent of new vehicles in 2014 to 15 per cent in 2020, resulting in 50,000 EVs in 2020 (Dineen *et al.*, 2014).

In Ireland, the delivery of the 2020 and 2030 renewable-energy targets is projected to result in one of the highest penetrations of variable non-synchronous generation on any power system in the world and is expected to create very challenging future operational constraints for the grid-system operators (EirGrid, 2013). The requirement to develop an Irish smart grid, which will enable increased control over the electricity system and consequently improve the overall efficiency and reliability of the electricity supply, has been pushed up the energy policy agenda and has resulted in significant national commitments to investment in electricity system infrastructure. An important element of this new smart-grid infrastructure will be the provision of an EV charge-point network. As the number of EVs grows so too will the electrical storage capacity, and the storage capabilities of EVs could provide an effective means of power matching and balancing the electricity system as they can charge at times when wind generation is abundant an available.

The Electric Vehicle Grant Scheme was introduced in April 2011 to incentivise and support the early deployment of EVs in Ireland. Grants of up to €5,000 are available. These grants are in addition to the VRT reliefs of up to €5,000 that apply to EVs. The ESB has committed to installing home charge points free of charge for the first 2,000 electric car owners through its 'E-Cars' Programme. The Sustainable Energy Authority for Ireland (SEAI) has also commenced a project for the development of wind or ocean energy for the supply for electricity for EVs in the Aran Islands (Gaotha go Rothaí – Wind to Wheels).[12] It is hoped that this will act as an incubator programme for novel technologies for EV use in a 'learning by doing' environment.

SEAI has also pledged support to a number of private and public-sector bodies to test EVs in a commercial environment in 2010 as part of a trial experiment. This included trials of Verde Cargo Vans by Dublin Port Authority and Cork City Council as well as trials of the Smith Electric Newton trucks by the Office of Public Works and Celtic Linen. In the Celtic Linen trial, which commenced in 2010, the cost of the vehicle was

[12] http://www.seai.ie/Renewables/EV_support_programme_launched/aran_islands_EV_prog/.

€123,000 (excluding VAT) for which SEAI provided 45 per cent support. Most of the routes were between 45 and 85km in length. The fuel cost for the electric truck was 9 cent per km compared with 20 cent per km for the diesel equivalent.[13]

The electrification of transport will play a significant part in the overall 2050 low-carbon economy solution. There are currently 1,200 public charge points across the island of Ireland, including fast chargers along the main inter-urban routes. Advances in Lithium battery technology has led to the current development of passenger EVs by mainstream suppliers such as Renault, Nissan and Mitsubishi and, coupled with improved ranges of up to 185km on a single domestic overnight charge and fuel-cost savings of up to 70 per cent based on night-time electricity prices, it is hoped that EV uptake will improve. There have also been legislative changes in this area to facilitate EVs.[14] However, more will need to be done to facilitate charging and fuelling infrastructure generally.

4.3.4 Natural Gas

Natural gas can also be used as a transport fuel. Natural gas is a low-emission fuel that does not contain sulphur or heavy metals and its use can significantly reduce exhaust and GHG emissions. CNG is also non-toxic on release to water environments and there are fewer toxic and carcinogenic pollutants. However, there are storage and fuelling issues. Use of CNG is growing worldwide with an estimated 11 million NGVs currently in operation. Germany is one of Europe's fastest-growing NGV markets, with the development of over 800 CNG filling stations in the last five years. Sweden has integrated CNG as an alternative and renewable transport fuel with approximately 58 per cent of the gas used in the transportation sector consisting of biogas.

In many European cities, CNG is replacing traditional fuels in large, high-polluting vehicles such as buses and refuse collection trucks. For example in Madrid, all the refuse-collection and city-cleaning trucks are fuelled with CNG and 35 per cent of the urban bus fleet will be replaced with CNG by the end of 2010, accounting for 700 CNG buses. Similar approaches are being followed in other cities including The Hague, Paris, Barcelona and Rome. Ireland is now exploring the use of CNG as an alternative to petrol and diesel.

[13] http://www.seai.ie/Renewables/EV_support_programme_launched/Commercial_Electric_Vehicle_Trials/.

[14] The Road Traffic (Traffic and Parking) (Car Clubs and Electrically Powered Vehicles) Regulations 2014 (S.I. No. 325 of 2014) amend the Road Traffic (Traffic and Parking) Regulations 1997 (S.I. No. 182 of 1997) and provide for the reservation of parking spaces for car-club cars and for the recharging of EVs.

4.3.5 Promotion of Cleaner Public Transport

There is a particular need to promote clean public transport, especially in urban areas. Action 33 of the Smarter Travel Plan provides that

> 'The Government will provide leadership through the use of alternative technologies in the public vehicle fleets. We will require every public sector organisation and public transport provider to prepare a plan for fleet replacement based on the most sustainable vehicle and fuel type.'

The Directive on the Promotion of Clean and Energy Efficient Road Transport Vehicles (Directive 2009/33/EC) requires energy and environmental impacts to be linked to the operation of vehicles over their whole lifetime and taken into account in all purchases of road-transport vehicles.[15] The Directive has been transposed by the European Communities (Clean and Energy-Efficient Road Transport Vehicles) Regulations 2011.[16] Member States must ensure that contracting authorities, contracting entities and operators under a public service contract take into account the operational lifetime energy and environmental impacts when purchasing road-transport vehicles and may take into account other environmental impacts. The energy and environmental impacts that must be considered include energy consumption, CO_2 emissions and emissions of NOx, Non-Methane Hydrocarbons (NMHC) and particulate matter.

The Directive provides for a methodology for calculation that monetises the cost of energy consumption, CO_2 emissions and pollutant emissions during a vehicle's operational lifetime. The operational lifetime cost of the energy consumption of a vehicle is calculated using the following method. Fuel consumption per kilometre is calculated in units of energy consumption per kilometre. The calculation uses a single monetary value per unit of energy. The operational lifetime cost of the energy consumption of a vehicle is calculated by multiplying the mileage already performed by energy consumption, and then by the cost per unit of energy.

There were limited trial operations of CNG buses in the 1990s and more recently of a hybrid electric bus in the Dublin area. However, although Dublin Bus has expanded and upgraded its fleet in recent years, it is not clear to what extent the use of AFVs is considered in its procurement strategy or whether this is predominantly based on the acquisition of diesel vehicles. There should be transparency in procurement decisions by national bus operators who are required to comply with the Clean and Energy Efficient Road Transport Vehicles Directive as well as the active development

[15] Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles.

[16] S.I. No. 339 of 2011. See also the Cleaner Road Transport Vehicles Regulations 2011 in the UK.

of alternative fuel and vehicle strategies for near-term technologies in addition to trial operations for nascent technologies.

