EVUE II
Electric Vehicles in Urban Europe
Advisory Notes

URBACT II

European Union
European Regional Development Fund

Connecting cities
Building successes

URBACT

EXECUTIVE SUMMARY

SINCE 2009, A NUMBER OF CITIES FROM ACROSS EUROPE HAVE BEEN WORKING ON WAYS TO SUPPORT THE TRANSITION TO ELECTRO-MOBILITY. THIS REPORT IDENTIFIES THE FINAL CHALLENGES THAT HAVE BEEN EXPERIENCED AND WAYS TO OVERCOME THEM.

Whilst at an individual level, the transition to electro-mobility can be relatively simple, when considered from the perspective of the municipal authority, five key factors have been identified that impact on potential uptake:

- Environmental
- Regulatory
- Technical
- Financial
- Communication

These thematic challenges have been identified through the EVUE partner cities as critical to achieving the introduction of electric vehicles on a larger scale.

Urban authorities, either at the local or regional level, have a duty to support the transition to fossil fuel free transport under various European, national and often, local policies. However, the considerable public and benefits that e-mobility may provide are challenged by two key factors: cost variation between electric and internal combustion engine (ICE) vehicles and consumer willingness to change.

Local authorities can reconcile these factors by considering the points below and achieve the goal of fossil fuel free urban transport.

Environment

Within our urban environments, air pollution is generated by two main sources: building (heating & ventilation) and transport. While it may be difficult to address the emissions from the built environment, transport is a different proposition.

Modern society is dependent on transport for the movement of people, goods and services. Until recently however, we have been limited to either (predominantly) petrol or diesel powered vehicles which while effective, emit significant levels of harmful pollutants such as oxides of nitrogen (NO_x) and particulate matter (PM).

Our understanding of the effects of these pollutants has also developed with the clear health impacts of cardio-pulmonary disease and respiratory illness through to impacts on brain function and cognitive development being identified. The impact of this on mortality and quality of life is clear for all citizens.

The introduction of zero (tailpipe) emission vehicles can now provide an effective and viable solution to the air pollution problems affecting our cities and should be supported a matter of priority.

Regulation

E-mobility combines energy, transport and health regulations at a variety of levels. Many of these regulations however also developed before e-mobility was even considered and may inadvertently limit the development of e-mobility in our cities.

Regulations can impact in two key areas:

- Legal Requirements: particularly where poorly drafted, may be inconsistent or outdated due to changing technology, e.g. prohibition of large EVs in areas due to air quality regulations based on vehicle size rather than emissions)
- Procedural barriers: often realised through the hindered decision making such as connecting EV charging points to the grid.

E-mobility can now provide benefits for energy generation and storage, new business models and further opportunities that can provide economic and environmental benefits.

At all regulatory levels, careful consideration is required to ensure that all relevant policies and rules assist rather than obstruct the goal of fossil fuel free cities. This can range from grid operation and upgrade specifications through to who can sell electricity.

In addition to the structural regulatory framework, cities are also uniquely placed to modify functional or financial local regulations to support e-mobility. This can be through targeted incentives such as free parking, vehicle charging and permission to use priority access lanes.

Regulations get introduced in response to particular challenges and issues. When they are no longer required or fit for purpose, they are then removed or no longer enforced. However, with e-mobility being a disruptive technology affecting multiple disciplines regulatory bodies need to ensure that they consider their areas of responsibility to ensure they are supportive and do not negatively impact the transition.

Technical

The technical challenges associated with e-mobility have been identified and there are numerous bodies which are well placed to advise on these areas such as European Association for Battery, Hybrid and Fuel Cell Electric vehicles among others.

From a local authority perspective, there are four key areas that have been identified as being potentially problematic:

- Grid Capacity
- Charge point siting
- Charging point type and connectors
- System Administration

While these are each generally recognised by implementing authorities as factors for consideration, the significant impact that they can potentially have is often under-estimated.

The need for a well considered and comprehensive strategy is essential to ensure that longer term objectives are not compromised due to issues with one of the above.

Financial

The work undertaken by the EVUE cities has identified key financial arguments which it is recommended should be added to cost benefit assessments.

The cost of air pollution to cities exceeds €100 billion per year and range from the impacts on individual health through to consequential impacts on economic productivity and competitiveness (worker absenteeism and environmental mitigation costs).

