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JOINT COMMITTEE ON
CLIMATE CHANGE AND ENERGY SECURITY
FIRST REPORT

DRIVE FOR ZERO
ELECTRIC VEHICLES ARE A WINNING PROPOSITION

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Foreword by the Chairman

Climate Change is now widely regarded as the most significant challenge the world faces, with consequences that go far beyond its effects on the environment. In recent months global uncertainty caused by the crisis in the financial system and the economic slowdown have deflected attention from the huge threats posed by climate change to life on this planet. However the negative effects of climate change continue to gather pace. It is crucial that energy security issues and the development of greener technologies are kept centre stage as we strive to restore stability to the financial system and search for ways to revive the economy. Waiting for economic recovery, rather than taking decisive action now, will make the future climate challenge far greater.

By solving the practical issue of energy security we reduce the damage done through climate change. For Ireland this means developing the abundant wind and wave energy resources around our shores to produce renewable electricity and reduce our dependence on volatile supplies of imported oil and gas.

The implementation of the recommendations set out in this very significant report will not only reduce our greenhouse gas emissions from transport but will also give a huge impetus to economic recovery through creating a market for new products and skills in a new market for vehicles powered by our own natural resources.

On behalf of the Committee I wish to thank Deputy Coveney for producing this impressive report in such a timely manner.

SEAN BARRETT T.D.,
Chairman.

April 2009

Recommendation of the Joint Committee

At its meeting on 27 November 2008 the Joint Committee on Climate Change and Energy Security appointed Deputy Simon Coveney as rapporteur with the task of producing a report on electric vehicles.

The Committee wishes to acknowledge the impressive work carried out by Deputy Coveney in producing this Rapporteur Report for the Committee and unanimously supports the recommendations made.

April 2009

Photo of Committee on Climate Change

DRIVE FOR ZERO

ELECTRIC VEHICLES ARE A WINNING PROPOSITION

REPORT FOR THE JOINT COMMITTEE ON CLIMATE CHANGE
AND ENERGY SECURITY

BY
SIMON COVENEY, T.D.

Foreword by Deputy Simon Coveney, Rapporteur

Climate Change is the greatest global challenge of our generation. Challenges of this enormity require radical change that can only be delivered by completely new thinking. We are being forced to rethink how to sustain our current quality of life: the way we generate power and heat, our energy usage and consumption, the food we eat and how we produce it, the way we move around. Our current lifestyles and the associated emissions are simply no longer sustainable.

This report proposes a plan to transform the way in which the two million cars in Ireland are powered, to drive down emissions, improve efficiency and reduce costs. It's radical, viable and exciting.

Transportation is the big problem area in terms of emissions in Ireland. Not only does it make up more than 20% of our entire national emissions, it is by far the biggest growth area. Since 1990 transport emissions in Ireland have increased by 165%; our commitment under Kyoto was just 13%. In 1990 we had 800,000 cars on Irish roads, 10 years later it was 1.3 million, now the figure is 2 million.

Most commentators view transport as an impossible sector to tackle in terms of meeting emissions targets. I see it as the most exciting area to provide the solutions we need.
We need to get people out of cars, but also reduce the carbon reliance of the vehicles that remain. Public transport and bicycles alone will not suffice, because of how and where we live. Bio-fuels have a role to play, so too do gas powered vehicles and possibly hydrogen engines. However the really exciting revolution will happen in battery powered electric vehicles. Make no mistake, this revolution will happen and has already begun.

By linking electricity generation and management of the electricity grid with powering cars, we can create a new energy formula that can massively reduce our reliance on imported oil and the associated emissions.

It is both feasible and realistic to aspire to achieve the complete replacement of petrol and diesel engine driven cars with electric vehicles within 15 years. The electric vehicles I'm referring to will not be confined to the small, cartoon like designs that are currently available. These will be mainstream cars: big, safe, fast and comfortable; but powered in a different way.

This is already happening abroad. Israel is planning for the replacement of hundreds of thousands of cars within the next five years. Within the EU, Denmark is planning for the same change. If this is to work, we must be aggressive and ambitious: our target must be the complete replacement of oil powered cars.

The electricity generation consequences of over a million cars, requiring batteries to be recharged, may sound like a barrier to progress. But in fact it is a new opportunity that can level the demand curve for electricity consumption and provide a new electricity storage system, in batteries, for use when the power is needed.

Ireland is bursting with natural resources that can be exploited to produce affordable renewable energy. We have better and more consistent wind speeds than any other country in the EU and wave energy research projects are showing real promise. By linking the energy generation sector, particularly renewables, with fuel demand for transport, we are creating a symbiotic relationship between the two sectors that increases the viability of renewables, through storage of power, but also dramatically reduces emissions from transport.

Ireland, as an Island and a small country, has a competitive advantage over larger countries in terms of the capacity to transform areas of our economy quickly. We have a small and geographically isolated economy ideally suited to making a dramatic shift to electric vehicles.

This is the choice: either we sit back and allow other countries take the lead in adopting electric vehicles and be a follower in the technology or we can be a leader in this new and rapidly growing global industry. Being a first mover in this area will not only reduce our transport emissions by up to 8 million tons per year, but it will also be the start of an exciting new industry employing tens of thousands of highly skilled people.

It's not a time to be hesitant. We should be ambitious to grasp the exciting opportunities that exist for Ireland in the electric car revolution.

Executive Summary

Climate change poses a major challenge for Ireland. Increasing emissions in the transport sector is seen by many as the most serious barrier to meeting our climate change obligations. This mentality must change: future transport provision should be seen as the solution instead of the problem in reducing emissions.

Carbon emissions from the transport sector, at 14.4 million tonnes (Mt) (2007) are rising inexorably and are forecast to reach 18.1 Mt by 2020.[1] At the same time Ireland has agreed to reduce its greenhouse gas (GHG) emissions perhaps by as much as 30% by 2020 over a 2005 baseline. Emissions reduction policy in transport needs to be turned on its head; we need to think differently. By developing a symbiotic relationship between smarter energy generation and passenger car transport, through electric vehicles (EV) charged on the electricity grid, we can not only provide an exciting support for the renewable energy industry, but also a more fuel efficient, cost effective and power efficient national car fleet that produces no carbon emissions at all.

In addition to climate change impacts, a continuing dependence on imported oil carries significant risks for security of energy supply. Ireland's dependency on imported fuels is around 93%, compared with 80% in the EU-25. This is particularly relevant to the transport sector, which is 99% dependant on fossil fuels.[2] It may sound unrealistic to some, but the long-term ambition should be to reduce transport fossil fuel imports to zero by developing an entirely new way of powering cars and heavier vehicles. Why spend some 1 billion each year abroad to purchase fossil fuel for passenger cars (and €2.55 billion for transport overall) when we can develop our own fuel sources here at home and develop an industry around that fuel provision?

There are a range of measures to tackle carbon emissions from transport outlined in the government's policy paper on sustainable travel and transport.[3] However, it's clear that in addition to smarter and more energy efficient use of existing transport infrastructure, there is an urgent need to be radical about changing entirely the types of vehicles and how they are powered.

As has been recognised in many other countries,[4] the biggest potential reductions in emissions from transport will be realised as a result of new technology, including the wide deployment of EVs in the medium to long-term. The case for EVs is compelling. Industry consensus is that Battery EVs (BEVs) will deliver better results in terms of climate change impacts than Hybrid EVs. The employment potential resulting from the more widespread use of EVs is also an important secondary factor.

It is important we act now to put a strategic roadmap in place to encourage the rapid deployment of BEVs in Ireland. This shift to BEVs is going to happen across the world with or without early adoption in Ireland. However, there is an opportunity for Ireland to be an early mover, to develop an infrastructure that will allow our country to benefit from being an incubator for the global EV revolution and enjoy all the research and development opportunities that comes with that ambition. We can achieve not only immediate carbon savings in the short-term, but also send clear market signals that Ireland intends to be a world leader in the technology and application behind the shift away from fossil fuel driven engines towards BEVs. This can be an exciting new industry employing scientists, environmentalists, marketing and sales people, engineers, mechanics, IT and software developers and so many more as part of the new green economy.

Against this background, the Joint Committee believes that it is vital that we fully embrace the emerging opportunities presented by EVs. It is recognised that the government is already engaged and has announced a number of initiatives to promote the uptake of EVs and that SEI has produced a number of informative reports in this area and is planning to finance a number of demonstration projects.[5] The signing by the Minister for Communications, Marine and Natural Resources and the ESB of a Memorandum of Understanding with car manufacturer Renault-Nissan is another notable milestone.[6] Nevertheless, the Committee believes that much more ambitious targets need to be set within a shorter time frame than is currently envisaged; the EV project can and should be advanced in a more dynamic manner. A fully costed strategic roadmap for Ireland to become a global research laboratory for the deployment of new battery and EV technologies should be in place within six months. In this context, the future development of a national EV project should not be limited to any single supplier of EVs, electricity, and supporting infrastructure. Competition must prevail.

