Church of Scotland
Church and Society Council

Energy and Transport –Moving Forward

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1. Introduction

1.1 The Church and Society Council's Report to the 2007 General Assembly on the topic of *Energy for a Changing Climate* focussed on electricity supply. It concluded that the primary focus should be on energy conservation and meeting future demands from renewable sources. Large scale technologies such as nuclear power or fossil fuels with carbon capture were seen as options of last resort as they use finite fuel resources and leave a legacy of waste materials for future generations.

1.2 The Report recognised that electricity production represents around one third of total energy use, with heat production and transport accounting for a further third each. The General Assembly instructed that further work be done on these areas. This Report addresses some of the critical issues surrounding the use of energy in transport. The Church of Scotland has recognised the need for action to combat climate change[1] and this Report seeks to examine the wider implications of that in the area of transport from a number of perspectives.

1.3 Transport is a more complex issue than electricity supply. Both bring substantial benefits for society in economic and social terms, both raise issues of long term fuel supply security, and both are associated with the critical problem of climate change**.** One of the Deliverances for last year's Report reads "The General Assembly recognise the urgency with which major changes are needed to avert the worst consequences of climate change."[2] However, transport also raises complex issues including urban development patterns, the negative consequences of congestion and the issue of food miles. The broad conclusions reached on electricity supply – conservation and renewable sources - also apply to transport. Additionally, transport demand is currently growing much more rapidly, the technologies to deliver emission reductions are much less well developed, and the implementation of conservation measures would have a much more noticeable impact on our lifestyle.

1.4 The moral and ethical dimensions of transport are also somewhat more complex. Our duty of stewardship and care for the poor dictate wise use and prudent stewardship of resources, but our duty to go into the world in mission and in care for others urges a need for well thought out travel. The Biblical record is full of journeys and they are usually seen in a positive light. Travel can be enjoyable, educational, economically productive, socially essential or prompted by our faith; but it can just as easily be wasteful and self indulgent. This report seeks to discuss these various facets.

1.5 There is a fundamental tension between the legitimate use of transport and the damage that it causes. There is no simple – or quick – technological fix to replace liquid petroleum and diesel; our primary response must be based around our lifestyles as this is the most effective place where we can make a difference.

1.6 The need for understanding of these complex and often contradictory pressures is thus more pronounced than for electricity. The debate surrounding transport can become over simplified and 'sloganised':

'The problem is rapid growth of air travel' – The reality is that although growing quickly, air transport represents only a fraction of emissions and brings high business and tourism benefits to many parts of the world.[3]

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[1] "The General Assembly recognise the urgency with which major changes are needed to avert the worst consequences of climate change." Deliverance 17 on the Report of the Church and Society Council to the General Assembly 2007.

[2] Deliverance 17 on the Report of the Church and Society Council to the General Assembly 2007.

[3] *Towards a Sustainable Transport System*, Department for Transport 2007 (http://www.dft.gov.uk/about/strategy/transportstrategy/pdfsustaintranssystem.pdf) §2.50 states "CO2 emissions from EU aviation (including all flights departing and arriving in the EU) are forecast to rise from around 0.1

'We should stop transporting food half way round the world' – A recent report by Carbon Trust[4] (the independent body set up by Government to look at energy use and carbon dioxide emissions) concluded that in many cases the energy and greenhouse gas emission implications of growing food overseas where climatic conditions are optimum and without use of intensive methods (fertilisers, mechanisation etc.) are considerably less than local production.

'Large 4x4 vehicles should be taxed off the road' – These vehicles are already very highly taxed in terms of fuel use, are often owned by the well off who see them as status symbols (or who value them for safety?) and therefore are possibly the least likely to be influenced by higher costs. Those in rural areas, where such vehicles can be seen as more of a necessity due to the lack of alternative means of transport and poor roads, might however be severely impacted. Using economic instruments to alter behaviour can be fraught with difficulties.

'Government should not waste any more money on road building' – The economic consequences of congestion (whether it be road, rail or air) are considerable and £1 spent on reducing congestion can easily lead to £10 of benefit in time saved, improved air quality and reduced carbon dioxide emissions. Allowing congestion to become a 'rationing mechanism' can lead to substantial economic underperformance making less available to spend on social expenditure.

'People should use public transport' - while this is essential wherever possible, for those living in rural areas public transport is often extremely limited, if available at all.