Improvements can also be made in fuel economy through eco-driving and the regulation of speed limits. Eco-driving includes driving more slowly, avoiding rapid acceleration and excessive braking, using on-board fuel monitors and maintaining tyres at the correct pressure. More efficient driving can reduce emissions by up to 20 per cent, with lower savings in the long term. In Ireland, it was estimated that the difference was between 6 and 13 per cent (Daly & Ó'Gallachóir, 2011).

Eco-driving is a particularly low-cost measure that could be supported through information campaigns and changes in the driving test. The SEAI's Strategic Plan for 2011 to 2015 specifically recognises the need for driver training and fleet-management training in the transport industry. The RSA is currently including driving skills and behaviours that support eco-driving as part of the syllabus (and mandatory lessons) for learner drivers.

An interdepartmental working group on intelligent transport systems is also developing a National Systems and Services Action Plan, which is intended to realise efficiencies in: (a) road freight through improved travel information, fleet management and logistics; (b) public transport through fleet-location technology, passenger information systems and integrated ticketing; and (c) road transport through traffic-management and incident-management technologies on busy sections of the road network. This work should capitalise on the Dublin City Council/IBM Smarter Cities initiative and considers how information and communication technology can enhance the delivery of sustainable transport in both urban and rural areas.

4.4 Spatial Planning and Land Use

As previously noted by NESC, the transport sector is shaped by Ireland's low population density and a planning system that has enabled suburban sprawl and rural one-off housing, neither of which is conducive to sustainable transport (NESC, 2012a). The alternative to urban sprawl is the development of sustainable neighbourhoods that are less car-dependent and more compact. NESC (2004) has previously outlined five key principles for sustainable housing and development:

i) Significantly increased urban densities to make best use of the available land, ensure effective service provision, create quality neighbourhoods and reduce car dependence;

ii) Consolidated urban areas within a well-defined urban footprint;

iii) Compact urban satellites that are well defined and seek to include not only residential development but also commercial and employment opportunities;

iv) Rapid communication networks that facilitate the provision of effective transport services;

v) Sustainable rural settlement patterns and house design that support vibrant rural communities and protect Ireland's natural landscape.

Spatial planning and land use are critical in terms of where people live and work. In theory, the optimal spatial planning model is based on mixed use, and compact and high-density urban forms where people reside close to sources of employment and recreational activities and are not required to travel long distances for work. However, there has been a tradition of low- density suburban patterns of development and rural housing in Ireland for a variety of reasons. These patterns are historic, as one can see from the suburban housing estates in Dublin and other cities and towns that were built in the 1950s and 1960s. Urban sprawl is not a recent phenomenon and the challenge is to retrofit more compact patterns of development within this legacy framework of traditional low-density spatial patterns.

Ireland does not have a tradition of high-rise building and apartment developments may have negative connotations in the minds of some members of the public. In any event, there is a disconnect between the policy rhetoric of what is aspirational and what is feasible. People may choose to live some distance from work for a variety of reasons; for example, to be close to elderly parents, the desire for a family support structure where parents are rearing young children, the bequest of sites for development in traditional rural areas, the desire to rear children in a rural environment, or change of employment that necessitates long-distance commuting, etc. Although there is certainly a demand and supply mismatch in the Greater Dublin Area (GDA), the price of housing may not be the sole factor in why people select to commute long distances.

The 2002 National Spatial Strategy (NSS) was originally introduced in order to achieve a better balance of social, economic and physical development across Ireland, supported by more effective and integrated planning. It recognised that in order to drive regional development, areas of sufficient scale and critical mass should be built up through a network of gateways and hubs. While the National Development Plan (NDP) 2000–2006 identified Dublin, Cork, Limerick/Shannon, Galway and Waterford as existing gateways, the NSS designated four new-national level gateways, including the towns of Dundalk and Sligo and the linked gateways of Letterkenny/(Derry) and the midland towns of Athlone/Tullamore/Mullingar. In

addition, the NSS identified nine, strategically located, medium-sized 'hubs' to support the gateways and link out to wider rural areas.

The hubs that were designated are Cavan, Ennis, Kilkenny, Mallow, Monaghan, Tuam and Wexford, along with the linked hubs of Ballina/Castlebar and Tralee/Killarney. The NDP 2007–2013 aligned the NSS centrally through a specific horizontal chapter on balanced regional development, and capital investment was prioritised in line with the NSS to establish the Strategy as a viable and practical policy measure to encourage more balanced regional development. The NSS was supported by an initial €300m Gateway Innovation Fund for the period 2008–2010 as part of a strategic targeted intervention to stimulate Gateway development and further the NDP cross-cutting objective for more balanced regional development.

The Planning and Development (Amendment) Act 2010 aimed for a closer alignment with Regional Planning Guidelines (RPGs), development plans and local area plans (LAPs) and requires development plans and LAPs to be 'consistent' with national and regional objectives whereas previously, under the 2000 Act, the requirement was merely to 'have regard' to national and regional policies and objectives. The 2010 Act also introduced the concept of the 'core strategy', which aims to ensure adherence between development plans and the NSS and relevant RPGs.

Although the 2010 Act included the need to reduce anthropogenic GHG emission as an objective that should be included in county and city development plans, it may be necessary also to place the Smarter Travel Plan on a statutory footing so that Development Plans and LAPs are required to be consistent with smarter travel policy as well. This would place an express obligation on planning authorities and An Bord Pleanála to take account of smarter travel rather than to merely take it into consideration. Furthermore, it is arguable that smarter travel as a concept should be placed on a statutory footing with a hierarchy of travel modes and more sustainable options placed at the apex.

The provision for RPGs has now been replaced by Regional Spatial and Economic Strategies, following the Local Government Reform Act 2014. Notwithstanding these changes, the NSS appears to be in a moribund state and is in need of resuscitation or else a successor strategy should be developed that consolidates its focus on a number of select city-regions, which can act as regional drivers of employment growth. It has been argued that one of the failings of the NSS was that it identified too many gateways and hubs and as a result the laudable goals of the strategy were diluted because of the failure to focus on a concentrated number of conurbations.

Although the NSS is still officially in place, the Government has announced plans for a National Planning Framework as a successor. The Planning Policy Statement 2015

suggests that planning must be plan-led and evidence-based and must proactively drive and support sustainable development as well as the transition to a low-carbon future. It also suggests that planning must encourage the most efficient and effective use of previously used or brownfield land, and create and develop communities in a sustainable manner.

It is also proposed that an Office of the Planning Regulator will be established, which will maintain an overview of all regional strategies and city and county development plans and LAPs to ensure they are in compliance with national and regional planning policies and guidelines. The General Scheme of Planning and Development (No. 2) Bill 2014 envisages the establishment of an Office of the Planning Regulator in line with the recommendations of the Mahon Tribunal. Chapter II of Part II proposes that the OPR will be responsible for the evaluation and assessment of draft development plans, variations to development plans, LAPs and amendments thereto and Regional Spatial and Economic Strategies. It is also proposed that the OPR will have a role in research, education and training and that planning will be more evidence-based and operate within a framework of national top-down scrutiny.