The growing availability of EVs will not only boost the flagging car manufacturing industry, but will accelerate innovation and R&D activity in developing new car technologies. It is both feasible and realistic – and must be an essential element of Ireland's National Climate Change Strategy, post-2012 - to set and meet a target whereby all new cars on sale by 2020 would

1. *Environmental Protection Agency, Ireland's Greenhouse Gas Emissions, press release, 13th March 2009.*
2. *Department of Transport, 2020 Vision – Sustainable Travel and Transport: Public Consultation Document, February 2008.*
3. *Smarter Travel; A Sustainable Transport Future. A New Transport Policy for Ireland 2009-2020, 5 February 2009.*
4. *See for example, UK Department of Trade and Industry: Meeting the Energy Challenge. A White Paper on Energy, May 2007.*
5. *Press release, Minister for Communications, Marine and Natural Resources, 26 November 2008.*
6. *Press release, Minister for Communications, Marine and Natural Resources, 3 April 2009.*

be powered by electric engines, with at least 350,000 EVs in use by 2020. Allowing for an average replacement rate of 8.4% per annum, by 2030, all private cars in Ireland should be BEVs.

The Government should immediately prioritise the setting up of an independent EV Task Force, including private sector experts with a full-time international expert appointed to drive the project. He/she should be assisted by a four to five person full-time support group of expert advisors. This group should engage with the main players - motor manufacturers, battery producers and energy experts - at global level to put a roadmap in place, with a view to promoting Ireland as a R&D Centre and testing ground for emerging BEV technologies.

The mandate of the Task Force should also include an assessment, based on international best practice, of the most efficient tax and incentive package that may be required to accelerate the rapid deployment of BEV technologies on the island of Ireland.An immediate priority – and a task that should also be completed within six months – is the carrying out of a comprehensive economic, regulatory and technological assessment of the Better Place model for EV development to ascertain if it could be suitably adapted for our island. Specifically, the issue of granting one or more companies the option of providing the supporting infrastructure needs to be addressed.

As forecast emissions by 2020 from passenger cars is some 8.1Mt, the proposal set out in this submission is potentially the single largest GHG emission reduction measure currently under consideration.[7] The BEV Project therefore justifies the allocation of substantial public resources. It is anticipated that significant private sector investment will be forthcoming provided the right regulatory framework conditions are put in place.

This BEV Project, with the co-operation of the Northern Assembly, should be an all-island project and has the potential to create new synergies between the research communities in Ireland and the UK.

The Government is urged to position Ireland as a leader in terms of facilitating rapid deployment of BEVs. To do this it is necessary to work with multiple partners and to set a target that all private combustion vehicles will be EVs by 2030. Such a signal will seek to convince the motor industry and investors of the seriousness of our intent. Ireland has the potential to become a global Centre of Excellence for EV development if the correct strategy is adopted.

Acknowledgement: The Joint Committee wishes to acknowledge the research carried out by EPS Consulting (www.epsconsult.ie) in the preparation of this report.

7. Assuming that an average car emits some 3.25 tonnes of CO_2e per annum and that some 2.5 million private cars will be licensed by 2020.

Terms used in the report

- Battery electric vehicles (BEVs) are powered by electricity stored in large batteries within the vehicle. The battery needs to be recharged by plugging into recharging points.

- Hybrid electric vehicles (HEVs) are powered by a combination of electricity stored in a battery and either a petrol or diesel internal combustion engine. A hybrid vehicle does not need to be plugged in to recharge its battery, as it is recharged automatically as the vehicle is being driven.

- Plug-in hybrid electric vehicles (PHEVs) work similarly to conventional hybrids in that they operate using the vehicle's petrol or diesel engine, or by using electricity to power an onboard electric motor. However, PHEVs have much larger batteries than conventional HEVs and so can be charged from the mains when not in use and this means the vehicle can cover a greater distance. There are two types of PHEV:

The first can run indefinitely with the petrol/diesel motor providing power as in a normal car.

The second is effectively a battery-powered vehicle with a small onboard generator to extend the distance the car can travel.

Most new EVs also use an advanced braking system – known as 'regenerative braking' – that allows the electric motor to re-capture the energy expended during braking and to improve energy efficiency.

Overview of the Reports' Findings

A totally compelling case has been made that the wider use of EVs, and in particular zero emission BEVs, could reduce sharply the Ireland's transport emissions and the sector's over-dependency of imported fossil fuels. BEVs are typically charged at night availing of off-peak electricity. As a consequence, the running cost of a BEV can be nearly 90% cheaper per km than a conventional combustion engine; generating average savings of some €1,600 per annum. An added advantage of using electricity generated by renewables during the night is that it levels out the demand curve throughout the day and creates a national energy storage system.

Ireland will have an abundant supply of renewable electricity within six years (by around 2015) and the bringing on stream of this additional capacity is expected to coincide with a global shift by car manufacturers to start the mass production of EVs and BEVs. The gradual introduction of passenger BEVs will require new car and battery standards to be adopted at EU level; that an adequate battery replacement infrastructure be built; that a nation-wide battery recharging infrastructure be planned and installed; that public confidence be garnered; and that the BEV Project becomes a matter of national strategic interest.

Some 2.5 million passenger cars are expected to be licensed in Ireland by 2020. They will emit some 8.1 million tonnes (Mt) of CO2e. Assuming a carbon price of €30/tonne, this represents an annual saving of some €243m per annum in terms of carbon credits that would not have to be purchased.

If by 2030 all passenger vehicles were BEVs, Ireland's dependency on imported fuels for transport purposes would fall significantly; a saving of some €1 billion (2008 prices).

1. Introduction

The Irish Government is clearly aware of the scale of the problem facing the country as regards climate change. In June 2007, climate change took centre stage with the adoption of a National Climate Change Strategy 2007-2012 which, in conjunction with the Programme for Government, sets out GHG reduction targets of 3% per annum in an effort to meet our commitments under the Kyoto Protocol.[8] The strategy states that "Through innovation, energy efficiency and more sustainability in our personal choices, we can achieve the necessary lowering of the carbon intensity of our economy without sacrificing competitiveness, economic performance or quality of life".[9]

Despite the anticipated reduction in GHG emissions due to the effects of the current economic recession, the size of the task facing Ireland is immense. Our per capita emissions of GHG is the fifth highest in the world. Furthermore Ireland's current level of emissions (69.2Mt in 2007) are some 25% over

8. *The European Commission outlined a package of measures in January 2008 to stabilise GHG emissions that will result in temperature rise of no greater than 2°C. Importantly, the EU also proposes an increase in emissions reduction from 20% to 30% by 2020 if a global agreement is signed in Copenhagen in 2009. This package was agreed in December 2008.*
9. *Ireland National Climate Change Strategy 2007-2012. 10. EPA, Ireland's Greenhouse Gas Emissions in 2007, press release, 13 March 2009..*

our 1990 emission baseline level (of 55.6Mt). Transport, which accounts for approximately 14.4Mt CO2e (2007) is one of the fastest growing sectors. In fact, transport emissions are now some 178% over our 1990 figures.[10]

As a consequence of the EU climate change agreement, the Irish economy has to 'decarbonise' by 17 Mt of CO2e by 2020 moving to a new baseline figure of approximately 48 Mt CO2e. It will not stop there, however, and further cuts in emissions will follow as Ireland, with Europe, attempts "to become the most resource efficient economy in the world".[11]

The targets for the reductions in GHG emissions contained in the EU's climate change/renewables package will pose significant challenges for Ireland. It is now clear that drastic action will be needed if we are to get anywhere near achieving the levels of reductions in emissions that are required.

As indicated in the Joint Committee's report on the European Commission's '2020 package' on climate change, the Joint Committee believes that given Ireland's track record at meeting its current Kyoto commitments, these proposals represent a significant challenge not only for government, but also for the business, farming and general population.[12] Moreover, it is also clear that the targets set are just a first step in the endeavour to move the economy to a lower carbon footprint.

