Future "greener" urban transport: accessible, mobile and resilient cities?

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Geographers, amongst others, have been considering urban futures for some time now. They all try to conceptually understand what a "sustainable city" in Europe (Beatley et al., 2012; Creedy et al., 2007) / the UK / globally (Chikyū et al., 2012); Kallidaikurichi & Yuen, eds, 2010; Ling, 2005) might look like. Concepts such as liveable, "green", sustainable and resilient (including on energy issues) are being discussed (Flint & Raco, 2012; Newman et al., 2009; Rees and Wackernagel, 1996), with carbon emissions and transitions, including from transport (Hickman and Banister, 2007; Kousoulidou, 2008) being a key feature (Sovacool and Brown, 2010). Mobility (or what some authors call motility) is one strand, with lifecycle assessment of vehicles and fuels being applied (Lane, 2006). Newman et al. (2012; 90-91) map out a vision for more resilient urban transport, based on seven elements: 1) a transit system that is faster than traffic in all major corridors; 2) viable centres along the corridor that are dense enough to service a good transit system; 3) walkable areas and cycling facilities that can mean easy access by non-motorised means, especially in these centres; 4) services and connectivity that can guarantee access at most times of the day or night without time wasted; 5) phasing out freeways and phasing in congestion taxes that are directly connected back into the funding of transit and walk/cycle facilities as well as traffic-calming measures; 6) continual improvement of vehicle engines to ensure emissions, noise, and fuel consumption are reduced, especially a move to electric vehicles; and 7) regional and local government that can enable visionary green transport plans and funding schemes to be introduced.

Stephen Marshall (2001) had characterised the changing approaches in transportation planning (as adapted by Wheeler (2004: 76) in the following way:

Traditional approach	**Sustainability-oriented approach**
Engineering perspective	More holistic perspective
"Traffic centred"	"People oriented"
Focus on large-scale movements, often ignoring local trips (within zones)	Concern for local movements, small-scale accessibility
Automobile as the priority	Pedestrians, bicycles, and transit as priorities
Economic criteria for decision-making	The street as public space with multiple uses
Increase road-user costs and benefits	Environmental and social criteria as well
Focus on facilitating traffic flow	Transportation demand management (TDM) programs to reduce demand
Segregate pedestrians and vehicles	Consider other costs and benefits as well
	Calming / slowing traffic where necessary
	Integrate pedestrian and vehicular space where appropriate through careful design

The ecological footprint of passenger transport combines a number of important activities that have an impact on the environment: emissions of carbon dioxide from the burning of petroleum, from the manufacture and maintenance of vehicles, as well as the land use for transport (roads, car parks), which can be calculated via the UK Emissions Factors Database connected to the National Atmospheric Emissions Inventory (http://naei.defra.gov.uk/data/ef-transport) per km for a range of different vehicles. Car occupancy is combined in the calculations (since the higher the occupancy the lower the impact per person), so that the ecological footprint can be calculated on an individual basis, but also the shared impact of individuals, and scenarios can be developed for reducing the footprint of transport. (Barrett and Simmons, 2003: 37). Part of that agenda is the "greening" of urban transportation – and the connection of cities to their hinterlands (Schiller et al., 2010). After adjusting the ecological footprint of car travel, which is responsible for ca. 86 per cent of road space, to a world average productivity land unit, Barrett and Simmons (2003: 39) came to an ecological footprint index (100 = petrol car) where taxis perform significantly worse (133), motorcycles little better (96), local buses significantly better (73), and trains (38) and non-local buses / coaches (37) much better. (Petrol) car use is stated to be responsible for 74 % of the ecological footprint for mobility. This can be applied to individual cities or conurbations, as done for Merseyside (Barrett & Scott, 2003). Wheeler (2004: 72) suggests three main areas of addressing the imbalance between motor vehicles and human needs: (1) providing good alternative modes of travel, in particular stressing mobility by walking, bicycling, and public transit; (2) changing land use and urban design policies to support these alternative modes and to reduce the number and length of trips that people need to take every-day; and (3) reforming transportation pricing to incorporate the full societal and environmental cost s of driving into the price of fuel, road use, parking, motor vehicles, and vehicle registration. The notion of and slow rise of environmentally conscious transportation (largely so far by early adopters, who seek semiotic and value-based meaning, and economic savings, some of which are only feasible over a medium term perspective) is argued to help in this regard (Kutz, 2008). Another key area of public policy debate are so-called co-benefits - in the area of public health and safety, economy, time, planning – resulting from carbon-aware travel choices, and this can be demonstrated a city-scale level and in a comparative and interactive fashion (CATCH, 2012). This can contribute to what environmental sociologist call the 'framing of messages' to effectively communicate, including on environmental issues, to influence behaviour (Avineri and Waygood, 2013).