The key objective is to reduce travel demand and this can be facilitated through more sustainable land-use patterns, although this will take some time to take effect and achieve emissions reduction. One radical option that might be considered is the use of compulsory purchase powers under s.10 of the Local Government (No. 2) Act 1960 as amended by s.86 of the Housing Act 1966 and Part XIV of the Planning and Development Act 2000, to acquire land for the development of higher-rise buildings, particularly in urban centres that are in need of regeneration. This should be considered in conjunction with the new vacant site levy introduced by the Urban Regeneration and Housing Act 2015 and the various Living City Initiative Special Regeneration Area Orders made for Cork, Dublin, Galway, Limerick, Kilkenny and Waterford in 2015.

4.5 Mobility Management

Mobility management refers to measures that influence behavioural change and encourage a reduction in car dependency through enhanced information awareness. These include car sharing, flexible working, travel blending, personalised travel planning (PTP), workplace travel plans and school travel plans. Mobility management can be applied as a strategic demand-management tool or as a site-specific or area-specific measure.

4.5.1 Workplace Travel Plans

Workplace travel plans are particularly suited to major employers operating on a campus that offers parking facilities but is well served by public transport. These might include working with employees to address perceptions, fears and practical difficulties in overcoming car dependency; establishing databases to assist in ridesharing and carpooling; providing shuttle services to nearby rail or bus services (e.g. the PwC service); putting in place on-site measures to make cycling and walking safer and more attractive, for example footpaths, cycle lanes, secure cycle parking, and shower facilities; providing fiscal and organisational incentives to use non-car modes; introducing staggered or flexible working hours so that commuters can avoid peak hours; allowing compressed working weeks; promotion of working at home, teleworking, and e-working, and increasing the use of telecommunications.

Although there might be a concern that employees will be less productive if they work from home, and flexible working will require good broadband access and a relationship of trust between the employer and employee, workplace travel plans have the potential to deliver emission savings at low cost. Examples of workplace travel plans that have been implemented in Ireland include the ASTUTE (Advancing Sustainable Transport in Urban Areas to Promote Energy Efficiency) project, which is operated by CODEMA (City of Dublin Energy Management Agency), and VIPRE, who implement soft measures to manage transport demand. The Smarter Travel Workplaces Programme, which is under the auspices of the National Transport Authority (NTA), is a public-awareness programme working with large employers (minimum 250 employees) to implement voluntary workplace travel plans. To date, the programme is engaged with over 100 organisations including Accenture, Apple, Dell, Deloitte, Dublin City Council, EirGrid, ESB, KPMG, Oracle, NUI Maynooth, Mater Hospital and Vodafone.

4.5.2 Personalised Travel Planning

PTP involves providing information to individuals or households to enable them to choose a different pattern of travel behaviour, reduce their car use and/or increase the use of more sustainable transport modes. These approaches have developed from commercial marketing techniques aimed at increasing public-transport use and public-sector campaigns aimed at raising community understanding or awareness of environmental impacts of transport. Individualised marketing is mainly aimed at achieving modal shift from driving to public transport, walking, cycling or car sharing. PTP programmes include Individualized Marketing (IndiMark), adopted by Socialdata, and Travel Blending, which has evolved into the ‘living neighbourhoods’ or ‘living change’ approach. These programmes may involve direct marketing of travel-

behaviour change as well as targeted personal approaches to people identified as potential mode switchers with personalised information, advice and incentives provided to encourage change. They are mostly aimed at infrequent users who may not have sufficient information about services.

4.5.3 Travel Blending

Travel blending or 'living change' policies seek to reduce the overall need for travel through combining or 'blending' activities or destinations. Travel blending involves an in-depth analysis of individual travel behaviour followed by detailed suggestions on how behaviour can be modified, with follow-up monitoring and feedback. It refers to the way that individuals can reduce car use by blending or mixing their travel choices over time. Tools adopted in travel blending include ideas for changing current travel, activities or timing of activities; the completion of a travel diary, following which suggestions are given on how to reduce travel; personalised journey plans, brochures and local activity guides; free public-transport tickets or incentives such as 'loan-a-bike'.

4.5.4 School Travel Plans

Measures to encourage walking and cycling to school are important because sustainable patterns of travel behaviour are often carried into adult lives and play an integral role in formative experiences. Measures to encourage more sustainable school travel include:

- Physical improvements in the vicinity of schools such as traffic calming, low speed zones, cycle lanes and safe crossings;
- Consultation between schools and communities;
- Education and information measures;
- Road safety training and
- Initiatives such as 'walking buses' and 'cycle trains'.

School travel plans set out to improve the safety and the physical environment for walkers and cyclists and help to encourage children and parents/guardians to walk and cycle, use a bus or car-share. Particular co-benefits include the health benefits associated with physical activity, reduced traffic congestion at peak time, improvements in road safety and pedestrian skills, mental development and independent mobility, increased independence for children, greater knowledge of environmental and citizenship issues, community benefits, increased social inclusion and the development of social networks.

The Dublin Transportation Office (DTO) initiated the Safer Routes to School project in 2000 and six pilot schemes were implemented. The objectives of the follow-up scheme, i.e. the Green Schools Programme, are to raise awareness of sustainable travel and transport, reduce school-related congestion and improve physical health and fitness. Funding was provided for an initial two-year development programme, which was rolled out under the auspices of the An Taisce Green Schools Programme. Results from the initiative show that between March and June 2006, walking to school increased by 7 per cent to 40 per cent and car use decreased by 8 per cent to 46 per cent, while walking from school increased by 4 per cent from 37 per cent to 41 per cent and car use fell by 9 per cent. The Green Schools Travel Programme was rolled out nationally in September 2008 after a successful pilot programme in the GDA.

Since then DTO has collaborated with over 1,400 schools around the country to promote sustainable travel to school. The Green Schools Programme has dedicated Travel Education Officers who are working closely with schools to support them through a seven-step process to implementing sustainable transport.[17] The idea is that participating schools develop an Action Plan and voluntarily set their own travel targets in order to increase the numbers of pupils walking and cycling or availing of park 'n' stride, carpooling and public transport. Other related initiatives, which have been implemented, include Walk Once a Week (WOW) and the Golden Boot as well as the recent Scoot to School Week '15, National Walk to School Week and Green-Schools Bike Week.[18]

4.5.5 Car Clubs and Liftsharing

The basic idea behind car clubs or 'car sharing' is that people can have quick and easy access to a car without owning one. Typically, car-club members (both residential and business users) pay a monthly fee to an operator who provides and maintains a range of vehicles in their neighbourhood. Members then pay by the hour and kilometre when they use a vehicle. By providing cars for people when they need them, car clubs decouple car *use* from *ownership* and users are free to consider the best way of making a journey, rather than being tied to the car as a default option.