In addition to these (in)direct costs, all member states are also responsible for complying with the National Emission Ceilings Directive regarding air pollutants. Failure to achieve these minimum standards exposes the responsible authorities (national, regional and local) to significant financial penalties. While they have not yet been imposed, recent rulings by the European Court of Justice have reaffirmed this responsibility and with penalties ranging from €40-300 million, the direct financial impacts of failing to support emission free transport are significant.

In addition to these factors, of potentially more importance at the municipal levels are the reputational, financial and corporate risk for cities that do not provide an attractive and healthy environment for its citizens and businesses. In a highly competitive and globalised environment, failure to perform in this area could substantially impact on city appeal and fundamentally its tax base.

Communication

Of all the areas by which municipal authorities can support e-mobility, communication can be the most significant. Whether it is informing it citizenry about the environmental and health benefits of EVs through to the promotion of regulatory or policy changes that support zero emission transport.

An understanding of local market/consumer conditions to ensure that the correct messaging is being applied. Will environmental focused reasoning resonate with the audience or is that a secondary priority that will not engender behaviour change? Is the private vehicle a utilitarian means of transport or a psychological status symbol?

The EVUE partners identified the following key messages:

- E-mobility is part of the solution, not THE solution
- Place innovation and technical evolution into context – who would still want to use a 1990s mobile phone? Why would you still want to use an engine developed in the 1900s
- Ensure that the personal benefits of behaviour change are identified so that the individual has a personal stake in improving the actions
- The value of people directly experiencing an EV cannot be under-stated in changing their opinions and is an essential component that needs to be taken into account
- Be open and honest about range concerns, while highlighting the wide range of vehicles available that can meet

Conclusion

While electro-mobility is only one aspect of sustainable urban mobility planning, it provides the opportunity for a step change in our urban transport systems in that maintains the flexibility of individual freedom while negating many of the associated externalities.

It is also however, a disruptive technology. As such, advocates for it need to consider the wider challenges which will affect its uptake and adoption. The thematic areas addressed in this report have been identified through careful consideration of these challenges in a variety of different urban areas in Europe.

As noted, there are a lot of other, more detailed sources of information on the individual aspects, but without a holistic and considered approach to each of the factors, activities aimed at enhancing the uptake will be compromised.

The purpose of this report has been to identify these areas and provide direction and suggestions by which these factors may be addressed successfully. It is only by integrated implementation that the move to fossil fuel free urban mobility can truly be achieved.

CONTENTS

BACKGROUND

Since 2009, electric mobility has experienced something of a renaissance. While electric vehicles (EVs) have been around for 100 years, they never established a position in the market place as a viable alternative to the internal combustion engine (ICE) vehicle. Industry developments until now were led by specific challenges such as oil crises (or significant cost increases) since the 1970's or the tightening of vehicle emission standards, but were still hampered by technological challenges such as battery chemistry.

By 2008 however, public policy was increasingly focused on achieving market suitable and sustainable mobility solutions. This was due to a variety of factors including:

- The impact of CO2 emissions and global warming (use of fossil fuels for transport)
- Energy security – volatility in oil production and prices meant a greater focus for energy independence, particularly with road transport being a significant consumer of oil derived products
- The 2007-2009 financial crisis significantly impacted on major vehicle manufacturers with the consequential effect on employment and national economies.

As a result of these challenges, policy makers were prompting manufacturers to re-orientate their product portfolios with a greater focus on minimising environmental impact. This was achieved through new regulation as well as the ramifications of the government intervention with the 'Detroit 3[1]' which saw these manufacturers commit to fuel saving and electric vehicle technology.

In parallel with the American development, Japanese manufacturers, such as Nissan and Toyota, had already been making significant progress on EVs. European manufacturers, whether independently or through their affiliation to other companies, e.g. Nissan-Renault, were also starting to produce EVs and the market was reaching a turning point.

One of the big challenges with EVs however, was the need to ensure access to battery charging infrastructure. Being seen as an example of the 'chicken & egg' scenario, market uptake was being constrained through a lack of charging infrastructure, which in turn was inhibiting sales as consumers were concerned about their ability to charge.

To help address this, public authorities at the national, regional and local level began to concern themselves with supporting the transition to e-mobility and infrastructure provision.

A wide range of concepts and charging models were then developed either independently or with the private sector. However, due to the high cost of infrastructure rollout and the low revenue potential, no economically viable business models developed without the need for substantial public sector subsidy.

At the European level, the lack of common standards for charging infrastructure also inhibited development as different connectors and interfaces resulted in a lack of compatibility and unnecessary duplication.

To overcome this, larger city, region or nationwide charging network models were developed such as Source London (and Source East) in the UK through to the national Mobi.E programme in Portugal.