To achieve this, therefore, Ireland must set ambitious targets for GHG reduction across all sectors of the economy. While behavioural change is clearly necessary, technology must also play a central role in helping us to meet this significant challenge. As highlighted by the International Energy Agency (IEA), their analysis demonstrates that:

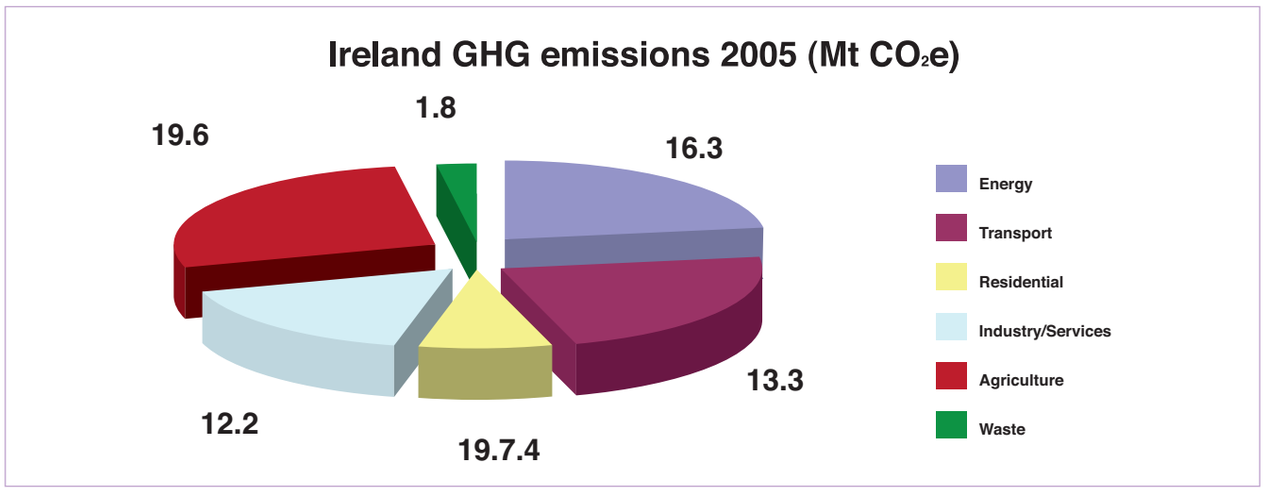
"a more sustainable energy future is within our reach, and that technology is the key… We must act now if we are to unlock the potential of current and emerging technologies and reduce the dependency on fossil fuels with its consequent effects on energy security and the environment." [13]

On the other hand, the Stern Report concluded as follows:

"Transport is one of the more expensive sectors to cut emissions from because the low carbon technologies tend to be expensive and the welfare costs of reducing demand for travel are high. Transport is also expected to be one of the fastest growing sectors in the future. For these two reasons, studies tend to find that transport will be among the last sectors to bring its emissions down below current levels." [14]

This scenario should be rejected by Ireland given the EPA's forecast transport emission levels (18.1 Mt) by 2020.

Ireland must instead be ready to fully embrace emerging technology solutions that can help achieve the national objective of reducing transport emissions and over-reliance on fossil fuels. In the area of transport, alternatively powered vehicles such as EVs have the potential to achieve real reductions in emissions while continuing to balance the needs for personal mobility and economic growth.



10. EPA, Ireland's Greenhouse Gas Emissions in 2007, press release, 13 March 2009..

11. EU Lisbon Treaty, http://ec.europa.eu/news/eu_explained/071213_1_en.htm

12. Houses of the Oireachtas, EU Scrutiny Report No 1 on three EU proposals relating to the implementation of the EU climate and energy legislative package, October 2008,

13. IEA: Energy Technology Perspectives 2008- Scenarios and Strategies to 2050.

14. The Stern Review on the Economics of Climate Change (London: HM Treasury, 2006).10. EPA, Ireland's Greenhouse Gas Emissions in 2007, press release, 13 March 2009.

2. Ireland's Growing Transport Problem

A) VEHICLE REGISTRATIONS

Transport is a significant and growing source of carbon emissions. In recent years, Ireland has seen significant growth in vehicle ownership and usage. According to CSO statistics,[15] at the end of 2007 there were almost 2.45 million vehicles licensed in Ireland. Private cars, at 1.88 million, made up 77% of the total, with goods vehicles making up a further 14%. The size of the national vehicle fleet increased by 70% between 1997 and 2007 and in 2007 alone, 246,446 new vehicles and 59,000 imported second-hand vehicles were licensed for the first time. While recent economic developments have impacted on the overall number of vehicles being registered in Ireland, it is clear that the long term trend in vehicle ownership is upwards. And indeed, despite the rapid growth of recent years, vehicle ownership levels per head of the population are still below the EU average.[16]

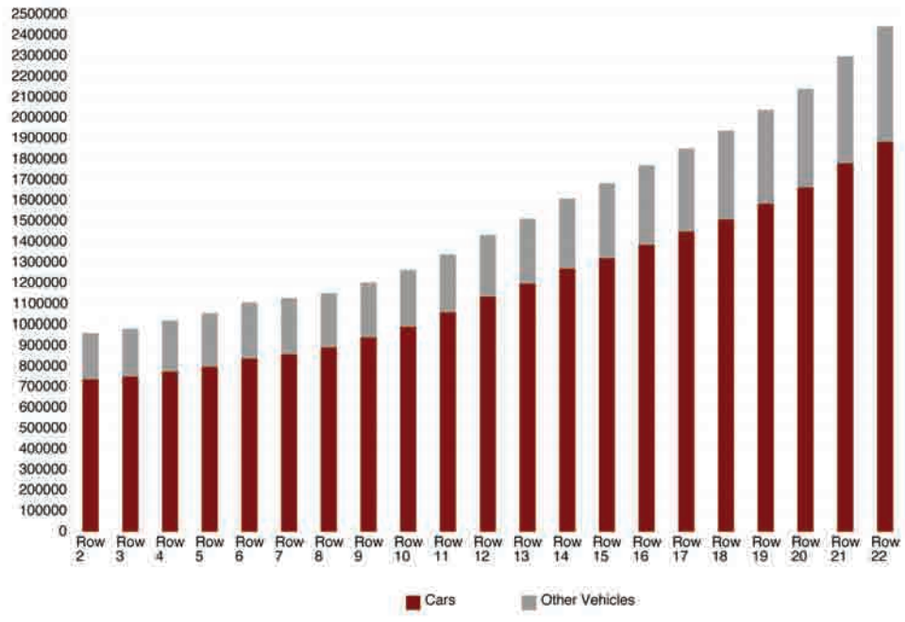
As highlighted in the Consultation Paper on Sustainable Travel and Transport,[17] current trends for travel and transport are unsustainable. This conclusion was based on the assumption that the population could exceed 5 million by 2020; that car ownership levels could increase to beyond EU average levels; that the total number of private cars licensed could increase from 1,800,000 to 2,600,000 by 2020; and that car use will continue to increase.[18]

Although these predictions may need to be modified in light of the economic downturn, it is nevertheless clear that unless drastic action is taken now, the number of vehicles on Ireland's roads is set to continue to rise to 2020.

B) VEHICLE USAGE

It is also clear that not only are vehicle numbers rising but average vehicle usage is also on a strong upward path. The number of journeys by car more than doubled between 2001 and 2006 and while in general people are making shorter trips, the average distance travelled for some trips also increased. This was particularly noticeable for commuting, for example, which accounts for roughly 35% of the total distance travelled per annum. [19]

FIGURE 1: NUMBER OF CARS AND OTHER VEHICLES LICENSED IN IRELAND: 1987 TO 2007



Source: CSO

15. CSO: Transport 2007, December 2008.

16. Department of Transport: 2020 Vision – Sustainable Travel and Transport: This public consultation document highlights the fact that in 2006, private car ownership in Ireland stood at 528 cars per 1,000 adults, compared with an EU-25 average of 558 and a UK average of 555. It is expected that this trend will continue until ownership reaches average EU levels.

17. Department of Transport.

18. ibid.

19. Ibid. There is also evidence of increased car usage for a range of other trips. This includes school runs for example, where it is clear that demand for travel for education is becoming more and more centred on the private car. Moreover, for the vast majority of the other trips we make and the kilometres we travel, such as shopping, leisure and visiting friends, the car is also the primary mode of transport.

In 1991 the average distance travelled to work was around 7.7km, by 2006 this stood at 15.8km." This means that car usage for relatively short journeys is rising sharply and looks set to continue to do so. In 2006, there were 1.2 million people driving to work and according to Department estimates this could exceed 1.7 million by 2020. Should this scenario occur, it would mean that by 2020 the number of people driving to work will have doubled since 2000. Clearly, this will result in increased congestion, travel times, energy use and emissions. [20]

Whilst acknowledging the fact that these predictions may now be somewhat optimistic in the current economic climate, it is clear that even at lower levels of growth Ireland is facing into a major problem unless radical action is taken now. Given the fact that transport is central to economic well-being and competitiveness, and will remain so for the foreseeable future, ways need to be found of enabling people and businesses to continue to enjoy mobility whilst at the same time minimising the impact on the environment. By way of example, given that there are 1.2 million commuters travelling an average distance of 15.8km per day; that equates to 18,960,000 km travelled every day. When one considers that an average car produces some 165g/km of CO2 while an EV such as a Reva produces just 0.2g/km then the potential reduction in emissions from a switch to EV even for the daily commute to work are potentially enormous.

Although the average number of trips being taken has increased significantly, average annual kilometres has been on a downward path. This is consistent with the evidence on vehicle usage as it indicates that on average people are making shorter journeys but are doing so more often i.e. they are making more trips over relatively shorter distances. This is an important finding as EVs, even with their current restricted range, could offer a viable alternative.

While average mileage for passenger cars in Ireland have been falling in recent years, total passenger-kilometres has increased due to increasing ownership rates. Moreover, increased demand for larger engine vehicles in recent years has largely offset the increased fuel efficiency of new cars and has meant that total final energy consumption (TFC) within the transport sector increased by 166% between 1990 and 2006 and accounted for 41% of final energy demand in 2006. Of this, private cars accounted for 46% of road transport energy and 38% of all transport energy use in 2006.[21]

C) ALTERNATIVELY FUELLED VEHICLES

Of the 180,754 new cars licensed in 2007, just 1,848, or 1%, were powered by alternative fuels (petrol/electric, petrol/ethanol or other). Indeed, over the whole period from 2002 to 2007 just over 3,000 alternatively fuelled cars were licensed. While numbers have increased sharply in recent years, they are still extremely low and it is clear that on a Business-As-Usual basis, it is likely to take an unacceptably long time before alternatively fuelled vehicles become the vehicle of choice for Irish car owners. While the changes to the VRT system will help to encourage a shift to smaller more fuel efficient vehicles, this will take some time to work through the system.

