Scottish Council for Development and Industry

POLICY SUBMISSION

LOW CARBON VEHICLES AND ALTERNATIVE FUELS

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SCDI is an independent and inclusive economic development network which seeks to influence and inspire government and key stakeholders with our ambitious vision to create shared sustainable economic prosperity for Scotland.

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Low Carbon Vehicles and Alternative Fuels

1. SCDI is an independent membership network that strengthens Scotland's competitiveness by influencing Government policies to encourage sustainable economic prosperity. SCDI's membership includes businesses, trades unions, local authorities, educational institutions, the voluntary sector and faith groups.

Introduction

2. Sustainable transport for the future should be based on the following principles:

   - **Security of supply** – fuel sources should be available and able to meet the needs of people and the economy
   - **Decarbonising supply** – fuel utilisation should increase energy efficiency and reduce carbon emissions to support climate change targets
   - **Affordability of supply** – fuel supplies should be affordable for people and businesses to support sustainable economic growth targets
   - **Convenience of supply** – fuel supplies should be convenient for people and businesses in urban and rural areas to support opportunities for all

3. By 2050, the global fleet of passenger cars is expected to quadruple to nearly 3 billion. As a result of the challenges of 'peak oil' and climate change, the status quo in the global transport sector is not sustainable. Governments agree that there is a need for lower carbon transport. Building a truly sustainable transport sector will take decades so work needs to start now. SCDI welcomes the Scottish Government's consultation on *Low Carbon Vehicles and Alternative Fuels*.

4. Despite the projected increase in the global fleet, the passenger car industry faces a number of major challenges. While Government action has prevented the leading manufacturers from failing in the current global recession, it has also sustained overcapacity in production, which, in Europe alone, is 30% or 7m vehicles annually. Profits will also be affected over the next 10 years by trends to smaller, more fuel efficient cars especially in developed countries, driven by three factors. Firstly, the cheap credit which many consumers used to buy larger cars is no longer available. Secondly, over 65s drive 45% fewer miles than average and it is estimated by Credit Suisse that in 2020 40% of new car buyers in developed markets will be over 60 compared to 30% today. As they change their cars less frequently, underlying sales in developed markets could fall by up to 30%. Thirdly, increasingly stretching international carbon emissions targets are being agreed by governments. While the industrial impact of these trends will be far more significant in countries with mass car manufacturers, they are relevant to Scotland's climate change and sustainable transport targets. Less profitable car companies may be less able to invest in low carbon technology. On the other hand, with Scotland's ageing demographic profile, smaller, fuel efficient vehicles may become more popular and there could be an effect on average journeys.

5. This wider context should be taken into account when developing the *Low Carbon Vehicles and Alternative Fuels* strategy. A consistent policy framework across Europe and between Europe and other major markets is important. The advantage of consistency is that it helps both manufacturers and global businesses which want to play an active part in supporting the industry. Common fuel standards allow international trade which in turn reduces cost. Inconsistent use of policy frameworks, targets and measurements adds complexity and costs.

6. The between close collaboration between the Scottish Government and the UK Governments on their Low Carbon Transport policies is therefore welcome. The UK Low Transport Strategy recognises that action is needed on three fronts:

   - Vehicle manufacturers - to develop vehicles that are more energy-efficient and emit less CO_2e per unit distance traveled
   - Road transport users - to take fewer and more efficient journeys, encouraged by government policies that influence driver behaviour and mobility choices
   - Fuel suppliers - to develop fuels that have a lower Well-to-Wheel CO_2e intensity

   Vehicle Manufacturers

7. Improvements to the combustion engine, producing large fuel savings and fewer carbon emissions, are being made. The European vehicle fleet is 40% more efficient than the US vehicle fleet, which saves around 3.5m barrels of oil imports per day equivalent to the combined oil consumption of France and the UK. The King Review of low carbon cars found that efficiency improvements to internal combustion engines could achieve a 30% fuel efficiency saving for the average new vehicle within the next 5-10 years, at a cost of £1,000 to £1,500 per vehicle. Companies are testing smaller engines, some of which could work with hybrids or plug-in hybrids, capable of breaking the 100mpg barrier and their whole-life environmental performance will compare very favourably with today's hybrids.

   Road Transport Users

8. A recent report for the Scottish Government, *Transport Research Series: Mitigating Transport's Climate Change Input in Scotland: Assessment of the Policy Options*, found that, under a business as usual scenario, carbon emissions from cars, vans and HGVs are projected to increase from 8.7 $MtCO_2$ to 9.6 $MtCO_2$ in 2006 and 11.7m $MtCO_2$ in 2022. It calculated that the CO_2 reduction from all transport required to meet the Scottish Government's interim target is 7.3 $MtCO_{2.}$ However, even under an Ambitious Scenario of Scottish, UK and EU measures, it suggested that a maximum cut of 4.3 $MtCO_2$ would be achieved. This would represent a reduction in emissions levels of 13% against 1990, when the Climate Change Delivery Plan indicated that a 27% reduction was possible.