1.7 In the following analysis this Report examines just some of the issues but it does illustrate the complexities of the topic and the need for careful thought and analysis and prayerful consideration; followed by personal action. The churches' Eco-Congregation Programme has a very considerable role to play in this area, by making objective material available, stimulating discussion and encouraging individual and group action.

2. Issues and Approaches

2.1 The following sections of the report explore some of the aspects of the transport dilemma, highlighting the problem and the implications of possible solutions. The 'problem of transport' is often not well defined. It has a number of dimensions, each with their own solution, that are often not complementary in effect. There are a number of issues that can be viewed from different, though not mutually exclusive, perspectives. Some of these perspectives argue for urgent change, others resist it.

2.2 An environmental perspective tends to emphasise the carbon dioxide emission impacts of transport.[5] Transport emissions represent around a third of all carbon dioxide emissions and are the most rapidly growing sector. Air transport emissions are small (see above), but growing rapidly, particularly in the leisure sector (only around 15% of travel is for business purposes). Short weekend breaks on the continent are now frequent, as is travel to and from second homes abroad. Rail freight and shipping are efficient means of transporting goods and emissions are growing slowly, but the largest part of the sector is road transport. Although cars are becoming ever more fuel efficient, we

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billion tonnes in 1990 to 0.4 billion tonnes in 2020. At that point, they would account for 8 per cent of EU total emissions."

[4] E.g. *EU scientists query bloc's biofuel strategy*, Financial Times, 18 January 2008 http://www.ft.com/cms/s/0/f09ceb44-c544-11dc-811a-0000779fd2ac.html

[5] Carbon dioxide, while a contributor to climate change, is a harmless gas in small quantities with no local health implications.

Other emissions from motor vehicles include carbon monoxide, nitrogen oxides and smoke, all of which can be damaging to health. Very small particles (pm10) have also been linked to lung disease. Further information is available from COMEAP (Committee on the Medical Effects of Air Pollutants) http://www.advisorybodies.doh.gov.uk/COMEAP/statementsreports/longtermeffects.pdf

are living further and further from work, owning more vehicles per household, travelling further and more frequently to shop and the 'school run' is now a feature of the daily lives of many.

2.2.1 An environmental perspective tends to see the issue as indicating an urgent need to change – through moral imperatives, economic instruments to change behaviour, regulation to outlaw less efficient technologies etc.

2.3.1 A purely economic approach would tend to see most aspects of transport growth as positive.

- Tourism is adding to the income of many in remote areas.
- Business travel and interconnectedness in the global village is adding to growth and political stability through trade.
- Developing economies are finding markets for their primary products – principally food and raw materials enabling them to grow and move out of poverty.
- Many households now have more choice in terms of shopping, leisure options and lifestyle choice and in a service economy such as the UK this is a major driver for growth.

Economists recognise the problem of climate change and have, following the Stern Review, shown a willingness to include the cost of carbon dioxide emissions in their calculations. The Stern Review, published in 2006, estimated that transport accounted for 14% of all global greenhouse gases and that transport was the fastest growing source of greenhouse gases in OECD countries. Stern notes that the key driver behind transport growth is wealth: "As people get richer, they tend to want to transport more goods and make longer trips" The Review also notes that transport is one of the most difficult sectors to cut demand, both because of the cost of alternative technologies and the welfare costs of reducing demand for transport.[6]

2.3.2 The principal problems of transport from the economist's viewpoint are lack of infrastructure and congestion particularly in urban and well-developed areas. Even allowing for the £70 cost of carbon[7], £1 spent on road improvements or new runway facilities can generate £10 in additional economic development. Given Government's desire to move forward on climate change (and most other issues) through the use of markets rather than direct intervention, this poses some difficulties. Even attempts at direct regulation are considered in terms of economic impact. The reality is that transport is highly productive and can easily cover its carbon costs. This, of course, means that reductions must be made elsewhere where costs are lower – renewable electricity, more efficient heating systems etc. However, the cost of these reductions may impact more heavily on the less well off.[8]