Experience has shown that car clubs work best in urban areas with certain characteristics. First, car clubs usually need a critical mass of 40–50 vehicles and 1,000 users in one contiguous area to be financially self-sufficient in the medium to long term. Second, most vehicles need to be located in areas of medium- to high-population density. Mixed areas with residential, commercial and retail elements

[17] https://www.nationaltransport.ie/projects-schemes/smarter-travel/green-schools-travel/
[18] http://www.greenschoolsireland.org/themes/travel.197.html

achieve this ratio more easily through daytime business use and private use in the evenings and at weekends. Car clubs tend to attract a certain number of 'early adopters' when they are first established. As a club becomes more established in an area and as public awareness of the benefits of car clubs increases, it becomes more attractive to a mainstream audience and is seen and used more like a public-transport service.

4.5.6 Flexible Working

Flexible working reduces the need to travel to a physical workplace at an appointed time by staggering out work allocation over different time periods and physical locations. It may include part-time, flexi-time, annualised hours, compressed hours, staggered hours, job sharing and home working. Home working may be facilitated through application of telematics, IT and videoconferencing, which further reduces the need for travel (Caulfield, 2015). Although this offers considerable advantages, particularly in a smart economy, it may be hindered by a lack of broadband availability. Three projects in Dungarvan, Westport and Limerick are being funded as part of the Smarter Travel Areas Programme over the next five years. Each area has identified a range of modal-shift plans and strategies. These follow on from over thirty smarter travel demonstration projects funded to date, which have been largely cycling-based. In addition, the Westport Greenway has proved to be a considerable success.

4.6 Institutional Governance

In order to deliver sustainable transport, it is imperative that we have robust and integrated institutional and executive arrangements at different vertical and hierarchical levels. Institutional governance should ensure that transport policy is implemented in accordance with a single national vision of sustainable transport, which supports economic growth and well-being and is integrated with other areas of national policy, for example in the areas of housing, land use, economic strategies and health. In preparing for the future, we should move away from predictive policy analysis and towards more adaptive policy that can address future challenges and predicaments, albeit within a strong institutional capacity guided by robust and rational policy making and a sound evidence base.

The DTTAS is responsible for implementing sustainable transport policy, largely through the Sustainable Transport Division (formerly the National Sustainable Travel Office). The Department provides financial support to local authorities and other agencies for the promotion of smarter travel by developing infrastructure to make smarter travel more attractive and safer and by educating people on the potential for making Smarter Travel choices, including through the An Taisce Green Schools

programme and the Smarter Travel Workplaces Programme, which is operated by the NTA on behalf of the Department. The Smarter Travel Workplaces Programme has projects in 77 of the largest workplaces in the State, including companies such as the ESB, Dell, Pfizer and major universities and hospitals. Employers who have taken part have found car use drop from between 10 to 30 per cent in their workplaces.

In 2012, a five-year multi-annual funding support programme named Active Travel Towns was initiated, principally for the strategic development of strategies and infrastructures to support walking and cycling in towns outside the GDA. Available funding of €6m was allocated to local authorities to deliver Active Travel towns through a competitive process over the period between 2012 and 2013. The principal objective of Active Travel Towns is to achieve a modal shift from car to either walking and/or cycling. It is hoped that this objective will be achieved through deliverables such as the provision of safer routes for people to travel by bike or on foot; a reduction in short-distance car journeys through the availability of good-quality travel information and alternative infrastructure; community involvement; improved walking and cycling access to public transport and tie-in with schools/colleges and workplace plans both through existing programmes and new linkages.

Funding was available in two parallel streams. Stream 1 envisaged the development of strategies for those towns that do not have a walking and cycling strategy. Stream 2 provides for implementation measures (principally infrastructure but also to include supporting behavioural change, including information dissemination) of existing and new local-authority strategies. A further competitive round of funding was made available for delivery in 2014–2016. Furthermore, the Department has administered in excess of €21m over a five-year period as part of the Smarter Travel Areas Programme 2012–2016. Smarter Travel Areas will identify which measures deliver the best results in different types of communities. Funding has been allocated to the Limerick Smarter Travel Programme (€9m), Smarter Travel Go Dungarvan (€7.2m) and Smarter Travel Westport (€5m).

The Transport Infrastructure Ireland (TII) was formed in August 2015 by the amalgamation of the Railway Procurement Agency and the National Roads Authority on the enactment of the Roads Act 2015. The primary function of TII is to provide an integrated approach to the future development and operation of the national roads network and light rail infrastructure throughout Ireland. It is expected that this rationalised agency will provide a more integrated executive agency for the delivery of transport infrastructure in Ireland.

The NTA, which was established in December 2009, is the transport authority for the GDA and the national public transport licensing authority. It was established following the Dublin Transport Authority Act 2008 and the Public Transport

Regulation Act 2009. The NTA has assumed certain functions of the Department of Transport and the former DTO as well as the functions of the Commission for Taxi Regulation. Unlike other executive agencies such as Transport for London, and RATP, which operates in Paris, the NTA is not primarily a service provider but operates public-service obligation contracts with public- and private-transport operators.

The NTA has been active in delivering integrated ticketing in the Dublin area through the 'Leap' card and has rebranded services under the name 'Transport for Ireland'. In December 2013, the NTA announced that around 10 per cent of routes currently operated by Dublin Bus and Bus Éireann under their Direct Award contracts will be subject to competitive tendering, with a view to services commencing in 2016. In February 2014, the NTA approved plans for a bus rapid transport (BRT) network in Dublin, which is expected to be fully operational by 2019. It has also been particularly active in transport planning policy in the Dublin area, having published a Strategic Transport Strategy, an Integrated Implementation Plan and a Strategic Traffic Management Plan. Furthermore, it has collaborated with Dublin City Council and has published a joint *Dublin City Centre Transport Study*. This includes modal share targets crossing the canals of 55 per cent for public transport, 15 per cent for cycling, 10 per cent for walking and 20 per cent for private car use in the annual cordon count by 2017.

The NTA has also been responsible for developing a 2030 Vision as part of a Transport Strategy for the GDA.[19] The Draft Transport Strategy for the GDA for the period 2016–2035 was published this year and the public consultation process for submissions closed on 13 November. The key proposals set out in the draft strategy are:[20]

- A 'Core Bus Network' for the region comprising 16 radial bus corridors, 3 orbital bus corridors and 6 regional bus corridors;
- New Metro North St. Stephen's Green to Swords and serving Dublin Airport, operating in-tunnel under Dublin City Centre, and providing a high-frequency, high-capacity service;
- Metro South from St. Stephen's Green to Bride's Glen, completing a full north–south high-capacity high-frequency cross-city rail corridor running from Swords to Bride's Glen through the central spine of the Metropolitan Area;

[19] https://www.nationaltransport.ie/planning-policy/gda-transport-strategy-and-guidelines/

[20] https://www.nationaltransport.ie/news/greater-dublin-area-draft-transport-strategy-2016-2035-proposes/.