9. The report emphasised the greater cost-effectiveness of demand-side measures. It found that Smart Measures have the most potential to reduce CO_2 emissions

and the potential of travel planning considerably exceeds all other policy options. Softer measures in workplaces and communities, such as providing information on travel options, work without imposing a heavier burden on vehicle usage which in some areas is a necessity. Flexible working should be promoted through better access to ICT, video conferencing, and workplace travel plans. The planning system can also discourage locating new housing where commuting and access to services and amenities is only achievable by lengthy car journeys.

10. Fiscal policy options are also assessed in *Mitigating Transport's Climate Change Input in Scotland* as offering significant abatement potential. SCDI continues to support the introduction of a UK-wide road pricing system which would replace fuel duty. This would reduce congestion and carbon emissions, and benefit rural areas of Scotland and the UK where public transport is generally less available.

Fuel Suppliers

11. A diversity of fuel supplies and vehicle options will be needed. Conventional liquid fuels will remain dominant for the foreseeable future, but there will be a growing role for biofuels, electricity, hydrogen and natural gas. For the liquid fuels, policy should incentivise a reduction in their CO_2-intensity, leading to fuel-saving conventional fuels, sustainable biofuels and the addition of CO_2 Capture and Storage to gas and oil production. Support for generators with renewable power sources, and CO_2 Capture and Storage technology development and deployment will deliver low-emission electricity for sustainable electric mobility.

12. Even with a phased introduction of alternative fuels, the conventional fuel fleet will take many years to become obsolete and there will be an ongoing requirement for rural filling stations. As volumes fall, this will inevitably put further pressure on the viability of these filling stations, and may result in 'fuel deserts'.

13. Action by Vehicle Manufacturers, Road Transport Users and Fuel Suppliers is essential if the necessary reduction in carbon emissions is to be achieved. The role of all Governments should be to define social and environmental standards, provide appropriate information, incentives and rewards, and support demonstration of different technological solutions. Regulations should provide a level playing field for all these technologies which allows them to compete in the market because some of them are still at a very early stage in their development and all of them may be required if a low carbon transport future is to be delivered.

Summary of Key Recommendations

- Electric vehicles will be first technology to be influential in reducing GHG emissions from the transport sector, especially if the growth in biofuels has to slow pre-2020, and will make an even more significant contribution post-2020
- The consultation is weak in its consideration of other technologies, such as hydrogen and marine biomass, in which Scotland also has an R&D lead and which have the potential to make a major contribution to longer term targets

- Government policy should seek to avoid the creation of a two-tier transport network in the longer term, with LCVs in cities and towns, and higher cost and less accessible conventional fuel in rural, remote and island communities
- The public sector is likely to take more of a lead in the roll-out of LCVs and help to establish the market through its procurement purchasing power, but to be effective this needs to be part of a general 'push' on all vehicle users
- By 2020, it should be possible for 95% of purchases for Scotland’s public sector fleet to be LCVs and, while their differing challenges and opportunities must be taken into account in any targets, all public bodies should participate
- Government and industry should work together to improve information and encourage fleet managers and all vehicle buyers to consider LCV options
- Incentives for consumers should be linked to traffic management measures
- The development of charging infrastructure which is aligned with emerging international standards should be supported by the Scottish Government through grants or rebates for organisations purchasing LCVs and subsidies for charging points on streets and in car parks, and in the planning system
- Collaboration between power generators and distributors, and vehicle and battery manufacturers on smart grid technology development should be supported and incentivised, which could then be licensed and sold globally
- Scotland has the capabilities for a globally competitive LCV industry, but other countries are offering incentives for leading companies such as Axeon Holdings and Allied Vehicles to relocate and it is essential that this expertise is retained in Scotland through support for their innovation at all stages
- The Scottish LCV industry has the potential to create hundreds of new jobs even at this early stage in development and the Scottish Government should consider an initiative to enhance automative-related engineering skills

Technology Options

Which low carbon technologies and fuels do you envisage will be first to be influential in reducing GHG emissions from the transport sector? Why?

14. It took decades before, first, petrol and, then, diesel, emerged as the dominant fossil fuels in the transport sector. It may, again, take decades before the market determines the most influential alternative low carbon power technology.

15. Biofuels will clearly be important if the EU Renewable Directive for the transport sector is to be met. Evidence has been presented that use of first generation biofuels would reduce agricultural production for food and biodiversity in Europe and the developing world and increase food prices. SCDI believes that more biofuels will be needed over time and in Scotland biodiesel from the waste oil market or straight vegetable oil may offer particular environmental benefits. But appropriate environmental safeguards need to be introduced and the Gallagher Review was correct to conclude that 4.5 – 8% for biofuels is a more appropriate target at this stage, but that it could be raised later if sufficient controls are enforced globally and new evidence gives more confidence on sustainability. The approach should be to find way to solve problems which arise rather than change the policy, which would be confusing and undermine investment by businesses.

16. The number of natural gas vehicles in the world has more than doubled since 2004 and there are now more than 9.1m on the road, including cars, heavy good vehicles and buses. In Germany, CNG-generated vehicles are expected to increase to two million units of motor-transport by the year 2020. There are currently 90 CNG filling stations available to the public in Sweden, with another 70-80 CNG filling stations are under construction or in a late stage of planning. New CNG models are being introduced which offer higher performance engines, improved range and further carbon emission reductions. Government could provide fiscal incentives and financial support for CNG vehicles and filling stations, and promote the conversion of local government vehicles and buses.