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[6] For further details of the Stern Review's discussion of transport issues see http://www.sternreview.org.uk/
The Stern Review puts a price on the results of climate change if economic development continues on its current path (business as usual or BAU) and compares this with the price of putting measures in place to mitigate the impact of climate change. Stern's conclusion is that, while expensive, it would be cheaper to mitigate the cost of climate change through action now to keep the amount of carbon dioxide in the atmosphere under 550 parts per million (ppm) rather than to pay for the damage that would result from higher levels.
"Preliminary calculations adopting the approach to valuation taken in this Review suggest that the social cost of carbon today, if we remain on a BAU trajectory, is of the order of $85 per tonne of CO2 … if the target were between 450-550ppm CO2, then the social cost of carbon would start in the region of $25-30 per tonne of CO2 – around one third of the level if the world stays with BAU.
Stern Review : The Economics of Climate Change, Executive Summary, xvi-xvii

[7] This is the standard figure used by the Treasury. Their guidelines require that the social cost of carbon be included in calculations. The social costs of carbon are huge and this monetary cost is based on 2000 prices for carbon emissions in that year. It increases by £1/tC per year in real terms to account for the increasing damage over time. The Treasury Paper *Estimating the Social Cost of Carbon Emissions* provides a literature review of this subject. http://www.hm-treasury.gov.uk/documents/taxation_work_and_welfare/taxation_and_the_environment/tax_env_GESWP140.cfm

[8] The Eddington Report 2006 considers this area. (http://www.dft.gov.uk/162259/187604/206711) and its conclusions are reviewed in *Towards a Sustainable Transport System* produced by the Department of Transport (http://www.dft.gov.uk/about/strategy/transportstrategy/pdfsustaintranssystem.pdf).

2.4 From the perspective of international diplomacy, the key issue is the high dependence of the transport sector on oil and oil products and hence the implications of political instability in the Middle East and the former Soviet Union. Alternative fuels could be developed, but only slowly and it is far from clear if any substitute for aviation fuel is practical even in the medium/long term. Given the dependence of developed country economies on oil and the rapid growth in demand from countries such as China and India this situation is not likely to improve soon. It must be recognised that the oil producing countries like ourselves have a vested interest in market stability as, in many instances, this is their key source of income. Actions to reduce oil dependency rapidly or the threat of military action to secure supplies could be counterproductive. Stable trade patterns offer the possibility for political stability, but require higher degrees of trust and co-operation. Calls for tough mandatory cuts in greenhouse gas emissions from all countries - not just the developed world - can also be seen in a destabilising light.

2.5 Sometime in the next decade or so, if we have not done so already, we go past the peak of oil production and supply starts reducing while demand is still increasing. This will have knock on economic effects. The problem for the diplomat is how to steer towards a solution that delivers a low carbon future, with less oil dependency within a stable framework which is not seen to threaten the producers or leave them with stranded assets and failing economies. Technology transfer agreements within the successor to the Kyoto Protocol might offer the answer, but these are proving elusive, as witnessed in Bali.

2.6.1 Transport has brought a number of great changes in our society in modern times. Mobility has opened up a range of new lifestyle options and opportunities: the family that would have been split for ever by emigration, only a hundred years or so ago, can now visit each other more regularly and more easily; foreign travel, and all the benefits it can bring in terms of understanding of different cultures, are now more available to all. Some possibilities now open to us embody the aspirations of many, for example a second home abroad; commuting over longer distances is now possible and affordable, enabling lifestyle choice – life in the country with it associated benefits, but work in the city and enjoy a cosmopolitan culture; an ever wider choice of vehicles available, from fast sports cars to chunky off road vehicles, enabling even the moderately well off to make lifestyle statements about their identity and aspirations.

2.6.2 Attempts to tackle congestion and reduce emissions can be resisted quite strongly, as they are counter cultural to some lifestyle aspirations and may be seen as limiting choice and self expression.

2.7 These different perspectives may or may not be justifiable logically or ethically, but they can be deeply held and reflect the nature of modern society, and therefore will be very difficult to change.

3. What technology options are available?

3.1 The Report[9] on electricity noted that there are a number of technological solutions available to reduce emissions from road transport. Some of these are well developed, but most are not and will take time to develop

3.*2 Fuel Efficiency*

Considerable potential exists to improve vehicle fuel efficiency. Steady progress has been made since the petrol and diesel engines were developed and these efforts are now driven by regulatory measures in both US and Europe (and indeed the performance of China in this regard is exemplary – well ahead of US and EU). Compact lightweight vehicles, dual fuelling and the use of regenerative braking,[10]

[9] Reports to the General Assembly 2007 *Energy for a Changing Climate*

[10] Regenerative braking is the absorption and re-use of energy dissipated while braking a vehicle. This is in use in electric powered vehicles, such as electric trains, and could be applied to electric and hybrid powered cars.

together with fuel efficient driving techniques could probably reduce fuel use by up to thirty or forty percent.[11] But there is consumer resistance to purchasing small 'fit for purpose vehicles', vehicle turnover times are around six to ten years and driving practices are difficult to change so these changes require both concerted will and time to have full effect.