As a result, by the start of 2010, the roll out of charging infrastructure had become a key focus for municipalities alongside the wider availability of EVs. The foundation for the widespread market uptake of EVs was laid with seemingly no major barriers remaining to the successful adoption of electro-mobility.

By the summer of 2011 however, many charging points were still relatively unused and the registration of EVs was still insignificant when compared to ICE vehicles. The only notable exception however was Norway, where due to a combination of incentives, EVs were showing a steady increase in market share. For all other countries, the assumption that the acceptance of EVs only failed because of a lack of vehicles and infrastructure was refuted.

Since that time however, steady progress has been made with regard to regulation, technology, funding and finance schemes as well as marketing and communication to place e-mobility on a positive trajectory.

EVUE2

Against this background of development, ten cities began working together in 2010 to help overcome common issues at the local authority level. The EVUE (Electric Vehicles in Urban Europe) project,

[1] Ford Motor Company, General Motors and Chrysler

funded under the European Commission's URBACT II programme, sought to address the common barriers being experienced by municipal authorities supporting the transition and uptake of EVs and propose solutions to overcome these against the following headings:

- Business Models
- Procurement
- Awareness Raising
- Infrastructure

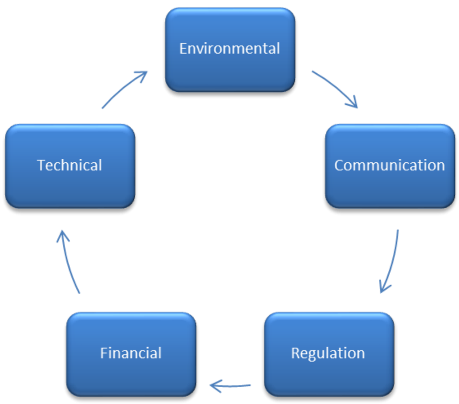
The final report of this project can be found here.

As part of this project, partner cities developed Local Action Plans (LAPs) that would take the knowledge and experiences gained from the project and, combined with local approaches, identify actions to address the specific local challenges.

To assess the effectiveness of the LAPs in the implementation phase, the URBACT programme provided funding for a sub-set of EVUE cities to engage further with regard to the challenges still being faced.

EVUE2, involving the cities of Frankfurt, Katowice, London, Oslo and Suceava, has focussed on examining the key common challenges that the cities have faced whilst implementing their LAPs:

- Regulatory environment
- Financial issues
- Communication approaches
- Environmental pressures
- Technical challenges



These five thematic strands reflect the key issues that have impacted on partners' capacity to fully implement their action plans, and represent important components in establishing the necessary integrated approach. As the LAPs are also generally reflective of most strategy or implementation plans that public authorities may produce when embarking on programme delivery, the EVUE2 participating cities have reviewed and discussed these challenges with the aim of improving their own methods and procedures, and drawing on this experience produce suggestions for other cities seeking to implement e-mobility.

While recognising that a lot of information and guidance already exists, in general partners have found it to be too technical or non-reflective of the specific challenges facing public authorities. In addition, due to the peculiarities and idiosyncrasies of local authorities and regulatory environments, direct transferability of actions is highly variable.

The key outcome of the EVUE2 project has been seen in identifying and communicating the common drivers by which stakeholders can be motivated to support e-mobility.

Over the last 16 months, the EVUE2 partners have been assessing these issues and identifying the key messages associated with the thematic areas. Their relative importance will alter depending on local context, however when combined, they provide a powerful framework around which the drivers supporting the transition to e-mobility can be identified.

The purpose of this report is therefore to share this learning to enable proponents of e-mobility to better understand the approaches that can be taken locally to achieve the goal of emission free urban transport.

While not being highly technical or prescriptive, it is our aim that the reader will be able to understand the key considerations, reflect on how cities have, or could deal with them, and gain an appreciation for how they could be applied.

Thematic Challenges

From a public authority perspective, the transition to electro-mobility provides a number of inter-related benefits as well as tests in terms of delivering a sustainable pattern of urban mobility. Personal mobility and transport is a complex interface of economic, social and environmental factors which affects the entire community. Successfully making the transition will help improve the health and quality of life of all citizens and the communities they serve.

The key thematic challenges identified to achieve this are listed below.

Environmental

While society has long recognised the negative impacts that the internal combustion engine has had on our cities, the social and economic case for personal mobility and transportation has been such, that without a viable alternative, no significant change has occurred in the last 100 years. On-going research however, has shifted the environmental case from generalised air and noise pollution to specific clinical evidence on the impacts affecting each individual exposed to conventional vehicle emissions, ranging from cardio-pulmonary disease and respiratory illness through to the effects on the brain and cognitive development.