17. Sales of Electric Vehicles (EVs), Hybrid Electric Vehicles (HEVs) and Plug-in Hybrid Electric Vehicles (PHEVs) are still low. Last year, EVs and HEVs accounted for less than 1% of the total. Just 179 electric passenger cars were sold in the UK in the last 12 months. EVs and HEVs are currently available and all the major car manufacturers are currently working on PHEV models. There are still significant challenges. The latest reports suggest that GM's PHEV Volt, which should be available in 2011, may cost twice as much as the equivalent petrol car and may not be commercially viable. First Group has recently cancelled an order for 10 electric and diesel-powered buses for Glasgow and Manchester as a result of concerns over the 50% higher purchase price and running costs, and doubts that they will save the anticipated 30% in fuels costs. Bosch says for EVs to become universally popular there is a need for a threefold increase in energy density and a reduction of two-thirds in the price of batteries.

18. However, progress is being made. The popularity of EVs and HEVs is growing. The Energy Technologies Institute and ScottishPower have announced plans to develop and implement plans for the installation of re-charging points in Glasgow from 2011, and Glasgow City Council, Allied Vehicles, Axeon Holdings and the University of Strathclyde have been picked by the Technology Strategy Board to receive £1.8m to trial EVs in the city over the next two years. This pilot will accelerate technological development, help encourage the take up of alternative fuel vehicles and identify and resolve issues that may arise in the production and use of this type of vehicle in a daily-use environment. The capacity of EV batteries is expected to improve by 8% per year and to double in a decade.

19. The King Review identified EVs as the lowest carbon emissions route to clean transportation. This was true for every potential scenario for the electricity mix. Even if their power comes from coal-fired power stations, the overall emissions produced by EVs could be half of today's combustion engine cars. However, SCDI's study *The Future of Electricity Generation in Scotland* found that Scotland is on course to generate a high level of power from renewable sources of over 50% by 2020. SCDI therefore believes that EVs will be first to be influential in reducing GHG emissions from the transport sector, especially if the growth in biofuels has to slow, and make an even more significant contribution post-2020.

20. The influence of EVs can be accelerated by converting Light Goods Vehicles (LGVs). These constitute the majority of the public sector fleet and are forecast to generate rising GHG emissions in contrast with other road transport vehicles. Axeon Holdings has calculated that the introduction of 5000 electric LGVs would result in a reduction of carbon emissions of 43,585 tons per year in Scotland.

21. Research for *Mitigating Transport's Climate Change Input in Scotland* suggests that if the electricity for EVs was generated from lower carbon energy sources (producing half of the level of CO_2 per KWh assumed in the main tests), the abatement potential would actually slightly reduce by 2%. This is said to reflect that more of the abatement potential in the main scenario test is derived from reducing travel by EVs than is derived from increasing the proportion of travel undertaken by EVs. However, lower carbon electricity generation would increase the abatement potential of the national measures, reducing the size of the gap to be met by devolved action. Greater abatement is projected from 2030 onwards.

Which low carbon technologies and fuels do you believe will ultimately have the greatest emissions abatement impact? Why?

22. There is no single, simple solution to the global energy challenge. In the transport sector, the UK Climate Change Committee and King Review have both suggested that EVs could feasibly be standard by 2050. However, in SCDI's view, it is probable that there will be a diverse range of fuel and vehicle options, with the preferred set of options varying by market. As a result, cars in the future will be more mission-specific than all purpose. All these options will be needed and all will have a place in addressing the challenge of sustainable mobility.

23. The consultation is weak in its discussion of the potential of hydrogen. Hydrogen fuel cell cars are presently unproven and too costly for the mass market, with commercial production years away, hydrogen is currently commonly produced from fossil fuels, overall carbon emissions may be higher than from a conventional engine, and the development of a hydrogen grid would be very expensive, although storage may make this less critical. However, hydrogen fuel cell cars are being developed and the technology has huge potential. Converting surplus or off-peak green electricity into hydrogen fuel for transport is completely carbon neutral and 1 MW wind turbine could produce enough hydrogen to power over 150 cars per year. With integrated production, the price of the fuel can also be controlled. While SCDI is not convinced that they will make a significant contribution to the 2020 GHG emissions target, but, in light of the longer term potential, government should support their development with financial support and the procurement of hydrogen fuel cell public transport and fleet vehicles.

24. One of the biggest obstacles is the lack of hydrogen fuelling stations. As part of the Energetica project, a hydrogen corridor is planned between Aberdeen and Peterhead, with hydrogen fuelling stations at Bridge of Don, Ellon and Peterhead, and it is proposed to extend this corridor to Inverness via Findhorn in Moray. This highway will employ a diversity of renewable energy solutions in different locations with hydrogen refueling stations placed at strategic locations along the route to service a range of users including public transport providers, local authority vehicles, Royal Mail vans and ultimately private car users. In the proposals, this first phase would then be extended south down the east coast, west to East Kilbride and Glasgow and north to the Western and Northern isles. One of the applications selected for the use of hydrogen produced and stored at the Hedridean Hydrogen Park is a fleet of hydrogen vehicles and a fuelling station has been installed. CO_2 emissions of 6.5 tonnes will be saved per year. The roll-out of infrastructure for these corridors, such as electrolyser plants and hydrogen filling stations, could be offered financial support and tax allowances.