3.3 ***Electric Vehicles***

Electric vehicles have been with us for many years, but have failed to gain popularity due to limitations in battery technology (and hence range). Work continues to improve their viability, but widespread uptake seems many years away. In any event there may be little to be gained in terms of carbon dioxide emissions if the electricity is generated from fossil fuels. There is a reduction in urban pollution but the power generation produces similar pollution elsewhere. Large-scale development of nuclear power, as a source of electricity, might be an option, but as highlighted in the 2007 Report to Assembly,[12] this is hardly a sustainable way forward. The environmental future value of electric vehicles (and indeed electric traction on rail) is dependent on very large-scale renewable energy development.

3.4 ***Vehicle Life Cycle***

The focus tends to be on the use of fuel while vehicles are in use, but in reality the 'embedded energy'[13] contained in a vehicle represents a high proportion of its total footprint. Therefore there is a tension between retaining and prolonging the life of older vehicles which may be less fuel efficient and the manufacture and purchase of newer vehicles even with potentially reduced fuel consumption.

3.5 Biofuels (BioDiesel and BioEthanol)

3.5.1 Biofuels are fuels derived by a biochemical process from crops either grown for that purpose (wheat or oil seed rape) or from agricultural or food production waste (e.g. bagasse from sugar cane extraction or straw from cereal production). Vehicles can run without modification with up to 10% addition of such fuels or with modifications on pure biofuel. Some countries have introduced policies that make extensive use of such fuels (particularly bioethanol in Brazil). The UK and US both have targets for increasing use of biofuels (the BioFuels Obligation in the UK rises over time to 10%). Such measures, in principle, offer the possibility for substantial emission reductions in the future (particularly in conjunction with fuel efficiency measures). However biofuels only result in emission reductions to the extent that emissions are not released through their production. The use of fertilisers, heavy machinery, heating in processing etc. all add to overall emissions. Biofuels might therefore release as much as 90% of the emissions of conventional fuels. A range of certification programmes is being developed to ensure that the real value of reduction is assessed. A knock on effect of biofuel production is in the change of land use that it often requires. The new land use often replaces rainforest or grasslands that sequestered more carbon than the crop that replaces them. The overall effect may not be as intended.

3.5.2 The principle concern surrounding biofuels which has come to prominence is their impact on food prices and environmental sustainability. The use of agricultural land for biofuel production removes it from potential food production. In the US this has led to a sharp increase in grain prices (with global implications). In developing countries this can exacerbate the industrialisation of agriculture with adverse effects on communities and sustainability. (Oxfam and environmental groups have expressed serious concerns in both these regards.)[14] In the UK it has led to set aside land being brought back into production with loss of wildlife habitat. On the other hand, increased prices

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[11] The Department for Transport has published guidelines on how smarter driving can help to reduce fuel bills and greenhouse gas emissions. See http://www.dft.gov.uk/ActOnCO2/?q=smarter_driving

[12] Reports to the General Assembly 2007 2/59 – 2/61.

[13] Embedded energy is the total sum of energy involved in the whole life of the vehicle – its production and final disposal and not just the fuel put into it to make it move.

[14] Issues here include people being removed from land and prime habitat (especially forests) destroyed to plant large monocultures. http://www.oxfam.org/en/files/bn_biofuelling_poverty_0711.pdf

and new markets (together with biofuels for electricity production) potential could greatly assist Scottish farmers as the CAP reforms continue to bite.

3.6 *CNG and LPG and Biogas*

Compressed Natural Gas and Liquid Propane Gas conversions to existing engines both offer the ability to reduce carbon dioxide emissions. However these still use fossil fuels and hence are not sustainable in the long term. The carbon dioxide emission reductions are limited by the energy used in processing, compressing and transporting the gas. In addition new infrastructure is required in the form of storage tanks, pumps etc. While desirable for improving air quality in towns the role of CNG or LPG in addressing climate change is less certain**.** It would also be possible to use similar technologies to those described above for biofuels to create biogas for use in vehicles – but the problems would also be similar.