Planning for, facilitating through design of safe(ly shared) spaces, and promoting non-motorised transport in urban environments, i.e. cycling (recently picked up by *The Times* as a national campaign) and walking (Tolley, 1997; together referred to as 'active travel', which has public health benefits – Lake et al., eds, 2010) is important. This may be assisted by freely accessible or commercially accessible convenient bike / cycle rental schemes, typically now supported by smart-phone or credit card access. Another major issue in sustainability of urban transportation is public transport, which underwent serious decline in the latter part of the 20th century, including in urban environs. Typically, public transport (which is most used by people living in large cities, with a strong link in the Uk between settlement size and distance travelled, with total distances travelled falling as settlement sizes increase) is by bus but also light rail (under- and overground) and tram / trolley / streetcar systems, as well some form of community transport and gendered subsidised and commercial transport (for security issues). Larger urban areas offer a number of efficiency gains in terms of their function at lower levels of total mobility, which can be measured in energy use, demand for new highway infrastructure, public and private costs, pollution, greenhouse gases and accessibility indicators (Smith et al, 1998: 87). Socio-economic accessibility (relating to urban design and costs / price / affordability, and consultation input to "hard-to-read groups" at the conception, planning and design stage) as well as readability and smart provision (based on ICT and real time information – referred to as intelligent transport) are a key dimension alongside other intelligence and integration of user needs (see e.g. AUNT-SUE, 2010), as well as routing and frequency which –

along with political discussions about subsidies and ownership of infrastructure and franchises – are critical for a sustainable transportation network from an social, economic and environmental perspective (Schiller, et al. 2010).

One of the major transformations that our cities – globally now – have underwent during the 20th century and are still experiencing with increased tendencies is the motorisation of transport with Internal Combustion Engine Vehicles (ICEVs), which has left us with unsustainable city transport (Banister, 2005; Wachs and Crawford, eds, 1992) along the lines of urban sprawl, congestion, urban air pollution and associated public health issues (road traffic accidents and collisions with other modes of transport, esp. cyclists and pedestrians; as well as enhanced probability of respiratory diseases), with remaining tail-pipe emissions of greenhouse gases and pollution through particulate matters, as well as a high use of energy, most of which is currently fossil-fuel based (Newman and Kenworthy, 1999). It has also clocked up our cities, especially at peak hours, with high levels of congestion up to gridlock (Kwarteng and Dupont, 2011). A major move needs to be to move beyond automobile dependence in cities themselves, but also in connection with their spatial (and hence also ecological) footprints, i.e. their commuting (Newman and Kenworthy, 1999) and logistical hinterlands (Rees and Wackernagel, 1988). Car sharing is a part solution to the issue of congestion and commuting environmental footprint, and is encouraged by many 'Green Travel Plans' and beneficial tax schemes, including in the case of university and FE campuses (Tolley, 1996) and workplaces, and planning consent may depend on it for new built. A range of authors have developed an agenda of Strategic Niche Management in sustainable transport innovations, based on experiments (Weber et. al., 2000), to combine economic, social, and environmental objectives as an integrated part of a process of introducing technological options to be embedded in transport technology policy aiming at sustainable development. This usually relies on experimentation and demonstration projects (CABLED, 2010), which other authors and organisations argue needs to be conceptualised and run as living laboratories for sustainability, to stimulate innovations and facilitate transitions– and those can be superimposed on an existing urban area, such as the Oxford Road Corridor in south Manchester between a range of partners (Evans and Karvonen, 2011). It also needs the application of specialised analytical research perspectives to help forward planning in an intelligent eco-systems approach (ElBanhawy et. al., 2012).