25. Biomethane vehicles are being produced in increasingly large numbers and it has by far the highest fuel yield of any biofuel as a diesel equivalent. There is sufficient organic waste in Scotland to produce 3tWh of biomethane per annum, which, if it was all used as a transport fuel, would provide 5.5% of Scotland's transport energy from renewables by 2020. Financial support for biomethane and financial support and tax allowances for Anaerobic Digestion plants would be required. The Scottish Government could also encourage local authorities to divert organic waste to Anaerobic Digestion, and put pressure on the Department for Energy and Climate Change to set a firm date for when biomethane can be injected into the grid and for fiscal incentives. It is estimated that biomethane would require financial support of 4p/kWh to be comparable to natural gas.

26. SCDI would like further support for R&D of second and third generation biofuels, especially non-crop based biofuels. Growing and processing of these requires extracting exactly the same amount of carbon from the atmosphere that the biofuel emits. While marine biomass is unlikely to make a significant contribution

in the period to 2020, Scotland has a good resource and is at the forefront of research. The Scottish Association for Marine Science (SAMS) is investigating the potential and practicality of using micro- and macroalgae, and the possibility that the excess electricity which will eventually be generated from marine renewables in the Pentland Firth could be used to produce renewable fuel from micro-algae. SAMS is committed to considering the potential economic and environmental impacts of these fuels at the same time, which is important.

27. Another possibility is hybrid vehicles which use compressed air power instead of electricity. SCDI understands that these would not require serious redesigns of vehicles because every car already has a makeshift air compressor in the form of the engine itself. Building a pneumatic car would thus be relatively cheap. It has been claimed that these vehicles have the potential to reduce fuel consumption by 32% and could offer 80% of fuel savings of a HEV and at a lower price.

28. It is also important to consider options for public transport. The development of the trams network in Edinburgh will, with the growing generation of renewable energy, reduce GHG emissions. Norway is currently allowing hydrogen-powered engines on ferry vessels as part of a joint fuel system. Hybrid or hydrogen-fuelled trains may become an option for rural and local rail lines in Scotland where electrification cannot be economically justified. Personal Rapid Transit systems - driverless four-seater pods which run on rails powered by electricity rather than fossil fuels – could also prove a cost-effective way of improving public transport.

What timescales do you believe are feasible for the **development** of specific low carbon technologies and fuels? Are there any important intermediate milestones within these timescales?

29. EV and HEV vehicles are available. PHEVs and are probably 3 to 5 years away. All the major car manufacturers are currently working on PHEV models.

What timescales do you believe are the feasible for the **uptake** of specific low carbon technologies and fuels? Are there any important intermediate milestones within these timescales?

30. The Society of Motor Manufacturers and Traders do not expect that EVs will be mass-market products by 2015-20. However, the Renault-Nissan Alliance thinks 10% of new cars bought in 2020 will be EVs and a report by the IDTechEx consultancy says a third of the cars made in 2025 will be electrically powered.

31. The UK Government has announced £250m to offset the premium on the expected higher purchase prices of EVs and PHEVs as they become available in the next 3 to 5 years which will improve their viability. The subsidy to be offered is expected to be between £2000 and £5000 per vehicle. In addition, up to £20m will be available to develop an electric vehicle charging infrastructure framework.

32. An important milestone will be the EU requirement for reductions in CO_2 for light commercial vehicles, which will be 175g/km by 2012-15 and 160g/km by 2015.

The latter is likely to be very challenging and may increase conventional fuel vehicle costs by around 16% to 18%. This may lead to increased uptake of EVs, HEVs and PHEVs, if they are a more commercially competitive option by 2015.

Are there other barriers to the **development** of such fuels and technologies that are not mentioned in this document? If so, what are they?

33. Barriers to development of EVs, HEVs and PHEVs include battery cost, durability and disposal. Petrol and diesel engines have an energy intensity up to 50 times that of current lithium ion batteries. There is still major uncertainty about the costs per vehicle. For vans, the difference could be as high as £35k per vehicle and for cars up to £10k. Ford has said that the industry should move towards a common standard of battery packs in order to cut costs. This could support another proposal which is for EV service points where batteries may be swapped.

Are there other barriers to the **uptake** of such fuels and technologies that are not mentioned in this document? If so, what are they?