3.7 *Hydrogen Fuel Cells*

Hydrogen fuel cell powered vehicles have been under development for some time and are approaching prototype stage. Hydrogen burns to form water vapour and so has no greenhouse gas implications at the point of combustion – and so would appear the ideal fuel for road vehicles. However, finding suitable supplies of hydrogen is problematic. Prototypes currently use hydrogen reformed from oil or by electrolysis of water using electricity. Given the process efficiencies, there are no overall carbon dioxide savings by these routes unless the electricity is generated from renewable sources[15] or nuclear power.

3.8 *Coal to oil*

Oil (or gas) can be produced from coal, so the 'coal powered' car could be a possibility. For example, South Africa developed coal liquefaction following the oil crises in the 1970s[16] and gasification of coal (potentially in situ in the coal bed) is proposed for electricity generation. However vehicles fuelled by these routes would still release carbon dioxide so the use of such technologies for electricity generation, allied to carbon capture and storage (only currently technically feasible at large scale) offers much more promising routes. The only possible role might be in reducing oil import dependence.

3.9 *Aviation*

While clean technologies exist or can readily be envisaged for road and rail, aviation poses different problems in that the power/weight ratio of aviation spirit is rather higher than natural gas or hydrogen (or battery stored electricity). Some projections use the assumption that if we are to reduce emissions by the necessary 80-90% to avoid the worst impacts of climate change, then electricity generation and transport will have to become zero carbon to allow continued use of fossil fuels in aviation, particularly at its current rate of growth. Some improvements can be made through more efficient aero engines, larger size, improved avionics and better loading. However, the speed of implementation of change is limited by the long time spans from design to safety case production to deployment and then the long service life of the aircraft. Aviation as well as being the fastest growing sector is technically the most difficult one in which to make substantial reductions.[17]

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[15] The PURE project is a demonstration project on Unst showing how the energy needs for a remote rural industrial estate can be met by using combination of wind power and hydrogen technology, on a comparatively small budget. (http://www.pure.shetland.co.uk/html/pure_project1.html)

[16] Coal gas was produced on an extensive scale across Scotland before the development of North Sea gas but a new gasification plant at Westfield in Fife has demonstrated that it is possible to generate gas from a gasification process using a mixture of biomass and coal. See House of Commons Scottish Affairs Committee *Meeting Scotland's Future Energy Needs: the Westfield Development Centre* Second Report of Session 2005–06

[17] The EU has lunched an initiative to help the aviation industry to develop environmentally friendly technology (http://www.euractiv.com/en/transport/eu-launches-clean-sky-research-project-low-carbon-aircraft/article-170120 and http://www.cleansky.eu/index.php?arbo_id=83&set_language=en).

3.10 ***Technology summary***
With the exception of aviation, it seems quite feasible to secure significant reductions in transport emissions, provided the public are willing to accept the new designs and their limitations and to adopt more fuel efficient motoring practices. Rail electricification is an established technology and, so long as the shift is allied to renewable energy development (or as a last resort nuclear or fossil fuels with carbon capture), it reduces emissions. Hydrogen fuelling and biofuels from agricultural and other wastes offer a route forward for road transport, but only if developed carefully with global sustainability at their centre.

4. Infrastructure and lifestyle implications
4.1 The use of transport is implicitly allied to infrastructure and lifestyle choices. Some would argue that transport choices are increasingly limited by the design of towns and cities and the availability of public transport options.

4.2 Urban design places limitations on choice and carries with it ethical implications. The move to out of town shopping centres tends to make car ownership more desirable. It can have negative impact on town centres and act against those who are less well off, and do not have access to a car. Similarly the centralisation of hospitals and their movement to out of town locations tend to favour the car owner. In even more simple ways building design can press towards car ownership – modern town flats might well have on or off street parking facilities, but are unlikely to have suitable storage for a bicycle even though these are the very places where cycle commuting might make most sense. (Urban car sharing schemes are helping – but other than in Edinburgh success has been limited).

4.3 The kind of housing we desire also has a major impact. Low density 'urban sprawl' with cul de sacs for privacy and safety (without linking paths etc as these would reduce our sense of security) - 'executive homes in the suburbs' - are the order of the day. But these designs are highly transport dependent, for routine mobility and commuting, make walking or cycling to work or school difficult, and are in all respects designed around multiple car ownership. This is in sharp contrast to the transport and energy efficiency of urban terraced or flat dwelling.