One of the recent modes of intervention and stimulation of a revived form of mobility is e(lectric)-mobility (Eberle and Heimolt, 2010; Sperling, 1996; Sperling et al., 1994), i.e. the electrification of the power train of vehicles for (including urban, and historically emerging there) urban transportation (Mom, 2004). This used to be an urban phenomenon, both hybrid (i.e. with a petrol engine also) and battery-only powered, particularly in the United States since the 1880s, but also to some degree in Europe and the UK. The reason for the virtual extinction of electric cars was, first in Europe and later in the U.S., the increasing inter-city major road connections favouring the petrol engine, as well as technological pathways and business interests and government policy direction, as well as cultural uptake preferences. E-mobility applies to buses, commercial vehicles (vans, some lorries, but also in-port systems), cars, scooters and bikes. Dijk et al. (2012) consider the (re)emergence of an electric mobility trajectory over the past 5 or so years, and argue that it has crossed a critical threshold, benefitting from various developments whose influence can be expected to grow: high oil prices, carbon constraints (Strahan, 2012), and the rise of organised car sharing and inter-modality (i.e. connecting different form of transportation). The transition of transportation modes needs to be governed, since there have been a number of recent false starts with stimulating e-mobility (Deventer et al., 2011). E-mobility policies vary significant internationally, as well as in Europe (Trip et al., 2012). The UK government has developed an on-going policy to stimulate (via packages relating to the design, manufacture, and take-up of alternatively-fuelled vehicles (typically hybrids, extended rage electric vehicles and battery electric vehicles), including for economic as well as other co-benefits (technology spill-over, environmental and public health) of ultra low-emission vehicles, co-ordinated by its inter-departmental agency Office for Low Emission Vehicles OLEV (Berkeley, 2012; Begley and Berkeley, 2012). Stimuli have included: R&D grants, investment in charging infrastructure (the 8 Plugged-in Places public-private consortia projects running until March 2013; plus others though other sources such as in Bristol and on the South East coast of England), consumer purchase grants (for both cars and vans), tax rebates, free parking and recharging; alongside penalties for purchase of higher emitting vehicles (Kotter and Shaw, 2013). Begeley and Berkeley (2012) argue that, since the consumer demand for EVs remains at best sluggish in the UK, policy focus needs to be reconsidered with greater emphasis placed on demand stimulus measures. It may be the automotive industry (strongly represented in Britain, though foreign owned) might have to adapt their business model in the context of low carbon mobility, esp. leasing (Coffey and Thornley, 2012), but also convertibles and swappables (batteries) (Forum for the Future, October 2012) and fleets may lead (Cenex et al., 2012) despite some remaining reliability and discounting perception issues amongst fleet managers. The uptake of ultra-low carbon vehicles, due to a range of issues such as higher sales prices but also 'range anxiety' and concerns over shelf-life (esp. batteries), is limited so far, in the UK, Europe, the US, Japan and elsewhere, though is predicted to rise with new innovations to come (though scenarios differ widely, and range from Business as Usual (BAU), to low, medium and high take-up) – and there are also ambitions and goals / targets at international (European Electric Vehicles Initiative, OECD / IEA, 2012 - with 20 million EVs on the road globally by 2020), European (the EU's European green cars initiative) and national (AEA, 2009; King Report, 2008; OLEV with BIS, DoT, DEC) level. Better enabling and connected and inter-operable infrastructure is being rolled out though with gaps still evident and commercial challenges when subsidies are being phased out and the need for an embedding at local, regional, national and trans-national (Kotter and Shaw et al., 2013; Lumsden, 2012) and costs hoped to come down (especially on batteries), with Vehicle to Grid and Smart Grids a major area of work, and workplace and home charging dominant over public on-street charging. Technology and people inter-face systems and socio-technical cultures are the key for a transition (Brady, 2010). Everett et al. (2011) and Graham-Rowe (2012) come to the conclusion that (including mainstream) consumers / car users in the UK that test EVs overall have positive responses, and adapt fairly quickly to the new technology-interface and usability.