34. Barriers to the widespread uptake of such vehicles in the UK are:

    - Cost
    - Proof of reliability and durability – Studies show that drivers currently do not have confidence in battery powered cars for longer journeys.
    - Lack of known residual values – See below
    - Lack of public charging infrastructure – See below
    - Lack of local availability of servicing, maintenance and repair skills
    - Need for three phase supply for most vehicle charging

35. An SCDI member in the light commercial vehicle rental business has highlighted that the biggest issue for them is the significant increase in holding costs for such vehicles. This is due almost exclusively to the lack of a premium in the resale market in line with the original purchase price. These vehicles therefore have to carry a far higher depreciation charge during the 12-30 months they are held. This makes them unattractive, as an option, for their 'regular' fleet users. Unless there is a general 'push' on all vehicle users, the demand for such vehicles from their public sector customers will inevitably attract premium rates, when supply is available. In practice this will mean that they are able to provide long term hires, albeit at a price, but will have much greater difficulty in meeting the short term needs of local public sector users. In addition they are in the hands of the manufacturers regarding fuels which can be used. Manufacturers decide the extent of any limits in level of warranty they will provide, and this in turn becomes their base line e.g. they are reluctant to extend the levels of biofuel which can be used in light commercial vehicles at present.

36. SCDI has been informed that many fleet managers, for instance in local government, do not have a full understanding of the opportunities. It is said that previous experiences with poorly performing LPG vehicles are hindering interest

in renewable technologies. Decisions on fleets are long-term commitments, but it would appear that they are only considered when the next contracts are about to be negotiated and that environmental sustainability has been a minor factor. There is a need to change attitudes before these decisions are being considered.

37. Insufficient progress has been made by Government in sorting out the regulatory issues which would help uptake. Clarity is required urgently on a range of points:

    - How the electricity supply infrastructure will be developed and charged for e.g. public ownership/ public good or competitive market
    - Planning policy and a built environment for charging of private vehicles
    - Smart metering requirements to get best value from current electricity generation
    - Support for consumer confidence when purchasing EVs and PHEVs e.g. standards for safe electricity connections to vehicles

38. Lack of information, misinformation, and a lack of incentives are also barriers to uptake. A programme of education and inducements to attract consumers, perhaps linked to traffic management, are required. This could include:

    - LCVs could be integrated into local business travel plans and car clubs
    - Public support for product development and reliability/ durability proving
    - Allowing electric vehicles to drive in bus lanes, free parking for EVs and PHEVs in city and town centres where parking parking is traditionally metered or ticketed, free parking for residents who own an EV or PHEV
    - Exemption from congestion or road-user taxes

Are there any negative social impacts associated with either the development or uptake of such technologies/fuels? If so, what are they?

39. If EV and PHEV infrastructure displaces much of the conventional fuelling infrastructure in urban areas and yet EVs and PHEVs remain more expensive than combustion engine vehicles, this would increase the cost of mobility and potentially make it unaffordable for some people on lower incomes. If cars become more mission-specific than all purpose in the future, those who cannot afford vehicles for all the journeys they want to make may be socially limited.

40. If fuel infrastructure is not rolled-out to rural areas, a two-tier transport network would be created, with low carbon technologies in cities and towns, and conventional technologies and higher costs in remote and island communities. This would also create negative economic and social impacts, for example making it less attractive for tourists with low carbon vehicles to visit rural areas.

41. The environmental impacts also have to be weighted up. Rigorous analysis is required of the whole-life environmental costs of HEV technology in comparison with the fuel efficient internal combustion engine cars in development. The evidence is disputed. At present, conventional vehicles have the advantage of

more shared parts, greater economies of scale, production closer to the point-of-sale and longer lives. Some studies claim that established technologies use much less energy in manufacture, transport, replacement and disposal, making the environmental costs lower than HEV over the whole life-cycle. Zero emission vehicles are actually said, at present, to generate the equivalent of 80g of carbon per 100 kilometres, not much better than the most efficient small diesel engines.

42. The evidence is also disputed on biofuels. Friends of the Earth say biofuels could lead to twice the carbon emissions of the fossil fuels they replace – 1.3m tones of CO_2 extra – due to cutting down on forests for food production which has been displaced for ethanol or biodiesel crops. However, the industry says supporters that it has been demonstrated that biofuels can come from sustainable sources.

What, if any, technical challenges would the grid reinforcement upgrades be likely to present? How might these be overcome?

43. HEVs do not place any demand on the grid. This technology is most suitable for buses, in which it can reduce exhaust pollutants and greenhouse gases by 30%. These vehicles are produced in Falkirk for global export by Alexander Dennis.

44. Axeon Holdings has calculated that the introduction of 5000 electric LGVs increase electricity demand by 29,190 mWh (or 54,987mWh for heavier box vans). The roll-out of EVs will probably not cause electricity supply problems in the short term. Early adopters like LGVs can be charged overnight which would result in no significant extra demand on the grid and, indeed, smooth demand.

45. If 100% of Scottish cars were full EVs it would require an additional 5TWh of electrical energy per annum (equivalent to approximately 15% of projected Scottish demand by 2020). If the uptake of EVs is more rapid than expected, flexible smart metering and new tariffs, which encourage charging overnight or when renewables output is at peak production, could be needed to make efficient use of electricity and avoid overloading the grid, especially if PHEVs prove popular following their introduction. Local grid reinforcement may be required.

46. Ways would need to be found to provide on-street infrastructure for garage-less owners. While charging points at supermarkets and offices could address the lack of them in some areas, they would use more expensive daytime electricity.