4.4 Towns tend to have developed around rail networks making commuting to cities possible (and driven by house prices etc.). However rail networks are, in many areas, operating to capacity. Making the infrastructure changes necessary to expand such commuting possibilities is often difficult - because of the disruption caused during engineering work or because the land needed for additional track would be very difficult to obtain. The same is true of the urban road network – where improvements could reduce congestion and hence emissions. A further confounding issue is that the better the road and rail infrastructure the further people are willing to commute and hence the more quickly the routes become congested. House prices also rise when commuting to a city becomes possible.

4.5 Rural areas suffer in a different way. Infrastructure is frequently poor (B class roads poorly maintained) and the economic justification based on time saved through reduced congestion is absent. Rail services are often absent and bus services poor or badly integrated due to the nature of regulation. Money is less likely to be spent in those areas, the services continue to be poorer and, due to distances and road conditions, the cost of travel greater. Second homes, whose owners usually have cars, tend to reduce demand for local transport placing further pressure on the community. Transport can therefore be an exacerbating factor in rural poverty. Despite this we recognise that there is a role for Government in supporting lifeline air routes and hence the communities they serve in Scotland's island communities.

The effect of aviation on climate change is discussed in detail in the House of Commons Research Paper Aviation and Climate Change (http://www.parliament.uk/commons/lib/research/rp2008/rp08-008.pdf) 24 January 2008.

4.6 Lifestyle choices also have an impact on transport demand. The ability to own second homes abroad is predicated on cheap air travel, and as noted above, road transport makes home ownership in remote areas a practical and desirable possibility. Such decisions lock in transport patterns for the future and will be very difficult to reverse. Similarly the linking of holiday destinations to air travel drives the demand for new runway infrastructure – and if the local economy in these destinations is dependent on tourism then the dilemma becomes even deeper. Clearly a populace who were happy with a single home and content with a holiday based on walking or cycling in the UK would build both our own tourist economy and allow homes to be owned by local people. It would bring considerable health benefits too. But such a vision for the future is quite different from the flight to the international theme park half way round the world for the kids, the holiday home in Spain and the five weekend breaks in Europe that many of the better off expect and many of us might aspire to. Patterns of lifestyle choice and infrastructure make transport emission reductions and congestion reduction difficult – particularly as these patterns are good for the economy.

5. Public Policy and Transport

5.1 Transport is central to a successful economy in an increasingly interconnected world. This is particularly true of Scotland, as a small country on the western fringes of the European Union. Although transport has significant environmental and lifestyle implications it is probably not surprising that the principal drivers in transport policy are determined by economics and that economic instruments are the preferred method of correcting any market failures arising from climate change rather than the fraught route of encouraging behavioural change.

5.2 Economic instruments in transport are very difficult to design effectively. Attempts to use taxation on fuel, with defined escalation year on year, fell in the face of resistance from farmers and road hauliers.[18] In any event it was arguably regressive in that it affected remote and less well off communities rather more than the better off in large urban settlements. The more recent attempts at differential charging on Vehicle Excise Duty (based on vehicle emissions performance) have done little to change purchasing patterns. Suggestions have been made of large increases in Vehicle Excise Duty for some large cars including 4x4s but this may be a marginal cost for people on high incomes and thus have little useful effect.

5.3 Some argue that urban congestion charging might be the answer, but as the Edinburgh experience shows, it is highly unpopular with city based businesses and while the populace support such measures in principle, when it come to the crunch it is not a vote winner. As a backdrop to all of this, increased transport costs drive up business costs, damage competitiveness and fuel inflation – none of which are popular with Treasury. The hard facts are that transport and mobility fuel our economy creating greater wealth and prosperity than the money spent on it (a highly positive economic multiplier). It is in classical economic terms a very sound investment and hence a cycle that is very difficult to break.[19]

5.4 Road pricing is also seen as a possible way forward – based on charging for road use rather than the current system based on fuel use or vehicle ownership. Differential charging rates could be applied, depending on such factors as location and congestion patterns. Such a methodology could, in principle, take account of rural issues including the availability of alternatives such as public transport etc. But the proposal is not without drawbacks. It would clearly be immensely difficult to design a system that all feel is fair. Nor does it directly take account of emission difference arising from vehicle choice. Further arguments would be promoted that the money raised in this way should be allocated to road provision and maintenance – with high revenue routes faring better to the

[18] In the 2000 Budget, Gordon Brown also scrapped the fuel price escalator, saying that future increases would be decided on the basis of the "due Budget process".