Depending on actual user data and payback models (dependent on taxation etc), it is possible to determine optimal EV ranges despite current limitations on market acceptance and electrification potentials of EVs, and depending on the national context plug-in hybrid electric vehicles (BHEVs) may be much more effective than battery electric vehicles (BEVs) for the time being (Tamor et al., 2013). For the Republic of Ireland and travel to work in the Dublin commuter belt, Brady and Mahoney (2011) come to the conclusion that the introduction of EVs represent as advantage every aspect of their emissions, with a 3 % net reduction in CO2 emissions (when assuming the most likely 'low' take-up scenario) relative to Business as Usual decrease, which is only mildly encouraging when considering that CO2 emissions resulting from commuting will most likely only account for 2% of the CO2 emissions from the transport sector in 2020. However, urban air pollutants are individually projected to decrease by up to 11% under the most likely 'low' market penetration scenario. Their results indicate that the time required for electric vehicles to make a significant share of the fleet means that they will have limited impact on climate change and urban air quality for at least the next decade, but supports existing evidence that EVs are a realistic alternative to ICEVs in the long term and can contribute to emissions reductions.

According to Hanley and Buchanan(2011), local authorities in the UK have a range of power and incentives they could use to stimulate the uptake of lower carbon vehicles, personal and commercial, passenger and goods distributing, not all of which they are using to full effect, which includes planning regulations to require plug-in vehicle recharging infrastructure in new domestic and workplace developments, parking incentives and parking and suitable parking signage for (U)LCV users, (U)LCV highway and access measures - including issuing a traffic regulation order to create a (U)LCV lane, introducing a Low Emission Zone or congestion charging (though existing powers currently do not explicitly legislate for tackling air quality and carbon emissions jointly). Also, there are two other policy levers that help to shape other (U)LCV incentives: the Localism Bill 2010–11 (which allows, for example, for the setting up of (U)LCV-related social enterprises or the reduction of business rates), and the Cleaner Road Transport Vehicles Regulations (CRTVR) 2011 (which requires public authorities and other bodies to take into account whole-life environmental impacts when procuring or leasing road transport vehicles). Transport for London has recently (end of January 2013) proposed to the Mayor of London to tighten the rules on London's Greener Vehicle Discount for the Congestion Charging Zone, meaning that drivers of all diesel and most hybrid vehicles would be forced to pay the charge, which resulted in a protest by the AA's president, Edmund King, about "green goalposts" being moved for drivers and businesses, and undermining the take-up of a range of "greener" vehicles (Lydall, 2013). A recent European decision making consultation with representatives from a range of municipalities ranked different available and potential policy measure s in terms of effectiveness, efficiency and political feasibility. The top 10 were to: Lobby for EU-wide standards for plugs and sockets; enable roaming between different regions (billing); support and enable infrastructure built-up; show political leadership; EV-readiness as a requirement for new developments; reserve on-street parking spaces for EVs; provide information to businesses and citizens: support car sharing initiatives with EVs; allow EVs to drive on bus / taxi lanes; and no toll / congestion fee for EVs (Bakker et al, 2012).

Others are more sceptical or critical on a mass take-up or mainstreaming of electric vehicles (personal or fleet, and commercial vehicles), with other more fuel efficient internal combustion cars (not designated as ultra low carbon vehicles) projected to remain dominant (James, 2013; Lytham, 2011; Lane, 2011; Lane and Potter, 2007) and argue that this will remain a niche market phenomenon - alongside hydrogen and fuel cell vehicles (Bakker et al., 2012; Niewenhuis et al., 2011) - and remain as yet unconvinced of the real environmental (cradle to cradle and fuel and indirect CO2 emissions) credentials of EVs depending on battery type and input, recycling and energy source (Thomas, 2011 and 2009), though other studies make an overall case for EVs though with differential benefits depending on the surrounding geography (or industrial ecology) (UCS, 2012).

References:

AEA (2009): Market Outlook to 2022 for battery electric vehicles and plug-in hybrid vehicles, Report for the Committee of Clomate Change. Dicot: AEA Group.