47. Some of these challenges can be overcome by investing in demand-side measures which reduce the reliance on technology to deliver GHG emission reductions and offsets the increased demand for grid reinforcement upgrades.

Who would fund any grid upgrades? And, how might these costs be recovered?

48. Grid upgrades in remote and island areas will be of above average cost. Given their economic and social fragility and unlikelihood that the market will deliver, this suggests that cost recovery will require special case dispensation or subsidy.

Do any of the technologies present any specific challenges or opportunities to island communities and sparsely populated rural areas in Scotland? If so, how might these challenges by addressed, and by whom?

49. The extent of the challenge to island communities and sparsely populated rural areas depends on whether low carbon vehicle technologies remain aimed at journeys in or between urban areas or they are developed to increase their range and endurance, and also on the creation of local or regional fuel production.

50. Even with a phased roll-out of these vehicles, the fossil fuel fleet will take many years to become obsolete and 4 wheel drive, off-road, load-carrying vehicles and rural filling stations will still be needed. But as volumes fall, this will put more pressure on the viability of these filling stations, and may result in fuel deserts.

51. These pressures will be further increased by the advent of bioethanol as a petrol replacement which will add real costs to them and further put into question some of their viability. A report by Experian for HITRANS, the regional transport partnership for the Highlands and Islands, has found that the increased use of biogasoline in conventional petrol as a result of the Renewable Transport Fuel Obligation may have unintended consequences in the Highlands and Islands. INEOS has been due to end production of conventional gasoline at the Grangemouth refinery once its new biogasoline facility is completed. Due to its character, biogasoline cannot be shipped north from Grangemouth because the existing marine vessels are unable to handle it. Nor can it be stored in forecourt tanks at petrol stations without modifications costing up to £3,000, which is outwith the resources of smaller operators. It is also likely that it will be too expensive to construct blending plants on the islands or even in the Highlands. A new distribution network would therefore be needed and in consequence a "green" policy would result in significantly increased carbon emissions from Grangemouth-based tankers travelling around the Highlands and Islands, with implications for security of supply and congestion on the roads. The region could, uniquely in the UK, also face much higher costs for fuel. The Gallagher Review has recommended that the introduction of biogasoline is delayed. Before it is introduced, there is a need to ensure that the infrastructure is put in place in the Highlands and Islands. The Scottish and UK Governments, and the fuel supply industry, must find a workable solution to the issues surrounding the introduction of biogasoline in the region before the national introduction of biogasoline, to remove uncertainty for the industry and consumers, and provide sufficient time for industry to make the investments required to ensure continuity of supply.

52. EVs are ideal for urban driving, but even with advances in technology, it's hard to see them as an ideal solution in the Highlands and Islands due to the geography and travel distances involved. On the other hand, Scotland's island authorities are developing major onshore and offshore renewable electricity projects and until such a point as subsea cables are constructed to the mainland will have excess capacity for their own demands. Assuming that they are not taken to the Mainland, given the confines of the island, EVs may not range as far. It may, therefore, be worth testing charging infrastructure there, for example on Lewis.

53. There are other opportunities for island communities and sparsely populated rural areas. As previously mentioned, Comhairle nan Eilean Siar's H2 SEED project will install an electrolyser in the Creed Waste Management facility to produce hydrogen from biogas. This received a £250,000 grant from the Hydrogen & Fuel Cells Support Scheme which provided £1m between seven projects to deploy and demonstrate renewable hydrogen and fuel cell technology.

Setting Targets

Do you think that having a twin approach for the public sector and other users is appropriate? If so, why? If not, why not?

54. On current trends and without specific incentives, Scotland is unlikely to reach even 4.5% of transport fuel from renewable energy and it will lag well behind the rest of the UK. Speeding up deployment is therefore a key challenge. The uncertain oil price, recession and increasing cost of finance, have seriously affected technology companies and the economics of investment in renewable transport fuel. In view of the economic and climate change policy objectives, government intervention is required. Risk and reward will need to be shared with the private sector to provide a more conducive climate for low carbon transport.

55. In *Mitigating Transport's Climate Change Input in Scotland*, an Ambitious Scenario is put forward which assumes that Scotland goes beyond UK/ EU plans. The policy consists of a total of £5m made available to the Scottish public sector to offset the additional costs of purchasing low carbon vehicles. For private vehicles, £100m will be made available to allow grants of £5000 to private motorists purchasing low carbon vehicles. The combination of initiatives has the effect of accelerating the rate at which the fleet of cars and vans in Scotland changes beyond that envisaged by the Climate Change Committee in their extended ambition scenario by 2 years from 2015 for cars and 3 years for vans.

56. SCDI has been informed that, at present, some large fleet managers are purchasing EVs faster than the public sector in an attempt to reduce their carbon footprints. SCDI would agree that the public sector is likely to have to take more of a lead, especially as EU legislation will oblige local authorities and contracting entities to consider lifetime vehicle and emissions costs in procurement practices. The Climate Change (Scotland) Act sets tough targets for all public bodies. Local government can play a major role in promoting the use of zero-emission electric vehicles, by adopting such vehicles for their own fleets. Such fleets, if powered by renewable energy, could significantly reduce regional carbon emissions. However, as previously mentioned, in order that LGV rental businesses can reduce their rates for and increase the availability of LCVs, this will have to be part of a general 'push' on all vehicle users, which increases LCVs' resale prices.