[19] The Eddington Report 2006 develops this argument. http://www.dft.gov.uk/162259/187604/206711

disadvantage of rural areas. Road pricing is in theory promising, but technically difficult and complex to implement effectively. We would encourage HM Government to undertake work that will meet these technical challenges so that road pricing can become a viable option.

5.5.1 Some environmentalists and economists argue that if the cost of carbon dioxide emissions is factored into the equation, hence correcting what is seen to be a market failure, then all will come right. This is particularly true in the field of aviation. However, even with carbon allocated a cost of £70/tonne as suggested earlier, the marginal cost of air travel is affected only by a small percentage – less even than the current level of flight taxation applied by Government. The same is true of road transport, where the cost of carbon is far less than the fuel duty currently applied. Carbon trading is also unlikely to cause significant shifts (cynics have suggested this is why it has been supported strongly by certain quarters within by the aviation industry), certainly at the current £20/tonne level.

5.5.2 Others propose 'carbon offsetting' as the effective way forward - paying an extra five or ten pounds on the transatlantic pre-Christmas shopping trip to make one 'feel good' that much money has been saved on the annual spending spree and little harm has been done to the environment. Certain insurance companies now offset emissions when an individual renews their premium and all new Land Rovers are alleged to have carbon free mileage for the first three years as a consequence of offsetting. Such offsets often trade for as little as £2/tonne, being based on activities in the developing world such as rainforest preservation, new planting or distribution of energy efficient lamps (which pay for themselves anyway). It is not surprising that this market has attracted some criticism and that there have been calls for tighter emissions reduction certification. This will no doubt happen, but the cost of carbon saved will still be lower than the current £20/tonne seen in the emissions trading market or the £70/tonne real cost. Hence these offsets have been compared to medieval indulgences – pay a small sum in restitution and continue with the sin in good conscience.[20]

5.6 If economic instruments seem to be potentially stony ground for major shifts in transport policy, does regulation offer a better route forward? Much has been done in this area with the securing of the Renewable Fuels Obligation, requiring fuel suppliers to move to inclusion of up to ten percent of biofuels in the mix and with European Union work on vehicle emissions standards. There is ongoing discussion as to the effectiveness of this approach.[21]

5.7 Public transport deregulation has, arguably, brought competition into the field and this should be a driver to bring down costs. However, these mechanisms are slow to take effect (rather slower indeed than the growth in emissions) and, in the case of the deregulation of buses, have led to issues with remote services, with Local Authorities (who do retain powers) sometimes reluctant to intervene. Similarly, a lesson which may be drawn from experiences with Network Rail, is that it is very difficult to control the investment level within a regulated monopoly in a way that builds infrastructure and serves greater public purpose and yet is both cost effective and attractive for the operator. Regulation can be efficient (both socially and economically), but requires vast effort on the part of policy maker and regulator against a background of future uncertainty. There is also the asymmetry of the operator having much more technical and financial information than the regulator. However it is clear that services for the travelling public could be improved, in many areas, at minimal cost through better information for passengers, through ticketing, better interconnections and integration of public transport, the removal of wasteful competition that leads to a surplus/duplication of buses on some routes, and the strategic use of 'public service' provision. The development of our rail infrastructure and especially of new routes or the re-opening of closed routes is to be encouraged, but it is also

[20] There is an introduction to this issue at
http://www.churchofscotland.org.uk/councils/churchsociety/cssrtp.htm#offsetting

[21] See f4.

recognised that in some cases new rail developments can cause levels of disruption and cost which may challenge the tolerance of passenger and public opinion.

5.8 Public awareness may be a vital driver. It is often said that politicians can only lead where the public will follow (at least until the next election). As seen above there is a huge demand for transport. It is built into our future lifestyle expectations and the nature of our infrastructure and built environment. Behaviour change is possible (free bus passes for those of retirement age have been a huge success), but it will have to go hand in hand with the necessary infrastructure to make the change possible and desirable – enough trains, showers for those who cycle to work, shared car ownership schemes etc. Public policy has imaginatively to combine behaviour change, better regulation and economic policy to motivate the public to make lifestyle shifts.