Avineri, E. and Waygood, O. (2013) Applying valence framing to enhance the effect of information on transport-related carbon dioxide emissions', forthcoming in Transportation Research Part A: Policy and Practice, Volume 48, 31-38

AUNT-SUE: Accessibility and User Needs in Transport for Sustainable Urban Environments (2010): http://www.urbansustainabilityexchange.org.uk/ISSUESOutputAUNTSUE.html

Bakker, S. et al. (2012) 'Competition in a technological niche: the cars of the future', Technology Analysis & Strategic Management, Vol. 24(5), 421-434

Bakker, S. et al. (2012): European Consultation on E-Mobility. Delft: OTB, TU Delft. http://e-mobility-nsr.eu/fileadmin/user_upload/downloads/info-pool/European_Consultation_on_E-Mobility.pdf

Banister, D. (2005): Unsustainable Transport: city transport in the new century. London: Routledge

Barrett, J. and Simmons, C. (2003): An Ecological Footprint of the UK: Providing a Tool to Measure the Sustainability of Local Authorities. Stockholm: Stockholm Environment Institute

Barrett, J. & Scott, A. (2003): 'The Application of the Ecological Footprint: A case of passenger transport in Merseyside', Local Environment, Vol. 8 (2), pp. 167-183

Beatley, T. (ed)(2012): Green Cities of Europe. London. London: Island Press.

Begley, J. and Berkely, N. (2012): 'UK policy and the low carbon vehicle sector', Local Economy, Vol. 27(7), 705-721.

Berkeley, N. (2012): 'The application of green technologies in the automotive industry: an assessment of policy attempts in the UK to stimulate the uptake of alternatively fuelled vehicles', Regions, No. 288, 27-28.

Brady, J. and O'Mahoney, M. (2011): 'Travel to work in Dublin. The potential impacts of electric vehicles on climate change and urban quality', Transportation Research Part D, Vol. 16, 188-193

Brady, J. (2010) Electric Car Cultures: An ethnography of the everyday use of electric cars in the UK. Master's thesis, Durham University. Available at: http://etheses.dur.ac.uk/690/

CABLED (2010) Data analysis report of ultra low carbon vehicles from the CABLED trial. A report to the Technology Strategy Board. Aston University: Birmingham. Available at: http://www.cabled.org.uk

CATCH (2012) Carbon Aware Travel Choice EU FPF project website, knowledge platform, and resources. Co-benefits fact sheet and "My City" tool. Available at: http://www.carbonaware.eu/resources/co-benefit-fact-sheets.html; or http://www.carbonaware.eu/knowledge-platform/whats-in-the-catch-platform.html; and http://www.carbonaware.eu/resources.html

Cenex / The Climate Group / Energy Saving Trust (2012) Plugged-in Fleets. A guide to deploying electric vehicles in fleets. Loughborough: Cenex.

Coffey, D. and Thornley, C. (2012): 'Low carbon mobility versus private car ownership: Towards a new business vision of the automotive world?', Local Economy, Vol. 27(7), 732-748

Chikyū K. et al. (2012): Low carbon transport in Asia: strategies for optimizing co-benefits. London: Earthscan

Creedy, A. et al. (2007) Towards Liveable Cities and Towns. Guidance for Sustainable Urban Management. Eurocities: Brussels

Deventer, P. A. et al. (2011) Governing the Transition to E-Mobility: small steps towards a giant leap. The Hague: Netherlands School of Public Administration. Available at: http://www.nsob.nl/EN/wp-content/uploads/2010/06/e-mobility-webversie.pdf

Dings, J. (2009) How to avoid an electric shock. Electric cars: from hype to reality. Transport & Envrionment. London.

Eberle, U. and Heimolt, R. v. (2010) 'Sustainable transportation based on electric vehicle concepts: a brief overview', Energy and Environmental Science, Vol. 3, pp. 689-699

Ehsani, M. et al. (2010): 'Environmental Impact and History of Modern Transportation', in: Modern Electric, Hybrid Electric and Fuel Cell Vehicles. CRC Press

ElBanhawy, E. et al. (2012) A Heuristic Approach for Investigating the Integration of Electric Mobility Charging Infrastructure in Metropolitan Areas: An Agent-based Modelling Simulation', http://e-mobility-nsr.eu/info-pool/

ElBanhawy, E. et al, (2012): Real-Time Electric Mobility Simulation in Metropolitan Areas. A case study: Newcastle-Gateshead. http://e-mobility-nsr.eu/info-pool/

European Commission, Directorate-General for Research (2010): European green cars initiative: towards an electric future ?. Luxembourg: Publications Office of the European Communities

Evans, J. and Karvonen, A. (2011): 'Living laboratories for sustainability. Exploring the politics and epistemology of urban transition', in: Bulkeley, H. et al. (eds), Cities and Low Carbon Transitions. Abingdon: Routledge

Everett, A., Burgess, M. Harris, M. Mansbridge, S. and Lewis, E., Walsh, C., Carrol, S. (2011) How quickly did users adapt? Initial Findings from the Ultra Low Carbon Vehicle Demonstrator Programme. Research for TSB. Technology Strategy Board: London.