D) CARBON EMISSIONS

Carbon emissions from the transport sector have been increasing strongly in recent years. According to the EPA emissions have increased by 178% between 1990 and 2007 to 14.4Mt CO2e. equivalent in 2007 and its sectoral share (of total emissions) increased from 9.34% in 1990 to almost 20.8% in 2007. In 2006, the transport sector was the only sector in the economy not to experience either reductions in energy related carbon emissions or low levels of growth compared with the previous year. The transport sector recorded a 7.1% growth in emissions in 2006 compared to 2005; and a 4.7% increase in 2007 on 2006. Transport now accounts for some 35% of energy related emissions. The vast bulk of these transport related emissions are from passenger transport - in fact total carbon emissions from the transport sector (excluding air, sea and freight transport) in Ireland in 2006 amounted to approximately 10 million tonnes.[22] [23]

Given the scale of the growth in Ireland's transport emissions in recent years, it is inconceivable that Ireland can deliver the level of reductions in emissions post-2012 (that will be legally binding) without drastic action being taken to encourage fuel switching in the passenger fleet.

Moreover, Ireland's transport sector is heavily dependent on imported fossil fuels and therefore is increasingly vulnerable to security of supply and global oil price volatility.

EVs offer a real opportunity to address both these challenges head on. However, it will only work if drastic and ambitious action is taken now to ensure rapid uptake of vehicles using more sustainable sources of power.

Table 1: Annual Average Kilometres Travelled by Private Car, 2002 -2007

Fuel Type	2002	2003	2004	2005	2006	2007
Petrol	16,777	16,623	16,352	16,066	15,873	15,895
Diesel	25,999	25,708	25,239	24,697	24,338	24,242
Both	18,006	17,865	17,572	17,251	17,074	17,137

Source: CSO

20. Op cit. Department of Transport.

21. Department of Transport, 2020 Vision.

22. SEI: Costs and Benefits of the use of Hybrid Electric Vehicles and Battery Electric Vehicles in Ireland.

23. Brendan Halligan, Chairman, SEI.

3. Electric Vehicles – Opportunities and Challenges

A) INTRODUCTION

EVs essentially fall into three categories:[24]

- **Battery electric vehicles (BEVs)** which are powered by electricity stored in large batteries within the vehicle. The battery needs to be recharged by plugging into recharging points.

- **Hybrid electric vehicles (HEVs)** are powered by a combination of electricity stored in a battery and either a petrol or diesel internal combustion engine. A hybrid vehicle does not need to be plugged in to recharge its battery, as this is recharged automatically as the vehicle is being driven.

- **Plug-in hybrid electric vehicles (PHEVs)** work similarly to conventional hybrids in that they operate using the vehicle's petrol or diesel engine or by using electricity to power an onboard electric motor. However, PHEVs have much larger batteries than conventional HEVs and so can be charged from the mains when not in use and this means the vehicle can cover a greater distance. There are two types of PHEV:

  1. The first can run indefinitely with the petrol/diesel motor providing power as in a normal car.

  2. The second is effectively a battery-powered vehicle with a small onboard generator to extend the distance the car can travel.

Most new EVs also use an advanced braking system – known as 'regenerative braking' – that allows the electric motor to re-capture the energy expended during braking and to improve energy efficiency.

B) BENEFITS

1) Major reductions in carbon emissions:

It is accepted that EVs offer the potential to reduce emissions from the transport sector in Ireland. SEI estimate that by replacing 10% of cars, vans and buses in Ireland with currently available models of hybrid and BEVs, a reduction in national carbon emissions of 350,000 tonnes annually could be achieved. This is equivalent to removing emissions from over 100,000 cars on Irish roads.[25]

As highlighted in the SEI report, using electricity to power a vehicle means there is no pollution at all when the vehicle is in use, unlike petrol and diesel cars. A car powered purely by a battery has zero emissions when in operation, whereas the emissions from hybrids and plug-in hybrids are lower than conventional vehicles as they use electricity for at least part of the journey. When in use, all electric vehicles contribute less to air pollution in towns and cities and so have much less impact on the climate than conventional vehicles.

If one looks at the emissions generated by EVs on the basis of a full life cycle analysis, the savings in emissions are still significant. In the UK for example, research showed that taking account of emissions from power generation, and emissions relating to production and disposal, EVs have the potential to offer significant GHG emissions reductions over time compared to conventional petrol/diesel fuelled vehicles. Based on the current UK grid mix, it was estimated that significant benefits of the order of 40% reduction could be achieved.[26] Moreover, it is clear that with the move to renewable energy sources, the potential saving is even greater.

In addition, according to Green Machines and GreenAer Mobility, two of the largest suppliers of EVs in Ireland, EVs pollute far less than petrol, diesel or even hybrid powered vehicles. Based on Ireland's current carbon/peat intensive energy mix, the electrification of automotive transport can deliver an immediate reduction in GHG emissions of at least 40% over the cleanest hybrid car available.[27]

2) Cheaper to run

As electricity is cheaper than petrol or diesel, the running costs of EVs are dramatically lower than conventional vehicles. The average fuel cost per month of a family car is €149 or approximately €1,788 per year. An electric vehicle costs approximately 0.01c per km, or a total of €204 in electricity costs per year, which represents a saving of €1,595 per annum.[28] However, this assumes the government will not tax electricity used by EVs to make up revenue lost from fossil fuel taxes.

Maintenance costs are also lower as battery electric cars are mechanically simple and of course, the recent changes in VRT and motor tax have also made EVs significantly cheaper than their petrol or diesel alternatives.

24. Sustainable Energy Ireland: Hybrid Electric and Battery Electric Vehicles; Buyers Guide. November 2007.

25. SEI: Costs and Benefits of the use of Hybrid Electric Vehicles and Battery Electric Vehicles in Ireland, November 2007.

26. BERR, Department of Transport: Investigation into the Scope for the Transport Sector to Switch to Electric Vehicles and Plug-in Hybrid Vehicles, October 2008.

27. Electric Transport: The Role of the Government. Compiled by Green Machines and GreenAer Mobility; Supported by Carra Ireland Ltd.

28. Ibid.

Indeed, an average car user, who owns a car for 10 years and drives around 17,000 kilometres a year, would achieve significant financial benefits from buying an electric car. Over the lifetime of the car, the owner could save around €6,900 by using an electric car instead of a petrol car and around €5,700 if they bought an electric car instead of a diesel car.[29]

3) Other Benefits:

EVs are also quieter than conventional vehicles as they operate in almost complete silence, except for noise from the tyres. This reduces levels of noise pollution, a factor which has been highlighted as making them particularly suitable for inner city and urban use.

C) BARRIERS AND CHALLENGES

While EVs offer a real opportunity to reduce sharply Ireland's transport emissions, there are a number of barriers and challenges that need to be overcome before widespread adoption is feasible. These are not insurmountable, however, and with the right policy measures and a real commitment from Government, enormous strides can be taken in ensuring that EVs achieve significant market penetration in the short to medium term.

1) Battery Cost and Technology

As indicated above, the day-to-day running costs of EVs are significantly lower than traditional vehicles and offer users the ability to make significant cost savings over the whole life of the vehicle. However, evidence from the UK indicates that for the majority of vehicle purchasers this is not fully taken into account when making a purchase decision but instead the focus is on the capital cost of the vehicle.[30]

This has been identified as a significant barrier to the uptake of EVs as the initial cost of some EVs can be much higher than traditional car models. This is largely due to the current high cost of the batteries, which not only adds to the initial capital outlay but also to ongoing maintenance costs as the battery is likely to need to be replaced at least once during the lifetime of the vehicle. [31]

Research from the UK has suggested that with current battery costs, an EV equivalent of a current production vehicle could be more than double the current price. This price differential - if it persisted - would make it extremely unlikely that large numbers of car purchasers will opt for an EV over a traditional vehicle. In fact, it would appear that while some price differential between EVs and equivalent internal combustion vehicles (ICVs) in the early years would be acceptable to the early adopters, a number of vehicle distributors have indicated that this price differential would need to be less than £5,000. Without significant Government intervention to address this price imbalance therefore it seems unlikely in the short term that EV vehicle purchases will take place in sufficient numbers to deliver real improvements in carbon emissions. The challenge, however, not only relates to cost but also to battery performance relative to vehicles powered by an ICV engine.

Technical developments within the sector are taking place at a rapid pace. Although nickel metal hydride (NiMH) is currently the dominant battery chemistry for HEV applications, there appears to be a growing consensus that lithium ion (Li-ion) offers the most promising combination of power and energy density for wider rollout of BEVs and PHEVs.