6. Food Miles

6.1 'Food miles' have become one of the issues often cited as critical to addressing transport. This is also far from a clear cut issue. Locally produced food often may have a considerably greater carbon footprint than the same product produced overseas with low fertiliser input, no use of heavy machinery and no need for artificial heating based on fossil fuels. It has even been recently shown that for a purely carbon and energy perspective it is better to send shellfish half way round the world to be processed by hand than to use high levels of mechanisation in Scotland.[22]

6.2 From a fair trade perspective would it be appropriate to reject food produced by local farmers using traditional methods in a developing country to be replaced by intensive methods here? Again the issue appears to come down to lifestyle choice. When we were content to eat local foods, farmed traditionally and in season, the concept of strawberries with Christmas lunch was absurd. Now that we have the choice, is it more morally justifiable that they be grown in UK using vast amounts of energy or naturally half way round the world in South Africa? It is not the food or the food miles which are the real issue, rather our decisions on what to eat and when.

7. Transport and Health

7.1 As well as having environmental and economic consequences, it is increasingly clear that transport has significant health implications and that in moving towards a more sustainable future this dimension will have ever more importance.[23] Walking and cycling to work would bring considerable health benefits to an ever more sedentary, obese, heart disease and diabetes prone population. Safe streets and appropriate routes, to allow children to walk to school and to play outdoors, would develop life habits which would benefit them greatly in middle age and onwards. Active outdoor holidays at home could enhance fitness and benefit our rural economy as well as reducing emissions. The development of mountain biking trails and the activities of the Forestry Commission are examples of this.

7.2 However, it is not simply a matter of lifestyle choice that has brought us to the current situation. Walking and cycling have been made difficult for many because of urban design – cul de sacs with no through routes, inadequate provision of cycle ways, lack of provision for bicycles on trains or buses tend to be a feature of our infrastructure – in sharp contrast to many towns and cities in the rest of Europe and even the US.

8. Christian Perspectives on Transport

8.1 The ultimate source of the Universe is God. This has huge implications for our existence on planet Earth. We are not owners of the planet who can do with it as we please but are accountable for that use to its creator. This calls us to stewardship or trusteeship of that creation.

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[22] http://news.bbc.co.uk/1/hi/uk/7150834.stm outlines the story. The research was carried out by Enviros Consulting Ltd.

[23] In addition to the work of COMEAP (f5) there has been work on respiratory disease and road congestion e.g. http://www.rbht.nhs.uk/index.asp?pgid=28114 and http://www.ij-healthgeographics.com/content/3/1/24

8.2 The Gospels make it abundantly clear that the poor and marginalised are especially blessed in God's sight. We, as Christians, have a particular responsibility to ensure that God's preference for the poor is carried through in our conduct in this world. They are not to be squeezed out, marginalised and oppressed by economic and other pressures and injustices.

8.3 Thus we are called to a creative tension between the stewardship of creation; the need to travel to build and sustain relationships; to spread the Gospel and ensure that the society in which we do that takes special care of those who are in danger of being marginalised. Further we are answerable for our use of time, talents and resources. The current world of transport raises many questions in this arena. Our stewardship must apply to our environment, our use of talents and resources and the health and well being of our communities.

9. Conclusions and Actions

9.1 The energy aspects of transport are critical factors in both our economy and in addressing the dangerous aspects of climate change. Technology and public policy have a strong role to play in bringing about change, but the key dimension is that of lifestyle choice and public expectations. For us, as Christian people, discipleship and mission, including priority for the poor and stewardship of Creation, will drive our actions:

- *Prayerful study of the issue, recognising the complexities of the problem and our duty as Christian people to Creation and to others.*
- *Personal action through lifestyle choice, recognising the impact of such aspects of our life such as choice of home, workplace, commuting patterns, holidays, food and leisure.*
- *Discussion in our Congregations, our Presbyteries and at the General Assembly with a view to balanced and thoughtful action.*
- *Taking action as Churches via the work of Eco-Congregation Programme.*
- *Urging Government policy to continue to promote measures to reduce greenhouse gas emissions, linking them to the necessity for widespread lifestyle changes.*
- *Urging all levels of Government to approach all planning issues with climate change in mind.*
- *Urging all levels of Government to fulfil their existing commitment to establishing a thoroughly integrated and affordable public transport network.*
- *Joining the national debate on climate change and responding to the Scottish Climate Change Bill consultation.*

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