- Luas Cross City connecting St. Stephen's Green to Broombridge and intersecting with the Red Line at Abbey Street (works underway);
- Extension of the Luas to Bray, Poolbeg, Finglas and Lucan;
- Reopening of the Phoenix Park Tunnel Link for passenger services, which will link the Kildare/Cork line to the city centre (works underway);
- Completion of the City Centre Resignalling programme, which will provide additional train paths through the city-centre section of the rail network (works underway);
- Implementation of the DART Expansion Programme, which will provide DART services as far north as Drogheda; to Hazelhatch on the Kildare Line (including a tunnel connection from the Kildare Line to link with the Northern/South-Eastern Line); to Maynooth in the west and to the M3 Parkway;
- New train control centre to manage the operation of the rail network;
- Construction of additional train stations in developing areas with sufficient demand;
- Programme of station upgrades and enhancement;
- Construction of the GDA Cycle Network, expanding the urban cycle network to over 1,485 kilometres in length and with over 1,300 kilometres of new connections between towns in the rural areas of the GDA;
- Network of strategic rail-based park and ride facilities at Swords, Finglas, Dunboyne, Liffey Valley, Naas Road and Greystones;
- Demand management measures.

The objective of the Strategy, which is required by s.12 of the Dublin Transport Authority Act 2008, is to provide a long-term strategic planning framework for the integrated development of transport infrastructure and services in the GDA. However, it must be considered whether the NTA should broaden its remit to include planning and analysis for transport and land use nationally and not just in the GDA.

To some extent, the transport sector does not have a unified representative voice at NGO level and representative organisations such as the Irish Road Haulage Association (IRHA) or Chartered Institute of Logistics & Transport Ireland (CILT) will naturally lobby on behalf of their members' interests. There are some examples of lobbying organisations in the area of sustainable transport such as the Dublin Cycling Campaign and the former Plan Better, which was an initiative of the Irish

Environmental Network. It is not clear why there is a lack of collective organisation in the area of sustainable transport but it is possibly because the benefits and externalities are dispersed among society at large.

It has been suggested that having a directly elected mayor, particularly for the Dublin region, could be effective in delivering integrated land use and transport policy for the GDA. The Local Government (Mayor and Regional Authority of Dublin) Bill 2010, which ultimately was not enacted, envisaged the establishment of a directly elected mayor with specified executive powers and functions. The proposed remit of the mayor was the development and promotion of the Dublin region in a manner that contributes to sustainable environmental, economic, cultural and social-cohesion development of the Dublin region. This had previously been raised in the 2008 Policy Paper *Stronger Local Democracy: Options for Change*.

The Local Government Reform Act 2014 proposed a plebiscite on the establishment of the office subject to a unanimous vote by all four local authorities in the Dublin region. Ultimately, the proposal was not approved because of, inter alia, concerns about funding, loss of autonomy for the individual local authorities and a lack of clarity about the executive functions that would be vested in the mayoral office.

Local authorities will play a key role in the delivery of services and in incorporating sustainable transport principles in development plans and LAPs. The NTA has also published technical guidance to assist local authorities and State agencies on the development of effective workplace travel plans and school travel toolkits. The textbox below highlights some examples of local-authority initiatives in the area of sustainable transport.

Finally, the forthcoming Climate Action and Low Carbon Development Act 2015 has institutional implications in relation to climate change, which include the establishment of a National Expert Advisory Council on Climate Change.[21] This has already been established in advance of the legislation and is chaired by Dr. John FitzGerald with support from the EPA. It is required to advise and make recommendations to the Minister for the Environment, Community and Local Government and the Government generally in relation to the performance of their functions under the Act, with particular regard to the National Mitigation Plan, National Adaptation Framework and sectoral adaptation plans. The Expert Advisory Council will be required to conduct an annual review of progress in achieving GHG emission reduction and furthering the transition to a low-carbon, climate-resilient

21 http://www.environ.ie/en/Environment/Atmosphere/ClimateChange/News/MainBody,41743,en.htm.

and environmentally-sustainable economy by 2050. It will also submit an annual report to the Minister for the Environment, Community and Local Government.

Local-Authority Initiatives in Sustainable Transport

- Sustainable Transport Strategy for South Tipperary 2012–2022. This sets targets to increase modal share of sustainable-transport modes and enhance the role of land-use planning. It also incorporated mobility-management plans for larger urban conurbations in South Tipperary.
- Kilkenny County Council has produced a Mobility Management Plan for Kilkenny City and its Environs. This was prepared in conjunction with what was then Kilkenny Borough Council for the period 2009–2014. The plan established a formal mobility and traffic-management plan for Kilkenny and proposed the introduction of more than 50km of cycleway lanes throughout the city as well as one-way street systems and the roll-out of parking charge proposals. It also considered bus-shuttle services, subject to financial subvention, and committed to the introduction of intelligent signage and real-time passenger information (RTPI) as well as special speed limits of 30km in certain areas on John Street and High Street.
- Waterford City Council has been actively working on encouraging greater use of public transport through the introduction of the Green Route on the Dunmore Road and the provision of bus timetables and travel information for city routes at www.waterfordcity.ie. To promote the use of bicycles, Waterford City Council has introduced cycling lanes on the Dunmore Road, Inner Ring Road and Cork Road. Bicycle parking has also been provided at the People's Park, Arundel Square, Broad Street, on the quay (at the Clock Tower), Mayor's Walk (opposite Garda Station) and Ballybricken Green (near bandstand).
- The Galway Strategic Bus Study was commissioned in 2006 and, having a number of difficulties with the urban bus system, made a series of recommendations to improve the bus service. The most noteworthy impact of these changes has been on one of the main services between the Eastern suburbs and the city centre – the Bus Éireann 409 route. This route benefitted significantly from the bus lane and was also improved with increased frequency, improved reliability, additional bus shelters and RTP at bus stops. In 2010, over 1,000,000 passengers were carried on this route.

The Expert Advisory Council must also conduct a periodic review, with particular focus on progress in meeting the State's GHG mitigation obligations under the EU's 2009 Effort Sharing Decision. Finally, the Bill requires the Minister for the Environment to make an annual Transition Statement to the Dáil and provide an overview of the mitigation and adaptation policy measures required to achieve the national transition objection. In addition, each Minister of the Government with responsibility for sectoral mitigation measures is required to make an annual statement to Dáil Éireann on mitigation policy measures adopted to reduce GHG emissions and on the effectiveness of those measures as well as a statement on national adaptation policy. It is hoped that these new institutional arrangements will support the current work done across Departments and executive agencies that has hitherto been co-ordinated by the Inter-Departmental Working Group on Climate Change.