At the present time, Li-ion batteries sourced from recognised suppliers to the automotive sector (with cost ranging from $1,000 per kWh to $2,000 per kWh) are currently seen as too expensive by at least a factor of two compared with conventional technology to facilitate a whole scale switch to EVs. However, the battery sector is confident that prices will fall sharply in the medium-long term, based on the massive investments that manufacturers are making in this technology and the falls in the price of mass-manufactured cells for consumer applications.[32]

Nevertheless, in the short term battery prices are not expected to fall sufficiently quickly to make EVs economically competitive with conventionally-powered vehicles. For this switch to take place therefore, it is essential that a range of measures are introduced to alter the economic balance between EVs and traditional vehicles. Such interventions will help to accelerate the speed with which a large scale switch to EVs can take place, and in turn by improving the economies of scale of battery production and making them cheaper to produce, will help to bring forward the date at which EVs can truly compete against conventional vehicles.

As the source of half of the world's lithium, Bolivia is a key supplier of the essential component for next generation BEVs. However, its government is somewhat belatedly engaging with global car manufacturers and battery producers with a view to striking a deal that will both guarantee supplies while adding value to the Bolivian economy.[33]

29. SEI: Hybrid Electric and Battery Electric Vehicles; Buyers Guide, November 2007. These savings relate to the use of relatively small cars, as these are the most common size of electric car available in 2007.

30. BERR report.

31. Current expectations on battery life and range are relatively low and while battery life for EVs and PHEVs is projected to reach ten years and 180,000 km in coming years, this is still well below the average life of an average passenger car (14 years). As a result, the battery is likely to have to be replaced during the life of the vehicle and this obviously brings further significant additional cost. In the UK, it was suggested that given that the most popular cars lose 50-60% of their purchase price after just 3 years, one could very rapidly reach the point where the cost of a replacement battery was higher than the actual value of the car, which in turn could possibly lead to premature scrappage of the vehicle.

32. BERR Report.

33. Newsweek, 2 February 2008.

2) Car Financing and Residual Values

Another factor that has been highlighted as a possible impediment to the rapid uptake of EVs is the fact that the high capital cost of the battery combined with the uncertainly about the battery life, reliability and obsolescence makes it extremely difficult to predict residual values for EVs and PHEVs. This in turn impacts on car financing arrangements and also increases difficulties for manufacturers in securing access to leasing companies – which traditionally have been large customers for new vehicles and an important route to market for manufacturers. As a result of these difficulties, it is expected that new models of vehicle ownership will need to develop to enable the uptake of EVs to become more widespread. This may take the form of leasing either the whole car or the battery separately or some system of "Pay As You Go" schemes similar to mobile phone ownership. Such arrangements are already emerging. For example, many of the EVs which are currently available are sold using packages which include complete purchase, purchase of vehicle and lease of battery, and combined lease of vehicle and battery.

3) Vehicle Choice and Range

Another obstacle that EVs have to overcome is the fact that the range of vehicles currently on the market is relatively limited and largely consists of small cars with limited power and range. The current EV range limit of most vehicles available on the market is about 120 km – and indeed a significant number are closer to 80km. Nevertheless, based on the statistics on vehicle usage and typical trip profile, it would appear that even this relatively limited range is sufficient to cater for a significant number of all trips made in Ireland, in particular in urban areas. On the other hand, the EVs' range is only about one fifth of the range of traditional vehicles and this obviously makes it more difficult to "sell" to consumers. While it is expected that Li-ion batteries will continue to develop, offering higher energy density resulting in increased ranges,34 it will take some considerable time - perhaps five to ten years - before EVs with comparable range to traditional vehicles emerge. As a result, the creation of a robust and easily accessible recharging infrastructure will be crucially important to persuading consumers to switch to EVs.

4) Charging Infrastructure

The availability of a comprehensive charging infrastructure is critically important to the successful adoption of EVs and to alleviate any concerns consumers might have about the limited range of EVs. If charging points are not available, this will restrict potential market development. Therefore, it is essential that charging points are put in place well ahead of market uptake as no consumer would buy an EV if they are unable to easily recharge their vehicle. Obstacles can be easily overcome with the right level of commitment from Government and adequate support and education of Local Authorities.

Home Charging: The most common location for charging an electric car will be at home utilising a 240V/13A or 16A connection. This will require a switchable socket and a surge protection device, but should not pose any problems for most homes.[35] Moreover, as most users are likely to be recharging their vehicles over-night, they will be able to benefit from significantly cheaper electricity costs. This also has a benefit for electricity generators as it helps to even out demand during the course of the day and create a demand for (renewable) electricity during off-peak times.

Public Charging Points: For practical reasons it will be essential to have a comprehensive infrastructure of public charging points available throughout the country. While many commentators have suggested that EVs are primarily suited to urban/city usage, it is essential that consumers in all parts of the country are given access to the opportunity of owning an EV. It is only in this way that sufficient market penetration on a large enough scale will be achieved to really impact on emissions from the transport sector.

There are likely to be a range of different methods for charging for the use of public recharging points. This could include, for example, levying an annual fee for free access or charging by the unit of time used. Payment could be made using smart technology, perhaps an extended use of the proposed Integrated Ticketing Systems technology. These chargers will need to be deployed both on streets and in car parks. Other areas of consideration are charging access for blocks of flats and work based charging.

Another approach that was highlighted in the UK was that charging points, like water and power distribution networks and telecommunications networks, could be designated as regulated assets, typically enabling the service provider to cover installation and operating costs and achieve an adequate return on their investment. This could be an incentive for utility firms to install them.[36]

The support of Local Authorities will be critical if public charging points are to be installed. To this end, it is understood that at least one Local Authority (Dun Laoghaire Rathdown) has initiated trials and has visited London to review their operations. [37]

While the primary focus of this submission is on passenger cars, it is clear that light commercial vehicles and buses also offer the opportunity to switch to EVs.[38] In these instances, it is likely that re-charging points at depots would be appropriate and would suggest that re-charging connections should be made available at most industrial or light commercial sites.

34. BERR report.

35. Ibid.

36. BERR report.

37. See for example, the presentation made by the Westminster City Council to the SEI/ESB conference on EVs, 18th February 2009.

38. It is thought that heavy goods vehicles are not realistic candidates for a switch to electrical power in the medium term, due to their size, weight and the size of the battery than would be required to power them. 39.Memorandum of Understanding concluded between ESB and Renault-Nissan, 3 April 2009.

Given the scale of investment required, the engineering complexities involved (including guaranteed connection to the grid), and competition policy, careful consideration will need to be given by Government in relation to the most appropriate business model that should be adopted which will generate value for money for the consumer. It is a concern the Government has decided that the ESB only will be responsible for rolling out a charging network to support EV deployment.[39] Other potential investors should not be prevented from investing in the EV supporting infrastructure. The Government has a responsibility to ensure that cost efficient, cutting edge, consumer friendly and commercially viable technologies are adopted in Ireland. Therefore the development of this new market for EV goods and services should be encouraged and facilitated by means of a competitive public tendering process.

Battery Exchanges: A limitation of the EV as it currently exists is that imposed by the battery's capacity and the time to recharge it. While this will not pose a problem for many drivers, given the fact that the majority of trips are relatively short, it does raise issues for drivers seeking to travel longer distances or to use their vehicles extensively during the course of the day. A battery exchange system offers a solution to this as it essentially involves swapping a depleted battery for a fully charged one at an "electric filling station". This model is designed to work in countries/regions with relatively low vehicle numbers and standardised battery type or low numbers of variation. This model has been proposed for both Denmark and Israel and is part of the Project Better Place introduction strategy, which is supported by Renault/Nissan and is outlined in more detail in Section 5 of this report. Indicative Costs: A working assumption along the following lines is submitted:

- **Battery Exchange Infrastructure: €250m**
  On the basis that 500 petrol stations are upgraded for BEVs at a cost of €500,000 per installation

- **Residential Dwelling Recharging: €200m**
  Some 2 million dwellings would require a modest €100 in spending

As the value of the carbon savings per annum could be in the region of €243m (by 2030), the BEV value for money equation is positive.

4. Government Policy

A) INTRODUCTION

Government recognises the benefits that EVs can deliver in terms of lower emissions. However, it is also clear that existing plans are modest by international standards and as a consequence much more needs to be done now to accelerate a more rapid switch to more sustainable forms of transport and to achieve real reductions in transport GHG emissions.

In the Carbon Budget presented by Minister for the Environment, Heritage and Local Government in October 2008, a target of 10% of the national road transport fleet to be powered by electricity by the year 2020 was announced. In February 2009 the Ministers for Communications, Energy and Natural Resources and Transport announced that 10% of energy within transport by 2020 will be sourced from renewable resources, including (second generation) bio-fuels.[40]

It was also acknowledged that Ireland's size suits EVs and that the opportunity exists for the country to become an effective test centre for the world's car manufacturers. Indeed, Minister Eamon Ryan went so far as to say that, "The Irish Government is signalling its intentions to national and international players that Ireland is 'open for business'. We are positioning ourselves as a centre for electric vehicles. The Government expects considerable international investment to emanate from this plan." However, while the Government calls the 10% target 'ambitious', it is clear that by international standards it is anything but ambitious.