E-mobility now provides a viable, effective and economical approach to addressing a significant source of urban air pollution. Chapter two provides an overview of the evidence and how it can be applied in supporting the transition.

Regulation

The regulatory framework and its implications for electro-mobility are quite significant. European, national, regional or local regulations apply and encompass everything from electrical safety, vehicle registration and operation, standardisation of infrastructure, down to air quality and environmental zones. While most of these are outside the scope of the municipal authorities, and by extension this report, there are a variety of ways local authorities can utilise existing regulatory powers to support e-mobility.

Through reviewing the approaches taken among EVUE2 partner cities in chapter three, it will be possible to see what measures may be applicable in other cities in support of increasing EV uptake, and this can have significant implications for the construction of effective and appropriate business models.

Technical

While on first assessment, the specifying and installation of EV infrastructure should be straight forward, it quite often it is not. Although a lot of technical requirements will be city specific such as local regulatory requirements, a comprehensive and considered approach is required to mitigate against issues associated with grid capacity and siting through to daily system management and administration.

Chapter four explores some of the key technical considerations and identifies approaches by which the installation and implementation of EV infrastructure may be successfully realised.

Financial

Discussions of public (financial) support for e-mobility are generally focused on the cost of infrastructure or other supportive policy measures e.g., loss of parking revenue. As these are subject to local constraints and considerations, chapter five examines the overarching drivers which apply to all cities and why e-mobility makes financial sense, including the cost of pollution, the penalties for poor air quality as well as the direct impact on cities.

Communication

For over 100 years, the marketing and communication of mobility has been dominated by the private ICE vehicle. In comparison however, aside from some occasional exceptions, information and understanding of electric vehicles has not been widely available or reached a high level of market penetration.

Although this is starting to change with the marketing campaigns for EVs, such as those undertaken by Tesla, Nissan, BMW and Renault, the wider case for EVs still has not really been made. Manufacturer led advertising has focused on specific vehicles and the concept of e-mobility has been overlooked.

While the case for e-mobility is very strong, unless the message is clearly communicated, the wider public support for EVs (and their benefits) will be lacking and this will result in insufficient political support. Chapter 6 explores the argument that by identifying the key messages such as the economic and health benefits from improved air quality and the best ways that these should be communicated, it will be possible to mobilise the support to ensure the regulatory (and political) framework is conducive for the achievement of an alternative, sustainable urban transportation system.

Summary

While we have split the challenges up into the five thematic areas, they are all closely related. As such we recommend that the reader review and reflect on all of the issues raised to ensure integrated implementation can occur.

As noted earlier, this is not intended to be a fully detailed manual of all the different approaches that may be taken. Within each country, region and city there are a myriad of rules, regulations and conditions which would not make this appropriate. It will hopefully however, provide you with different ways to think about the challenges and make your outcomes more successful.

This report details the main messages and findings from this process.

1. POLICY FRAMEWORK

Sustainable transport, and its component aspect electro-mobility, involves complex interactions but the fundamental goal is to secure present mobility needs without damaging the environment or human health.

The negative consequences of ICE vehicles have been known for decades, however without a viable alternative, only piecemeal improvements could be made such as the removal of lead from fuels.

Current European (and by extension national) policy has recognised the impact of transport, its inputs, outputs and outcomes and sought to balance the move towards sustainable development through a variety of aspects including:

- Consumer access to energy sources for affordable and stable prices,
- Sustainable production,
- Transport and energy consumption,
- Energy supply safety and
- Reduced greenhouse gas emissions.

Key documents and directives pertaining to this include:

- The 2020 Climate and Energy Package2 (20-20-20 targets)
  - A 20% reduction in EU greenhouse gas emissions from 1990 levels;
  - Raising the share of EU energy consumption produced from renewable resources to 20%;
  - A 20% improvement in the EU's energy efficiency.
- Europe 2020 Strategy priorities for Smart, Sustainable and Inclusive Growth which recognises that they can be met by undertaking investments that pay special attention to the environment by reducing pollution;
- Directive 2009/33/EC of the European Parliament and Council promoting non-polluting and energy efficient road transport vehicles stipulates the obligation for the member states to enforce at least one of the following:
  - Establishing technical specifications regarding energy and “green” performance in the documentation for purchasing road transport vehicles on every impact aspect envisaged, as well as other environment-related aspects; or
  - Including energy and environmental impact in the purchasing decision, in the sense of using these impact aspects as awarding criteria, in case a procurement procedure is applied.
- 2011 WHITE PAPER - **Roadmap to a Single European Transport Area**, which establishes that, by 2050, only clean, non-polluting vehicles will be allowed in European cities (2030 for logistics vehicles)
- Directive 2014/94/EU Deployment of Alternative Fuels Infrastructure[3] which requires member states to develop national policy frameworks for the market development of alternative fuels and their infrastructure.
- Regulation 715/2007 stipulates the type approval of vehicles with respect to emissions from light passenger and commercial vehicles. Currently on Euro 5 & 6, this reflects the progress that has been made since 1992 when Euro 1 was introduced.