4.7 Discussion and Conclusions

The challenges required to achieve sustainable transport are significant and will necessitate political will and institutional integration at executive level. The primary framing of the policy debate on climate change is often dominated by discussions on 'how much' within the framework of internationally binding agreements and top-down EU targets and commitments, particularly given the apparently tortuous path of the UNFCCC since its inception and the seemingly intractable conundrum of securing agreement between traditional developed countries and major developing economies.

While there is a legal imperative to comply with international agreements, and there will be a concomitant monetary cost for the failure to do so, there is also a positive message in dealing with climate change that is not just focused on carbon currency or the need to reduce emissions. This includes opportunities for innovation in low-carbon technologies and the development of smart communities that can enhance quality of life and well-being, improve individuals' health and maintain employment opportunities.-

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Appendix 1

A.1. International Commitments under the UNFCCC

The United Nations Framework Convention on Climate Change (UNFCCC), which Ireland ratified in 1994 and which has a total membership of 195 parties, has set an objective of stabilising '*greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system*'. It is widely accepted that to achieve this aim, global annual mean surface temperature increases should not exceed 2ºC above pre-industrial levels and developed countries should consider emissions-reduction pathways in the order of 80–95 per cent by 2050 compared to 1990 levels, while global emissions should be reduced by 50 per cent.

The Intergovernmental Panel on Climate Change issued its Fifth Assessment Report (AR-5) in 2014, which included three Working Group (WG) Reports and a Synthesis Report. In the Summary for Policymakers, it was concluded that warming of the atmosphere and ocean system is unequivocal. It also categorically stated that human influence on the climate system is clear and that recent anthropogenic emissions of greenhouse gases (GHG)are the highest in history. Many of the associated impacts, such as sea-level change, have occurred since 1950 at unprecedented rates.

The WG concluded that there is a clear human or anthropogenic influence on the climate and that it is extremely likely that human influence has been the dominant cause of observed warming since 1950. It was projected that further warming will continue if GHG emissions continue and that the global surface-temperature increase by the end of the 21st century is *likely* to exceed 1.5°C relative to the period between 1850 and 1900 for most scenarios. It was also noted that the level of confidence that industrial activities are responsible for climate change has increased since AR-4, which was published in March 2007.

A.2. Kyoto Protocol and COP-21 Negotiations

The 1997 Kyoto Protocol entered into force in 2005 and provides for legally binding targets to be achieved by industrialised countries with the aim of achieving a 5.2 per cent reduction in GHG emissions over the commitment period of 2008–2012. All Member States committed to a reduction of 8 per cent during this period, either jointly under the EU-15 'burden-sharing' agreement or individually, except Croatia, which committed to a reduction of 5 per cent and Hungary and Poland, which committed to a reduction of 6 per cent. Annex II to the 'burden-sharing' agreement set out the quantified emission limitation or reduction commitments for the purpose of determining the respective emission levels allocated to the European Community

and its Member States in accordance with art.4 of the Kyoto Protocol. Ireland's quantified emissions-reduction commitment was 13 per cent above the baseline 1990 level.[22] The revised emission levels allocated to each of the Member States were set out in Decision 2010/778/EU.[23]

The twenty-first session of the Conference of the Parties (COP-21) and the eleventh session of the Meeting of the Parties to the Kyoto Protocol (CMP-11) will take place from 30 November to 11 December 2015 in Paris. It is hoped that COP-21 will achieve a legally binding and universal agreement to regulate GHG emissions with parties having already outlined their Intended Nationally Determined Contributions. This will build on the work at COP-17 in Durban, which pledged to establish a legally binding deal to take effect in 2020 as well as the subsequent Conferences. At COP-17, some parties to the Kyoto Protocol (including EU Member States and Australia) agreed to a second commitment period during which developed countries would accept targets to reduce their GHG emissions although several major developed countries such as the US, Canada and Japan did not sign up to the second commitment period. The parties to the UNFCCC also agreed to commence negotiations on the so-called Durban Platform for Enhanced Action, with an objective to develop '*a protocol, another legal instrument or an agreed outcome with legal force under the UNFCCC applicable to all parties*'.

A.3. European Policy Targets and Effort-sharing Commitments

The March 2007 European Council endorsed a Community objective of a 30 per cent reduction of GHG emissions by 2020 compared to 1990 as its contribution to a global and comprehensive agreement for the period after 2012, provided that other developed countries commit to comparable emission reductions, and economically more advanced developing countries commit to contributing adequately according to their responsibilities and capabilities. The Community also pledged to make a firm unilateral and independent commitment to achieve at least a 20 per cent reduction of GHG emissions by 2020 compared to 1990 levels. The specific EU effort-sharing

[22] Council Decision of 25 April 2002 concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments thereunder (Decision 2002/358/EC). This was subsequently revised in Commission Decision of 14 December 2006 determining the respective emission levels allocated to the Community and each of its Member States under the Kyoto Protocol pursuant to Council Decision 2002/358/EC (Decision 2006/994/EU) and Commission Implementing Decision of 8 November 2013 amending Decision 2006/944/EC to include the emission level allocated to the Republic of Croatia under the Kyoto Protocol (Decision 2013/644/EU).

[23] Commission Decision of 15 December 2010 amending Decision 2006/944/EC determining the respective emission levels allocated to the Community and each of its Member States under the Kyoto Protocol pursuant to Council Decision 2002/358/EC.

commitments are set out in Decision No. 406/2009/EC, which notes that the ultimate objective of the UNFCCC is to stabilise GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

The Decision expresses the view of the European Community that in order to meet this objective, overall global annual mean surface-temperature increases should not exceed 2°C above pre-industrial levels.[24] This suggests that global GHG emission levels should be reduced to at least 50 per cent below 1990 levels by 2050 and that developed countries, including the Member States, should continue to take the lead by committing to collectively reduce their GHG emissions in the order of 30 per cent by 2020 compared to 1990 levels and by 60–80 per cent by 2050. All sectors of the economy should contribute to achieving these reductions, including international maritime shipping and aviation. In Recital 2 of the Decision, it was noted that these proposals should minimise any negative impacts on the Community's competitiveness while taking into account the potential environmental benefits.

Under the Effort Sharing Decision, Member States are required to limit their GHG emissions between 2013 and 2020 by meeting binding annual limits that are set according to a linear path. The annual targets or annual emission allocations (AEAs) follow a straight line between a defined starting point in 2013 and the target for 2020. Member States that have taken on an emissions-reduction target must ensure that their emissions in 2013 do not exceed their average annual emissions for the period 2008–2010.