Based on the Government's 10% target, this will mean that even in 12 years time there will still be just 250,000 EVs on Irish roads (and this is in a country where close to 250,000 new vehicles were licensed in 2007 alone). By way of contrast, Israel has already promised to electrify its entire transport fleet – some 2 million vehicles - by the same 2020 deadline.

B) KEY POLICY MEASURES

The measures announced by the Government to date include:

- Tax incentives for business to purchase EVs. Businesses can write off 100% of the cost of purchase against tax under the Accelerated Capital Allowance Scheme.
- A €1 million project by Sustainable Energy Ireland to research, develop and demonstrate vehicles nationally.
- Assistance for individuals purchasing EVs in the form of the publication of a "Buyer's Guide" and a "Cost of Ownership Calculator" by Sustainable Energy Ireland.
- Establishment of a National Task Force which will examine infrastructure options for national roll-out of electric vehicles, including street charging. A report from this group is due to be presented to Government in April and will address charging and grid infrastructure, enterprise opportunities and the role of captive fleets.

These policy measures have largely emerged from research reports commissioned by SEI over the last two years. While

40. Smarter travel; A Sustainable Transport Future. A New Transport Policy for Ireland 2009-2020, 5 February 2009.

these reports are comprehensive, the policy conclusions which have emerged from them seem cautious and conservative. For example, SEI estimate that the replacement of 10% of cars, vans and buses in Ireland with currently available models of hybrid and battery electric vehicles could reduce national carbon emissions from transport by only 350,000 tonnes annually. However, this compares with total carbon emissions from the transport sector (excluding air, sea and freight transport) in Ireland in 2006 of approximately 10 Mt.[41] This means that the net effect therefore of the "ambitious" target is to reduce vehicle related transport emissions by just 3.5% within 12 years.

Moreover, the SEI reports have taken a step-by-step approach which advocates targeting niche sectors of the population. For example, it is recommended that fleet vehicles in cities or urban areas, should be targeted first under any plans to bring about a move to the use of HEVs and BEVs. The report also argues that urban road transport is by its nature more fuel intensive and organisations with large numbers of vehicles in urban use, such as municipal vehicles, police and public transport fleets, would benefit most from efficiencies associated with the integration of HEVs or BEVs into their fleets.[42] While this seems a reasonable conclusion to draw, again it highlights the narrow focus and lack of real ambition contained in many of the recommendations. This slow and steady approach will not deliver the sea-change in vehicle ownership that is needed to deliver real and significant reductions in transport emissions.

On a more positive note, the report suggests that policies should be examined as part of a wider policy review to ensure that obstacles to the introduction of EVs in Ireland are minimised. This should include a review of the taxation system in the aftermath of the introduction of the new VRT regulations as well as the existing regulatory framework for the use of non-conventional road vehicles. Other supporting measures for stimulating uptake which were suggested in the reports include subsidies for vehicle purchase or conversion, subsidies for refuelling infrastructure, common procurement and public private partnerships.[43]

More recently, non-exclusive Memorandums of Understanding have been signed with car manufacturer Renault-Nissan by government and the ESB respectively. [44] The MoUs commit Renault-Nissan to provide an unspecified number of EVs to Irish consumers within two years and to help government to meet its 10% EV target by 2020. For its part, the ESB has guaranteed open access to all electricity suppliers and car manufacturers. Importantly, as a consequence of the MoUs, Ireland will get previously confidential information on the developments in EVs, thus 'enabling more detailed and precise planning around infrastructure, support mechanism and potential benefits accruing.' Another positive development was the comment by Renault-Nissan that 'We regard Ireland as a leader in the EV project. Demographics and political support make Ireland one of the most suitable locations for a large-scale roll out of EVs….we are particularly pleased with the Irish Government and ESB putting in place the correct conditions to support electric transport.'

The signature of the MoU raises some public policy and legal issues about how best the BEV Project should be developed in a manner that will encourage other energy and infrastructure providers apart from the ESB to commit. It is not suggested that the ESB should not be involved –- indeed the company's path-finding role is to be commended - but competition and perhaps public procurement issues clearly need to be considered as previously mentioned.

C) ELECTRICITY SUPPLY

A typical BEV will require on average some 2,321kWh per annum. Assuming that 2.5 million passenger cars will be all-electric by 2030, this implies that in the ballpark of some 5,680 GWh in additional electricity consumption will be needed. Given that an additional 8,000 MW in offshore wind will be built within this timeframe, the availability of power should not be an issue, nor a barrier to the rapid deployment of BEVs.

One of the great limiting factors with wind energy is that turbines produce power around 40% of the time. But often when they are producing power it is not actually needed, because demand is low, for example at 4am in the morning. By linking vehicles to the electricity grid a new demand for power will be generated which will use energy which would otherwise be wasted.

Ireland is blessed with an abundance of natural resources that can be exploited to produce affordable renewable energy. We have better and more consistent wind speeds than any other country in the EU and wave energy research projects are showing real promise. By linking the energy generation sector, particularly renewables, with fuel demand for transport, a synergistic relationship between the two sectors would be created that increases the viability of renewables, through the storage of power. The ESB is already on record as supporting the introduction of EVs as the above-mentioned MoU testifies.[45]

41. SEI: Costs and Benefits of the use of Hybrid Electric Vehicles and Battery Electric Vehicles in Ireland.

42. SEI: Review of worldwide experiences in the use and measures to stimulate the uptake of battery electric and hybrid electric vehicles 2008 Edition, Version 2, February 2008.

43. SEI Press Release: SEI Publishes Reports on the Costs and Benefits and Measures to Stimulate Uptake of Hybrid and Battery Electric Vehicles, 27 May 2008.

44. Press release, 3 April 2009.

45. See presentations by John Campion, Executive Director, Sustainability, ESB and Conor Garrigan of ESB Networks at the SEI/ESB conference on EVs, 18th February 2009.

5. Global Developments and Trends

A) PRODUCT DEVELOPMENT TIMESCALES

Battery technology has begun to develop rapidly in recent years. This is largely due to the development of batteries for the mobile phone and portable electronics sectors has led to lithium batteries and battery chemistries offering improved power and energy density. At the same time, the motor industry has begun to recognise the potential that EVs offer and many are now taking steps to secure the supply chain management for advanced battery development and supply, including the establishment of joint ventures with specialist battery producers (e.g. Toyota with Panasonic and Nissan with NEC).

In the past, BEVs have tended to be viewed as somewhat risky by the mainstream motor industry. This is based largely on the relatively high capital cost and poorer performance (principally on range) compared to an ICV. As a consequence the majority of vehicle manufacturer R&D programmes have been focused on HEV development for near market deployment and on fuel cell development for mid-long term deployment.

Recent studies such as the BERR Report have confirmed that a number of main stream vehicle manufacturers have advanced EV programmes, including the potential for BEV deployment in near term product plans – notably Nissan, Mitsubishi, and Mercedes via Smart and Suzuki. However, product development, supply chain development and investment in manufacturing assets mean that there is an anticipated lead time of at least four to five years before mass marketing of EVs is developed by these programmes. For other vehicle manufacturers with less well-developed programmes and supply chains the lead time will be longer. For this reason the marketing of EVs in, for example, the UK by mainstream vehicle manufacturers is not expected to commence until at least 2012, with a significant acceleration in EV availability and supply from 2015.

Table 2 Incentives to Promote up-take of EVs

Norway	Electric cars exempt from car registration tax. For a B class car the registration tax is around €7,500. VAT (25%) does not apply to electric cars.
Denmark	Electric cars are not subject to the annual car tax of €345. EVs do not have to pay road tolls in Oslo. EVs qualify for free parking which can provide annual savings of around €2,000-€4,000. EVs are permitted to use bus lanes.
Sweden	Low or zero carbon emission vehicles get a subsidy of 10,000 SEK (€2,500).
Netherlands	Electric cars in the Netherlands are exempted from car registration tax.
Belgium	Belgian vehicles which emit less than 105g CO2/km will have a €4100 reduction in registration tax.
Switzerland	Individual cantons provide their own EV incentives.
Germany	Germany is currently considering inner circle parking and congestion charge incentives for EVs similar to those in London.
France	A French initiative named Eco-pastille, which began on January 1st 2008, sees that people who buy electric cars receive €5,000 back. Free parking spaces for EVs (equipped with charging apparatus) are also being reviewed.
Greece	No road tax or car registration fees for electric cars. Electric cars are also free to drive in Athens when parts of it are restricted to other vehicles to reduce traffic congestion. There is also free charging on the street of some cities.
Italy	Certain cities in Italy have restricted driving within the city to EVs only. Some cities also allow free parking and charging for EVs.
Spain	For an electric car bought in Spain €6,000 or 15% of the price of the vehicle will be returned to the customer.
Israel	The Israeli government is providing tax incentives to help Project Better Place achieve its goals. It taxes petrol cars at 72% while electric cars are only taxed at 10%

Source: BERR Report

Moreover the majority of the mainstream vehicle manufacturers also have active HEV and PHEV development programmes in place. As a result, over the next five to ten years the availability of HEVs and PHEVs is forecast to increase significantly based on vehicles known to be in product planning cycles.
The ability to accelerate this deployment is restricted by investment and product planning timescales. The increased availability of EV and PHEV depends on both the niche vehicle and mainstream vehicle manufacturers. Studies in the UK for example, indicate that niche players are pioneering the EV market to be followed later by the OEMs. The emerging market for BEVs is focused in two main areas: city cars and light commercial vehicles (vans). These vehicles are predominately supplied by niche vehicle manufacturers (eg G-Wiz via REVA, NICE via Aixam, Modec, Allied Vehicles and Smith Electric Vehicles) meeting a market need that mainstream vehicle manufacturers are not currently servicing, aside from limited trials.