If so, should targets relate to the uptake of low carbon vehicles (either as a percentage of the fleet or an absolute number), or a reduction in total emissions across the fleets or another format of target? Why?

57. A total emissions target across the fleets would create a level playing field for all the technology option which allows them to compete fairly in the market. Any targets would need to be progressive, recognise the greater challenges in rural areas and not get too far ahead of the development stage and costs of LCVs.

If we follow a target relating to the public sector uptake of LCVs, what percentage of the fleet should be LCVs by 2020? Please give reasons for your answer.

58. By 2020, it should be possible for 95% of purchases for Scotland's public sector fleet to be LCVs. For example, the public sector bus fleet is predominately minibuses and it is possible for this fleet to entirely consist of LCVs by 2020. However, LCV technologies for HGVs are unlikely to be made available by 2020.

59. It is important that all public bodies with fleets take part in programmes, albeit the different opportunities and challenges they face must be taken into account. Programmes should also be introduced without unnecessary delays. There is a risk that programmes which are restricted to only some public bodies or incentives which are announced for some point in the future encourage public bodies which are not immediately involved to delay LCV investment decisions.

If we follow a target relating to the uptake of LCVs across all road users, what percentage of all new vehicles should be LCVs by 2020? Please give reasons for your answer.

60. Progress needs to be made across all road users. SCDI understands that for cars and LGVs it would feasible to set targets as CO_2 data on new vehicles is available and LCVs are available in reasonable numbers. However, for large commercial vehicles it would not as low carbon technologies are in their infancy.

61. While a Scottish target would be feasible, SCDI believes that a UK or European target would be more appropriate. Consistency would help manufacturers and the private sector support the uptake of LCVs, and ensure that businesses based in Scotland do not face higher costs which make them less competitive. The Scottish Government should, therefore, seek to influence UK and EU policies.

Are there any vehicle categories that should be excluded from the public sector target? If so, what are they and why should they be excluded? If not, why not?

62. It has been suggested to SCDI that specialist vehicles which have a replacement lifecycle in excess of 10 years, like gritters, should be excluded from the target.

As LCVs may have higher upfront costs than traditional vehicles (albeit with a smaller discrepancy between lifecycle costs) do you consider it to be efficient use of public resources to devote a greater short-term budget towards the purchase of LCVs? If so, why? If not, why not?

63. This approach of expanding the market through public sector procurement is endorsed at EU and UK levels. The EU Energy Services Directive and forthcoming Cleaner and More Efficient Vehicles Directive will require public authorities and certain public transport providers to take into account energy efficiency and environmental impacts when purchasing road transport vehicles. In the UK Low Carbon Transport Innovation Strategy, the UK Government announced funding of an initial £20m to develop a new programme of financial support for the public procurement of lower carbon vehicles, especially vans.

64. Procurement capitalises on the substantial buying power of the public sector. By establishing a market which is able to absorb the initially higher costs of new carbon vehicle technology, it can contribute to the expansion of the market through the economies of scale needed to reduce overall costs. In this case, it is necessary for the public sector to stimulate private sector investment in LCVs and address market failure to meet government economic and GHG targets.

65. Building critical mass would accelerate adoption by enabling the supply chain to gain scale, prove reliability, durability and reduce costs. It would encourage investment by infrastructure providers in charging stations. It would also enable fleet and private vehicle operators to buy with certainty of being able to operate vehicles, charge vehicles, get replacements and have expectation of residual value for older vehicles with new batteries or reduced ranges but cheaper costs.

66. Public sector spending is likely to be squeezed over the next decade and while LCV costs remain higher it will need to be adequately resourced for this purpose.

Are there any opportunities or barriers to public sector procurement of LCVs that are not mentioned in this document? If so, what are they?

67. SCDI has previously highlighted evidence from a light commercial vehicle rental business that unless there is a general 'push' on all vehicle users, the demand for LCVs from their public sector customers will inevitably attract premium rates and it will remain difficult to meet the short term needs of local public sector users.

What are the individual roles of different groups and organisations in ensuring the provision of any infrastructure required for low carbon vehicles?

68. In *Mitigating Transport's Climate Change Input in Scotland* it is assumed that larger towns with more than 40,000 people will be covered by the market as electricity companies and motor manufacturers are incentivised to invest in the infrastructure by national and EU carbon reduction commitments. Competition in the wider private sector to attract early adopters of LCVs to their businesses could also incentivise the provision of infrastructure at supermarkets, shopping centres, motorway services, car parks, offices, leisure destinations and hotels. Major transport interchanges such as airports and stations are also likely sites. Overnight charging of 6-10 hours will be suitable for most EVs, but developments in battery technology should lead to EVs being able to charge more quickly.