Member States that are allowed to increase their emissions must ensure that their emissions in 2013 do not exceed a level defined by a linear path starting in 2009. There is a certain flexibility in meeting targets in order to enhance the cost-effectiveness of the emissions path and Member States may 'carry over' emission allocations for future years, or transfer their AEAs with other Member States or acquire Joint Implementation/Clean Development Mechanism credits. The AEAs for each Member State were approved by the EU Climate Change Committee in October 2012, adopted by the European Commission in March 2013 and adjusted in October 2013.

The 2020 Energy and Climate Change Package is a set of binding legislative targets that aim to ensure that the EU meets its climate and energy targets for the year 2020. The package sets three key targets: a 20 per cent reduction in GHG emissions

[24] Decision No. 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020.

from 1990 levels, a 20 per cent share of renewables in the energy mix and a 20 per cent improvement in energy efficiency. The targets are also headline targets of the Europe 2020 Strategy for Smart, Sustainable and Inclusive Growth. These targets are particularly challenging but also present opportunities for innovation that must be captured if Ireland is to capitalise on any 'early mover' advantage. The reduction commitments are allocated between the Emissions Trading System sector, which accounts for about 45 per cent of EU GHG emissions, and the non-traded sector, which includes housing, agriculture, transport and waste.

The 2030 Climate and Energy Framework, which was adopted in October 2014, set three key targets for the year 2030 and aims for at least a 40 per cent reduction in GHG emissions from 1990 levels; a 27 per cent share for renewable energy and a 27 per cent improvement in energy efficiency. It builds on the 2020 Climate and Energy Package as well as policies set out in the 'Roadmap for Moving to a Competitive Low Carbon Economy by 2050', the Energy Roadmap 2050 and the 2011 Transport White Paper, 'Roadmap to a Single European Transport Area'.[25]

On 27 November, Ireland committed to the EU proposal for at least a 40 per cent reduction in GHG emissions by 2030 as part of its formal position at COP-21. Ireland's share of that 40 per cent reduction will be determined during negotiations in 2016, although it is anticipated that the formal negotiating position will make a special case for the national dependence on the agriculture sector.

A.4. Renewable Energy Directive and Fuel Quality Directive

In addition, the Renewable Energy Directive (RED) (Directive 2009/28/EC) requires the EU to source 20 per cent of its energy need from renewable sources by 2020 and all Member States must ensure that at least 10 per cent of transport fuels are derived from renewable sources by 2020. There is a common 10 per cent target for energy from renewable sources in transport in order to ensure consistency in transport fuel specifications and availability. Furthermore, as part of the 2030

[25] The Transport Roadmap envisages that by 2050 there will be no more conventionally fuelled vehicles in cities and a 60 per cent reduction in transport emissions by 2050. It proposes 40 concrete and discrete initiatives to increase mobility in a competitive transport system. This developed EU transport policy had been set out in the 2001 White Paper, 'European Transport Policy for 2010: Time to Decide'; The EU's Freight Transport Agenda: Boosting the Efficiency, Integration and Sustainability of Freight Transport in Europe [COM(2007)606]; the 2008 Greening Transport Package and Strategy for the Internalisation of External Costs; the Commission Communication: Strategic Goals and Recommendations for the EU's Maritime Transport Policy until 2018 [COM(2009)8] and the 2009 'A Sustainable Future for Transport'.

package, there is an additional target of 27 per cent of final energy consumption by 2030.[26]

The Directive specifies national renewable-energy targets for each country and Member States are required to set out how they will achieve these goals in National Renewable Energy Action Plans. The Directive suggests that increasing technological improvements, incentives for the use and expansion of public transport, the use of energy-efficiency technologies, increased share of electric vehicles (EVs) and the use of energy from renewable sources in transport are the most effective tools by which the Community can reduce its dependence on imported oil in the transport sector.

Annex I to the RED sets a target for Ireland of 16 per cent for the share of energy from renewable sources in gross final consumption of energy by 2020. Ireland's target under the RED is to ensure that 10 per cent of its transport energy comes from renewable sources by 2020. This includes transport energy supplied from liquid biofuels, biogas and renewable-electricity resources. The 2020 target is expected to be achieved largely through the increased use of liquid biofuels. However, beyond 2020 advances in battery-storage technology and the provision of EV charging infrastructure will probably see a significant rise in the volumes of EVs across the country.

Coupled with the RED, the Fuel Quality Directive (Directive 2009/30/EC) was introduced in 2009.[27] The 2009 Fuel Quality Directive amends a number of the petrol and diesel specifications and introduced a new art.7a in the original Fuel Quality Directive (Directive 98/70/EC).[28] This imposes a requirement on fuel suppliers to reduce the GHG intensity of energy supplied for road transport by way of a Low Carbon Fuel Standard. In addition, the Directive establishes sustainability criteria that must be met by biofuels if they are to count towards the GHG intensity-reduction obligation.

The amended Directive facilitates the blending of ethanol in petrol through an increase in the maximum ethanol content to 10 per cent and enables Member States to request derogation from the maximum permitted petrol-vapour pressure. In January 2007, the Commission proposed new standards for transport fuels that will

[26] According to data from Eurostat, the total share of renewable energy in the EU in 2012 was 14.1 per cent, up from 8.7 per cent in 2005.

[27] Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC.

[28] Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC.

reduce their contribution to climate change and air pollution through the greater use of biofuels. Directive 98/70/EC, as amended by Directive 2003/17/EC, contains the environmental fuel quality specifications for petrol and diesel fuels. Since January 2005, the limit on the sulphur content of petrol and diesel is 50 ppm and Member States are required to start phasing in ultra-low sulphur fuel with a maximum of 10 ppm sulphur content. Since January 2002, all petrol sold in the EU is unleaded.

A.5. National Climate Change Policy

In accordance with Decision No. 406/2009/EC, Ireland is required to reduce GHG emissions to 20 per cent below 2005 levels by 2020.[29] These international obligations and commitments to the UNFCCC were recognised in the "Climate Action and Low-Carbon Development: National Policy Position Ireland", which noted Ireland's existing and future obligations under European law and the evolution of climate policy within the EU and at a wider international level under the UNFCCC. It proposed that the evolution of climate policy in Ireland will be an iterative process, based on the adoption by Government of a series of national plans over the period to 2050.

It also proposed that GHG mitigation and adaptation would be addressed in parallel National Low-Carbon Roadmaps and National Climate Change Adaptation Frameworks through which the Government will develop and progress national mitigation and adaptation policy. This will enable the State to pursue and achieve the transition to a low-carbon, climate-resilient and environmentally sustainable economy in the period to 2050 and, in particular, to achieve an aggregate reduction in GHG emissions of at least 80 per cent (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors.