B) INCENTIVE PROGRAMMES
Incentive programmes to promote and encourage the uptake of EVs clearly plays a central role in the development of a market for EVs. The approach varies from country to country. The following table summarises the various measures which are being used around Europe. It is taken from a recent UK report on electric vehicles.

C) THE UK
Developments in the UK are relevant because vehicles developed and manufactured for the UK market will ultimately find their way into the Irish vehicle distribution network.

The existence of an emerging EV market in the UK owes much to the incentive structures that – through the combination of local and national policy initiatives – have seen the beginnings of an EV market in London. The structures take the form of a collection of different local and national incentives (free parking in parts of London, congestion charge exemption, lower vehicle excise duty, etc.) that combine both a financial dimension (payback) to support electric city car use and a real or perceived benefit of improved 'access'. The take-up of electric cars is reported to be as great as anywhere in the world, with the vast majority of incentives are largely centred in London. Whilst the link between the take-up and the interventions cannot be proven they would seem to be a major driver and an illustration of the effect such measures can have on the vehicle market.

London
- London congestion charge £8 / £10 per day.
- Electrically propelled vehicles: 100% discount. £10 registration fee.
- Up to £ 6,000 in free parking.
- Alternative fuelled vehicles: 100% discount (so long as vehicles meet emission
- standards. Over 3,500 kg = Euro III. Under 3,500 kg = 40% cleaner than Euro IV). £10 registration fee.
- Vehicles with 9 or more seats: 100% discount.
- Motor tricycles: 100% discount (must be 1 metre or less in width and 2 metres or less in length). £10 registration fee.
- Roadside recovery vehicles: 100% discount. £10 registration fee.
- Congestion zone residents get 90% discount.

UK-wide
- Zero vehicle excise duty.
- Reduction in the percentage (of P11D vehicle price) used to calculate Benefit in Kind company car tax (-3% for PHEVs, -6% for EVs).
- Significant tax differential between electricity and liquid hydrocarbon automotive fuels.
- Enhanced capital allowances for companies purchasing electric and low carbon cars

D) PILOT PROJECTS
A recent study on possible measures to stimulate the introduction of HEV and EV noted four key points in a review of UK and international experience. The authors recommended that a vehicle demonstration programme should:

- Follow the steps of a normal successful market introduction programme, including the provision of strong, independent project management;
- Target the right market segment;
- Select the appropriate technology; and
- Ensure that all stakeholders are involved.

These potential pilot projects are typically either regional projects – sponsored by varying combinations of local authority, Regional Development Agency (RDA) and business interests – or vehicle manufacturer-led initiatives. Given the emerging (pre-commercial to early commercial) nature of the market for EV and PHEV and the developing capabilities of technology providers and regional inter-relationships between organisations (including latent regional supply chains), none of these potential pilot projects is significantly more advanced than any other. Therefore there are as yet no 'stand out' projects that are recommended for special attention.

A recent example of a London project is the newly-announced PHEV trial by Toyota in conjunction with EDF that commenced in September 2008. Toyota has indicated that it intends to build on the trial by making PHEVs available to fleet customers in Europe by the end of 2009. This joint vehicle-infrastructure trial shows the critical importance of vehicle manufacturers and infrastructure/energy suppliers working together to promote the wider roll-out and acceptance of EVs. A non-UK example is provided by the collaboration of Ford and Southern California Edison on PHEV trials in California.

These EV developments mirror and share the experience of project development in other low carbon vehicle sectors, as for example in relation to hydrogen and fuel cells, where three differing categories of regional project have been identified viz.

- Urban centre' seeking to meet environmental objectives (e.g. air quality management);

- The regional 'technology cluster' (seeking future economic benefit for the region); and
- The 'remote community' seeking to link vehicle use with localised or regional renewable energy supply.

E) THE BETTER PLACE MODEL

Better Place - a US-based company (www.betterplace.com) - is now receiving world-wide attention as it has come up with a solution which can deliver a dramatic switch away from fossil fuel vehicles to BEVs.

Better Place is a mobility operator that aims to reduce oil dependence by delivering personal transportation as a sustainable service. Launched in 2007 with $200 million of venture funding, the company builds EV networks powered by renewable energy to give consumers an affordable, sustainable alternative for personal mobility.

Better Place does not supply electric cars, but builds the infrastructure to support their use. Owners of EVs pay a subscription fee to the company, which supplies a battery for their car, a recharging station for their home and a network of battery replacement depots at locations around the country.

Under the Better Place model, the company plans and installs a network of charge depots and battery exchange stations, giving drivers the same convenience to "top off" as they enjoy today with petrol stations. Much like the mobile phone model, Better Place installs and operates the network of charging infrastructure, while vehicle manufacturers produce BEVs cars for the Better Place network.

Better Place also sources renewable energy to power the network, creating a zero emission solution from generation to grid to transportation.

The batteries of a zero-emission vehicle need three things in place for optimum functionality: charging points, battery switching stations, and software that automates the experience. The Better Place model involves the provision of charging points at a wide range of areas, both at home, at work, in car parks and urban centres. These help to keep the batteries topped up with power so that they always have 100 miles of driving capacity.

For trips longer than 100 miles (161 km), battery switching stations will be available roadside. Stations are completely automated, and the driver's subscription takes care of everything. The driver pulls in, and the depleted battery is quickly replaced with a fresh one, without anyone having to leave the vehicle. The process takes less time than it does to fill a tank of liquid fuel. The battery exchange stations will be able to accommodate any Better Place-compliant vehicle. All manufactured batteries will be stocked so that any EV with a swappable battery, regardless of make or model, can pull in and be serviced.

For every 100,000 electric vehicles on the road, the firm anticipate having between 250,000 and 300,000 charging points and a further 100 to 150 battery exchange stations.

Due to the open, standards-based approach that Better Place has adopted in the development of its batteries, it is claimed that there will be many manufacturers contributing to the pool of available batteries. It is envisaged that this will maintain a steady supply and stable prices as more and more countries sign up to the Better Place model.

In January 2008, Israel announced its partnership with Better Place and Renault-Nissan, making it the first nation in the world to commit to an all-electric car infrastructure. It is believed that this will help it to achieve its stated goal of oil independence by 2020. This has been followed by agreements with Denmark, Australia, California and Hawaii to develop its network and Better Place has recently also signed a partnership with the government of Ontario to help bring an electric car network to the Province and create a model for the adoption of EVs in Canada. Ontario, which is one of North America's largest car producing regions, seeks to transition its auto manufacturing sector for future growth from EV production while reducing GHG emissions. Better Place will activate networks on a country-by-country basis with initial deployments beginning in 2010. It expects the first mass market EV models to be available in Australia by the 2012 model year, a year after its proposed mass market launch in Israel and Denmark.

Because most EVs will be charging during the evenings while at home, the batteries become distributed storage for clean electricity. In Israel, for example, excess power from the growing solar industry will be stored in the cars' batteries. Similarly, in Denmark, un-stored energy from the country's wind turbines will be utilized. Australia possesses wind farms throughout the country, as does California.

Better Place already has a partnership agreement with Renault Nissan and is in discussions with other car manufacturers to supply EVs. It has also signed partnership arrangements with a number of lithium ion battery companies. This includes Automotive Energy Supply Corp. (AESC), a joint venture between Nissan and NEC of Japan, and A123 Systems. However, it seems that Better Place is committed to a battery-agnostic approach as this is believed to offer the best approach to servicing a growing and dynamic market.

Better Place is keen to explore the possibility of expanding its proven business model into Ireland. [46] As a small geographical area, the company believes the island of Ireland is the ideal size for the progressive deployment of BEVs.

While not without its critics, the Better Place model is innovative, imaginative and its deployment in a small economy such as Ireland/Northern Ireland merits the most urgent consideration.

46. Meeting between Shai Agassi, CEO of Better Place and Simon Coveney, T.D. held on 16th December 2008.

6. The Need for a Far More Ambitious Target

While other countries such as Israel and Denmark are planning for the complete replacement of car fleets with EVs, or at least a high percentage in future, in Ireland the scale of ambition is a mere 10%.