Flint, J. and Raco, M. (2012): The Future of Sustainable Cities: critical reflections. Bristol: Policy Press

Graham-Rowe, E. et. al. (2012) 'Mainstream consumers driving plug-in battery-electric and plug-in hybrid electric cars: A qualitative analysis of responses and evaluations', Transportation Research, Part A: Policy and Practice, 46, 140-153.

Forum for the Future (2012): Convertibles and swappables. Can lateral thinking bring down the cost of EVs?, Green Futures, October 2012, 13

Hanley, C, SKM Colin Buchanan (2011) Going Green: How local authorities can encourage the take-up of lower-carbon vehicles. London: RAC Foundation

Hickman, R. and Banister, D. (2007): 'Looking over the horizon: Transport and reduced CO_2 emissions in the UK by 2030', Transport Policy, Vol. 14 (5), 377–387

Hostovsky, C. (2011) 'Hybrid and Electric Automobiles (Implications to Transportation Demand Management)', pp. 247-254 in Robbins, P.; Mulvaney, D. and Golson, J. G. (eds.) Green Society: Toward a Sustainable Future, Volume 10: Green Technology. London: Sage.

James, T. (2013): 'How to ... reach 100mpg', Engineering & Technology, Feb. 2013, 26-30

Kallidaikurichi, S. and Yuen, B. (eds(2010): Developing Living Cities. From Analysis to Action. London: World Scientific.

King, J. (2012): The King Review of low-carbon cars Five years since the King Review: a lot has happened…, Presentation at LCV2012. http://www.cenex-lcv.co.uk/assets/downloads/presentations/day-1/main/prof-dame-julia-king-aston-university.pdf

Kneeshaw, S. / Electric Vehicles in Urban Europe (EVUE) (2010): Electric Vehicles in Urban Europe Baseline Report. URBACT II network. EVUE.

Kotter, R. and Shaw, S. et al. (2013): Report for Work Package 3 Activity 6: 'Micro to Macro Investigation' and Supplementary Report WP 3.6: 'Methodologies for Mutual Learning'. http://e-mobility-nsr.eu/info-pool/

Kutz, M. (2008): Environmentally Conscious Transportation. Chichester: Wiley

Kousoulidou, M. et al. (2008): 'Road transport emissions projections up to 2020 in European urban environment, Atmospheric Environment, 42, 7465-7475

Lake, A.A.; Townshend, T. and Alvanides, S. (eds.) (2010) Obesogenic Environments: complexities, perceptions and objective measures. Chichester: Wiley-Blackwell

Lane, B. (2011): Market-delivery of Ultra-Low Carbon Vehicles in the UK: an evidence review. RAC Foundation.

Lane, B. (2006): Life cycle assessment of vehicle fuels and technologies. Ecolane Transport Consultancy on behalf of London Borough of Camden. London.

Lane, B. and Potter, S. (2007) 'The adoption of cleaner vehicles in the UK: exploring the consumer attitude-action gap', Journal of Cleaner Production, 15, 1085-1092

Lydall, R. (2013): 'Hybrid and diesel cars to pay the full C price', Evening Standard, 28 January 2013, p. 1 and 4.

Linde, A. (2010): Electric Cars – The Future is Now !. Veloce Publishing /RAC

Lumsden, M. (2012) Successfully Implementing a Plug-in Electric Vehicle Infrastructure. A Technical Roadmap for Local Authorities and their Strategic Partners. IET Standards Limited.

Lumsden, M. (2012) Electric vehicle charging infrastructure toolkit (2). Part 1- Outline. http://www.futuretransportsystems.co.uk/_diskcache/287-enevate-tool-kit-wp2-outline-part-1.pdf

Lytton, L. (2011) Shades of Green: Which low-carbon cars are the most eco-friendly ? London: RAC Foundation.