The Climate Action and Low Carbon Development Bill 2015, which recently finished its passage through Dáil Éireann, requires the Government to prepare a National Mitigation Plan and a National Adaptation Framework for the purpose of enabling the State to pursue the transition to a low-carbon, climate-resilient and environmentally sustainable economy by the end of the year 2050 (the 'national transition objective').[30] This requires the Government to achieve the national transition objective by the implementation of cost-effective measures and having regard to the ultimate objective in art.2 of the UNFCCC, as well as national GHG emission inventories and projections prepared by the Environmental Protection Agency (EPA).

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[29] See art.3(1) of Annex II to Decision No. 406/2009.

[30] Notably, the amendments to the Bill have resulted in a specific reference and commitment to climate justice.
http://www.oireachtas.ie/viewdoc.asp?fn=/documents/bills28/bills/2015/215/document1.htm.

Although s.4 of the Bill requires the Government to prepare a National Mitigation Plan and recognises the need to promote sustainable development and take advantage of environmentally sustainable economic opportunities, both within and outside the State, this is subject to the need to achieve the objectives at the least cost to the national economy and to adopt cost-effective measures that do not impose an unreasonable burden on the Exchequer. The National Mitigation Plan and sectoral inputs will be produced in 2016.[31]

A.6. European Commission Transport Policy

The 2009 Commission Document 'A Sustainable Future for Transport' recognised that at EU level the key trends and challenges are ageing demographics, migration and internal mobility, environmental challenges and increasing scarcity of fossil fuels and urbanisation.[32] It identified a number of policy objectives for sustainable transport, including:

- Quality transport that is safe and secure (with particular attention to working conditions in the freight industry, and security and privacy concerns that have recently emerged for those migrating across borders);
- A well-maintained fully integrated network that incorporates and coordinates different modes of transport and policy choices;
- More environmentally sustainable transport;
- Enhanced technological innovation and technology-led transport systems such as intelligent transport systems, real-time travel information, and traffic management systems for rail and aviation backed by Galileo and fostering virtual accessibility through information technology;
- Correct pricing of externalities through 'smart prices'.

In order to achieve the goals of increasing mobility and environmental protection, it is necessary to decouple the linkages between economic growth, transport demand and car use. The decoupling of transport dependency from economic growth was identified as a key objective in the 2001 White Paper on Transport and the EU Sustainable Development Strategy. This should be achieved through appropriate fiscal measures or pricing signals, behavioural and cultural change, governance

[31] A national mitigation strategy is overdue given that the current National Climate Change Strategy (NCCS) was prepared in 2007 for the period up to 2012; see also the National Review of Climate Policy, which was prepared in 2011, followed by a Roadmap for Climate and Legislation in January 2012.

[32] It is anticipated that the proportion of the European population residing in urban areas will increase from 72 per cent in 2007 to 84 per cent in 2050.

through effective and co-ordinated action and the promotion of market competition and liberalised markets.

The 2011 Transport White Paper, 'Roadmap to a Single European Transport Area', suggested that oil will become scarcer in future decades and increasingly sourced from uncertain sources (the security of supply concern). It also recognised the need to reduce GHG emissions and suggested that new technologies for vehicles and traffic management will be key to lower transport emissions in the global race for sustainable mobility. In setting out its vision for a competitive and sustainable transport system, it pointedly stated that curbing mobility is not an option but rather that the challenge is to break the transport system's dependence on oil by decoupling economic growth from transport without compromising on efficiency and mobility.

The White Paper outlined a number of key initiatives including, in particular, promoting more sustainable behaviour through the dissemination of travel information, vehicle labelling for fuel efficiency, carbon footprint calculators, eco-driving and speed limits and recognition of the principle of getting the prices right through smart pricing and taxation. It also advocated a 'zero vision' on road safety through road-safety technology such as driver assistance systems, (smart) speed limiters, seat-belt reminders, eCall, co-operative systems and vehicle-infrastructure interfaces as well as improved roadworthiness tests, including for alternative propulsion systems. This is a salutary reminder that transport policy should not be reductionist and focused exclusively on reducing GHG emissions, but must also include tackling congestion and improving safety as paramount concerns.

A.7. National Smarter Travel Plan

Before considering the various policy options in the area of sustainable transport, it should be recalled that Ireland already has a national policy on sustainable transport, which was published in 2009 at the height of the economic recession after an initial public consultation process. In the Foreword to that policy, it was recognised that delivering a sustainable transport system is an important dimension of the climate-change agenda and that while investment in the necessary infrastructure would be challenging, the real challenge is to change mindsets so that institutions and individual citizens realise the benefits from altering their travel behaviour (capturing hearts and minds). The 2009 Smarter Travel Plan was prepared at a time when it was recognised that current travel trends were unsustainable, and a number of key indicators were set out, such as congestion and travel times, with a prognosis that these would continue along a business-as-usual trajectory unless they were reversed (DoT, 2009a).

Five key goals were outlined in the Plan, including to:

- Improve quality of life and accessibility to transport for all and, in particular, for people with reduced mobility and those who may experience isolation due to lack of transport;
- Improve economic competitiveness through maximising the efficiency of the transport system and alleviating congestion and infrastructural bottlenecks;
- Minimise the negative impacts of transport on the local and global environment through reducing localised air pollutants and GHG emissions;
- Reduce overall travel demand and commuting distances travelled by the private car;
- Improve security of energy supply by reducing dependency on imported fossil fuels.

The Plan proposed 49 specific actions, which included:

- Actions to reduce distance travelled by private car and encourage smarter travel, including focusing population and employment growth predominantly in larger urban areas and the use of pricing mechanisms or fiscal measures to encourage behavioural change;
- Actions aimed at ensuring that alternatives to the car are more widely available, mainly through a radically improved public-transport service and through investment in cycling and walking;
- Actions aimed at improving the fuel efficiency of motorised transport through improved fleet structure, energy-efficient driving, and alternative technologies;
- Actions aimed at strengthening institutional arrangements to deliver the targets.

A.8. National Cycle Policy Framework (2009)

In addition, a National Cycle Policy Framework (NCPF) was published in 2009, which outlined 19 specific objectives with 109 individual actions. This set a specific (and optimistic) goal of ensuring that a cycling culture is developed in Ireland to the extent that by 2020, 10 per cent of all journeys will be by bike (DoT, 2009b). This aimed to reverse the trend of people commuting to work by bicycle which had fallen from 7 per cent in 1986 to 2 per cent in 2006. The NCPF envisaged a number of key 'interventions' in the infrastructure and physical environment (hard engineering

measures), communication and education (soft measures), financial resources, legislation and enforcement and human resources and co-ordination. Furthermore, it was acknowledged that a new approach is required in which a 'hierarchy of measures' is followed with a particular focus on: (a) reducing volumes of through-traffic, especially heavy goods vehicles (HGVs), in city and town centres and in the vicinity of schools and colleges; (b) calming traffic/enforcing low traffic speeds in urban areas; (c) making junctions safe for cyclists; and (d) removing multi-lane one-way street systems.