69. However, Government will have a critical role in ensuring the provision of a nationwide infrastructure for low carbon vehicles. *Mitigating Transport's Climate Change Input in Scotland* suggests that Scottish Government support should be initially focused on recharging points in areas in small to medium-sized towns, of 25,000 to 40,000 people, and recommends that households living in flats or accommodation rented from the local authority require priority assistance as they are the least likely to have domestic charging points. Under its ambitious scenario, 50% of these towns are covered which has the effect of increasing the projected number of EVs or PHEVs by one third from 12% to 16% by 2022. Scottish Government support for this infrastructure should be provided in consultation with private sector providers, the UK and European governments and standards agencies, especially over the standardisation of charging points.

70. Charging infrastructure for larger vehicles is readily available in commercial and council depots, but a grant or rebate scheme could be offered for organisations buying more than a certain number of vehicles to pay for their recharging station.

71. For domestic vehicles, especially in small to medium-sized towns, there could be a grant or rebate scheme for purpose built charging points on streets where requested, and publicly-subsidised charging points on streets and in car parks.

72. The Scottish and local government could also introduce more flexible planning rules for the installation of street furniture, including charging points. Local authorities could grant public land for the development of charging stations and require charging stations on new roads, and new retail or leisure developments.

73. Nissan is working on a programme where people lease the cars or buy the cars and lease the batteries. If the ownership of the battery is separated from the ownership of the car the battery becomes a running cost like petrol and the price of the car falls. As the consultation notes, US-company Better Place has been scouring the world for car markets which are "islands" and offering to fit them with networks of car-charging and battery swapping stations that will use robots to exchange exhausted batteries for fully charged ones in seconds. Israel and Denmark are among the countries which have already signed up. However, there are difficulties in adopting these approaches. As in the rest of Europe, consumer preference in Scotland is to own rather than lease their cars. The practicality of "hot-swapping" of batteries is questionable given the differences in EVs and batteries, with concerns over the costs, processes and safety of the technology. Better Place is also tied to a small number of specific vehicle manufacturers.

Are there other supply side/capacity constraints impacting on LCV development and uptake? If so, what are they?

74. There is a lack of servicing, maintenance and repair skills and facilities.

Are there barriers to the development of an indigenous low carbon vehicle industry in Scotland? If so, what are they and how might they be overcome?

75. A 20 year vision for the automotive industry published earlier this year by the New Automotive Innovation and Growth Team recommended that Government and the industry agree technology roadmaps for low carbon vehicles and fuels.

76. It recommendations were:

- Establish a joint industry/government Automotive Council to develop, guide and implement a long term strategic framework for the industry; and
- Focus the UK R&D agenda around a new industry-consensus technology roadmap, and as part of this establish 'Test Bed UK' a bold, large scale pilot to develop, demonstrate and build the new low-carbon personal transportation system including its infrastructure
- Creating a transformed business environment in the UK to provide a more compelling investment proposition versus other countries e.g. attract more Tier 1 suppliers to the UK which supply sub-systems to car-makers.
- Agreeing on the technology roadmaps for low carbon vehicles and fuels and exploiting opportunities to promote the UK as a strong candidate to develop these and other technologies; and
- Developing a stronger and more competitive supply chain through joint research on focussed areas, skills development and the enhancement and brokering of collaboration opportunities for achieving effective scale in R&D and core technology components

77. Scotland has the capabilities to develop a competitive LCV industry, with power utilities and public transport operators, specialist vehicle manufacturers in Allied Vehicles and Alexander Dennis, and a battery manufacturer in Axeon Holdings.

78. It is essential that this manufacturing expertise is retained in Scotland, especially with the US now offering substantial grant and local procurement incentives to relocate. Batteries are competing with a well-established engine technology and technology developments are expensive. Government therefore needs to continue supporting R&D from fundamental research to product development.

Should Scotland's industry focus on particular vehicle types? If so, what are they and why? If not, why not?

79. Scotland is well-positioned to take commercial advantage from the move to EVs. Allied Vehicles is currently developing a range of LGVs from 1.8 tonne to 4.5 tonne. Each of these will have passenger equivalents. Investment at this stage will maintain Scotland’s EV technology and production lead and, as the market grows, those countries which have a competitive LCV industry will be able to take advantage. Scotland has an ideal opportunity to showcase internationally its low carbon vehicle technologies in the vehicle fleets for the Commonwealth Games.

Are there gaps in the supply chain? If so, what are they and how might these be overcome?

80. The demand for the expertise of electronics and power-storage companies is likely to grow, some of which have not previously supplied the car industry.

Do we have the required skills base for the development of this market? If not, where are the gaps?

81. Even as a nascent technology, the Scottish LCV industry has the potential to create hundreds of jobs. If it is successful and expands with the market, its need and employment opportunities for automative-related engineering skills will grow. The Scottish Government should consider an initiative to enhance these skills.

How could the various stakeholders collaborate to stimulate the development and uptake of LCVs?

82. Government, industry and fleet managers can collaborate on a programme to improve information and encouraging vehicle buyers to consider their options.

83. Collaboration between power generators and distributors, and vehicle and battery manufacturers on smart grid technology development should be supported and incentivised. This would enable Scotland to take the lead in developing and introducing standards that could be licensed and sold globally.

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