As this report seeks to demonstrate, a massive shift over the next 15 years from petrol or diesel fuelled engines to EVs is achievable, sustainable and a realistic option as a way of dramatically reducing emissions in the transport sector. Global companies such as Renault-Nissan and Better Place are already investing heavily in anticipation of this development. The promotion of EVs to date has happened in a piecemeal way that has had mixed results and indeed the Government's recently announced targets for EV penetration fail to grapple with the real challenge that Ireland faces in reducing its transport emissions. Rather than take an incremental approach, Ireland needs to set ambitious targets for an effective sea-change in vehicle ownership and usage. We need to be at the forefront of the forthcoming revolution in BEV technology rather than waiting to see what happens and hoping that consumers respond to the policy measures that are currently in place.

Given the rapid growth in transport emissions in recent years, and the reductions that Ireland is committed to making, it is clear that Ireland is faced with a stark choice between finding cleaner, new ways of supporting the lifestyle we have grown to enjoy, or alternatively accepting a fundamental change in our lifestyle and behaviour. While the ultimate solution will involve an element of both, it is also clear that public transport will not be sufficient on its own. The answer is therefore, not only to get people out of cars but also to reduce the carbon reliance of the vehicles that remain. While biofuels have a role to play, so to do gas powered vehicles and possibly hydrogen engines. However, the really exciting revolution will happen in BEVs.

In addition to the benefits from lower carbon emissions, by linking electricity generation and management of the electricity grid with powering our cars, as well as our homes, we can create a new energy formula that can massively reduce our reliance on imported oil.

It is both feasible and realistic - and it should be an essential element of Ireland's National Climate Change Strategy post-2012 - to aspire to achieve the complete replacement of all new petrol and diesel engine driven private cars with EVs every year from 2020, with stretch interim targets from 2015. Therefore by 2030, all passenger cars in Ireland will be BEVs.

Such a recommendation is made against the background that a sea change in thinking has happened in many countries. For example, in Israel, Denmark, Australia, the US and Canada projects are already in place to replace hundreds of thousands of cars within the next five years, working with Better Place and Renault/Nissan to provide new electric powered Renault Meganes and other similar models.

Against the background of what is happening in these countries, the Government's target for 10% of cars to be electric by 2020 is not challenging enough. Not only will it have only a very limited impact on GHG emissions, the target will not even reduce the number of oil powered cars on the road by 2020, due to projected increases in car sales.

The energy generation consequences of over a million cars requiring batteries to be recharged may sound like a real barrier to progress. But in fact it is a new opportunity that can level the demand curve for electricity consumption and provide a new electricity storage system, in batteries, for use when the power is needed at a later stage.

7. Conclusions

The key messages are as follows:

- Transport should be seen as the solution not the problem.
- Ireland will be an EV technology taker rather than a technology driver unless policy is changed.
- A more intensive and inclusive dialogue with global motor manufacturers and battery producers is needed.
- EVs have the potential to offer significant GHG emissions reduction compared to conventional petrol/diesel fuelled vehicles.
- Although BEVs will start to enter the market in great numbers once the commercial propositions garners wider support, their mass penetration is unlikely to happen before 2015.
- A business-as-usual scenario suggests that without any intervention the number of vehicles will remain small and the impact on Irish transport emissions reduction will be negligible. Interventions are therefore needed to stimulate both the supply and demand side of the market.
- There are a number of barriers to the development, deployment and acceptance of EVs. Although none of these are believed to be insurmountable. For example, a single EU standard for batteries is an urgent priority.
- Private investment that is required to overcome the barriers will only be forthcoming if a clear strategic framework exists at Government level.
- It is important to develop a roadmap as to how emissions from the transport sector can be reduced over the long term and the role that EVs can play as part of this.
- Government must embrace the benefits of competition through a public procurement process so as ensure the most rapid deployment possible of EVs in Ireland. This has not happened to date.
- Finally, as an all-island venture, the BEV Project has the potential to create new synergies between the research communities in Ireland and the UK.

In the light of the evidence to hand, this report's key recommendations are as follows:-

- A business leader with international experience should be given ownership of the proposed Task Force on EVs. He/she should be assisted by a full-time four-five person support group. This group should engage with the main players – motor manufacturers, battery producers and energy experts - at global level with a view to promoting Ireland as the ideal testing ground for emerging BEV technologies.
- The mandate of the Task Force should also include an assessment, based on international best practice, of the most efficient tax and other incentives that may be required to accelerate the most rapid deployment of BEV technologies in Ireland.
- An immediate priority – and a task that should be completed with six months – is the carrying out of a forensic economic, regulatory and technological assessment of the Better Place and other business models (including that of the ESB) to ascertain, having regard to contractual, competition and procurement issues, what will work on an all-island basis.
- As forecast emissions in 2020 from passenger cars is some 8.1Mt, the proposal set out in this submission about the rapid deployment of BEVs is the single largest GHG emission reduction measure currently under consideration.[47] The BEV Project therefore requires to be resourced commensurately.
- Set a clear legislative landscape and a strategic framework for 2020 and beyond with regard to vehicle efficiency standards, which will act as a driver for technological innovation. Develop a 20 year roadmap for the ongoing development of EVs and PHEVs.
- Promote Ireland as a research centre for batteries, internal combustion engines for hybrids, electric motors, control systems, energy scavenging systems and battery recycling.
- Undertake further investigation to fully understand the range of potential environmental issues associated with Li-ion batteries and methods of mitigation.
- Government should make immediate contact with the Northern Ireland Assembly with a view to proposing a partnership approach to the development of an ambitious EV programme for the island as a whole.
- Facilitate pilot and demonstration studies to be carried out which will enable further real world research to be undertaken and to build market awareness and acceptance of BEVs.
- Identify the required charging infrastructure for EVs and PHEVs.
- Promote Ireland as a live laboratory for the rapid deployment of BEVs.
- These tasks should seek to ensure that the following targets are met:
- Within seven years (2016), 100,000 private BEVs will in operation
- By 2020, 350,000 BEVs will in operation
- By 2030, all cars in Ireland will be BEVs i.e. some 2.5 million vehicles.

47. Assuming that an average car emits some 325 tonnes of CO2e per annum and that some 2.5 million private cars will be licensed by 2020.

Appendices

APPENDIX A
ORDERS OF REFERENCE FOR JOINT COMMITTEE

Dáil Éireann on 14 November 2007 ordered:

"That a Select Committee, consisting of thirteen members of Dáil Éireann, be joined with a Select Committee to be appointed by Seanad Éireann to form the Joint Committee on Climate Change and Energy Security to consider, inter alia:

- medium and long term climate change targets and the key measures needed to meet those targets;
- the role of the Agriculture sector in providing bio-fuel and biomass crops and consequential implications;
- the levels of power supply which can be generated from renewables or other new power supplies;
- the projected energy demand from transport and the implications for energy security and emissions targets;
- such other matters as may be referred to it from time to time by both Houses of the Oireachtas

and to report thereon to both Houses of the Oireachtas in advance of the conclusion of the post-Kyoto negotiations by the United Nations Framework Committee on Climate Change (UNFCCC) and the associated EU 2020 burden sharing process.

(2) The Joint Committee shall have the powers defined in Standing Orders 83(1) to (9) inclusive.
(3) The quorum of the Joint Committee shall be five, of whom at least one shall be a Member of Dáil Éireann and one a Member of Seanad Éireann."

SEANAD ÉIREANN ON 14 NOVEMBER 2007 ORDERED:

"That a Select Committee, consisting of four members of Seanad Éireann, be joined with a Select Committee to be appointed by Dáil Éireann to form the Joint Committee on Climate Change and Energy Security to consider, inter alia:

- medium and long term climate change targets and the key measures needed to meet those targets;
- the role of the Agriculture sector in providing bio-fuel and biomass crops and consequential implications;
- the levels of power supply which can be generated from renewables or other new power supplies;
- the projected energy demand from transport and the implications for energy security and emissions targets;
- such other matters as may be referred to it from time to time by both Houses of the Oireachtas and to report thereon to both Houses of the Oireachtas in advance of the conclusion of the post-Kyoto negotiations by the United Nations Framework Committee on Climate Change (UNFCCC) and the associated EU 2020 burden sharing process. (2) The Joint Committee shall have the powers defined in Standing Orders 70(1) to (9) inclusive.

(3) The quorum of the Joint Committee shall be five, of whom at least one shall be a Member of Dáil Éireann and one a Member of Seanad Éireann."

APPENDIX B

Membership of the Joint Committee on Climate Change and Energy Security

Chairman:	Sean Barrett TD (FG)
Deputies:	Seán Fleming TD (FF)
	Michael Fitzpatrick TD (FF)
	Phil Hogan TD (FG)
	Ciarán Cuffe TD (GP)
	Dara Calleary TD (FF) (Vice-Chairman)
	Joe Behan TD (FF)
	Bobby Aylward TD (FF)
	Simon Coveney TD (FG)
	Andrew Doyle TD (FG)
	Martin Ferris TD (SF)
	Finian McGrath TD (IND)
	Liz McManus (LAB)
Senators:	Paudie Coffey (FG)
	Fiona O'Malley (PD)
	Ned O'Sullivan (FF)
	Joe O'Toole (IND)