Lytton, L. (2010) Driving Down Emission: the potential of low carbon vehicle technology. London: RAC Foundation.

Marshall, S. (2001): 'The Challenge of Sustainable Transportation', in: Layard, A. et al. (eds), Planning for a Sustainable Future. London: Spon Press.

Newman, P. et al. (2009): Resilient Cities. Responding to Peak Oil and Climate Change. London: Island Press.

Newman, P. and Kenworthy, J. (1999): Sustainability and Cities: Overcoimg Automobile Dependence. London: Island Press.

Niewnhuis, P. et al. (2011) ENEVATE WP3 Niche Typology August 2011. ENEVATE.

Rees, W. and Wackernagel, M. (1996): 'Urban ecological footprints: Why cities cannot be sustainable - and why they are a key to sustainability', Environmental Impact assessment Review, 16/4-6: 223-248

Schiller, P. L. et al. (2010): An Introduction to Sustainable Transportation. Policy, Planning and Implementation. London: Earthscan

Skippon, S, Garwood, M. (2011) 'Responses to battery electric vehicles: UK consumer attitudes and attributions of symbolic meaning following direct experience to reduce psychological distance', Transportation Research Part D: Transport and Environment, Volume 16, Issue 7, pp. 525–531

Smith, M. et al. (1998): 'Transport and Land Use Planning ', in Greening the Urban Environment. London: Earthscan

Royal Academy of Engineering (2010): Electric vehicles: charged with potential. London: RAE.

Sovacool, B.K. and Brown, M. A. (2010): Twelve metropolitan carbon footprints: A preliminary comparative global assessment, Energy Policy, Vol. 38 (9), 4856–4869

Sperling, D. (1996) 'The Case for Electric Vehicles', Scientific American, Nov. 1996, pp. 54-59.

Sperling, D.; Delucci, M.A. and Davis, P.M. (1994) Future Drive: Electric Vehicles and Sustainable Transportation. Island Press.

Strahan, D. (2012) 'Dump the Pump', New Scientist, 21 May, Magazine Issue 2865.

Tamor, M.E. et al. (2013): ‘A statistical approach to estimating acceptance of electric vehicles and electrification of personal transportation’, Transportation Research Part C, Vol. 26, 125-134

Thomas, S. C.E. (2011) ‘How green are electric vehicles?’, International Journal of Hydrogen Energy, Volume 37, Issue 7, 6053–6062

Thomas, C.E.S. (2009) ‘Fuel Cell and Battery Electric Vehicles Compared’, International Journal of Hydrogen Energy, Vol. 34, 6005-6020

Thomas, S.C.E. (2009) ‘Transportation Options in a Carbon-constrained World: Hybrids, Plug-in Hybrids, Biofuels, Fuel Cell Electric Vehicles, and Battery Electric Vehicles’, International Journal. of Hydrogen Energy, Vol. 34, 9279-9296

Tolley, R. (ed)(1997): The greening of urban transport. Planning for walking and cycling in Europe. 2nd edition. John Wiley & Sons.

Tolley, R. (1996): ‘Green campuses: cutting the environmental cost of commuting’, Journal of Transport Geography, Vol. 4 (3), 213–217

Trip, J.J.; Lima, J. and Baker, S. (2012) Electric mobility policies in the North Sea Region countries. Deflt: OTB, Delft Technical University. Available at: http://e-mobility-nsr.eu/fileadmin/user_upload/downloads/info-pool/3.3_-_E-mobility_policies_in_the_NSR_countries.pdf.pdf

Union of Concerned Scientists (2012): State of Charge: Electric Vehicles’ Global Warming Emissions and Fuel-Cost Savings across the United States. San Francisco: UCS.

Wachs, M. and Crawford, M. (eds)(1992): The Car and the City: The Automobile, The Built Environment, and Daily Urban Life. University of Michigan Press.

Weber, M. et al. (2000): Experimenting with Sustainable Transport Innovations. Seville: Institute of Prospective Technological Studies, Joint Research Centre.

Wheeler, S.M. (2004): Planning for Sustainability. Abingdon: Routledge.