Taken together the direction of travel is quite clear, public authorities at all levels must reduce the negative environmental impacts of transport.

In addition, failure to adopt, implement and/or achieve these policies and targets can also open up member states to enforcement action. While this has never been employed at the European level, recent court rulings have confirmed that national governments are liable. This has introduced the possibility of claims being lodged by individuals or lobby groups seeking governmental action.

---

2 http://ec.europa.eu/clima/policies/package/index_en.htm

3 http://ec.europa.eu/transport/themes/urban/cpt/index_en.htm

Global to Local

While the specification of European policy can provide the framework for action, the key drivers for this action, citizen concern and mitigating environmental impact, must be considered.

In many Western European countries, the environment, climate and energy issues are of increasing concern. When questioned (http://ec.europa.eu/public_opinion/archives/eb/eb80/eb80_first_en.pdf), 24% of Swedes, 11% of Germans, 11% of Danes and 9% of the British rated the environment, climate and energy issues as the most important concern facing them. In contrast 13% (SE), 7%(DE), 15%(DK) and 13% (UK) respectively stated the national economic situation.

For Eastern European states however, concerns about the environment, climate and energy drop considerably (Poland 2%, Romania 3% & Hungary 3%).

Although this can be understood in relation to relative economic positions, the impacts of climate change affect all of these countries equally, if not in different ways e.g., floods, droughts, heat waves.

The European Academies Science Advisory Council has estimated the cost of extreme weather events in Europe to be €405 billion since 1980.

With storms and floods amounting to total losses of €308 billion. Table 1 below shows the floods in Europe with the highest (inflation adjusted) losses. In addition to the total cost, note that during the last 50 years, 50% of the most significant impacts have occurred in the last 15 years. While a range of factors can affect the severity of weather events (land use planning, deforestation etc.) the increasing occurrence of severe weather affects is of major concern.

The latest Intergovernmental Panel on Climate Change (IPCC) report has shown that human induced climate change is occurring and poses risks for human and natural systems. Of particular note is that *many global risks of climate change are concentrated in urban areas[…]. Steps that build resilience and enable sustainable development can accelerate successful climate-change adaptation globally* (ibid pg 18).

Although measures to address the impact of climate change involve all sectors of society, government and business, concerted action will be required to achieve the aim to *"stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic [i.e., human-induced] interference with the climate system*" (http://unfccc.int/essential_background/convention/items/6036.php). Shifting to emission free urban transportation systems will be one part of realising this goal.

Table 0: European Flood Events since 1965

Flood Date	Country	Inflation Adjusted Damage (€)	Number of fatalities
November 1966	Italy	10 billion	70-116
August 1983	Spain	2-6 billion	40-45
November 1994	Italy	4.5 – 10 billion	64-83
July 1997	Poland, Czech Republic, Germany	2–6 billion	100–115
October 2000	Italy, France, Switzerland	7.5 billion	13–37
August 2002	Germany, Czech Republic, Austria	15 billion	47–54
August 2005	Romania, Bulgaria, Switzerland, Austria, Germany	1.1 billion	53
May/June 2013	Central Europe	13 billion	25

2. ENVIRONMENT

While there are a number of high level policy objectives that support the transition to e-mobility, the key driver is clearly environmental.

When discussing or implementing electro-mobility related activity, it is often noted that EVs are 'good for the environment', 'improve air quality4' and will help 'save the planet'. Although these are generally correct, there can be divergent opinions and this can sometimes confuse the discussion.

Fundamentally however with urbanisation, populations are exposed to increasing levels of pollutants, with buildings and road transport being the main sources, with detrimental health impacts. Measures to mitigate against these effects are often contained with local, regional and national (including European) policy alongside the duty to remedy the issue. The basic premise of this chapter is that in the urban context, EVs provide a viable approach to achieve these environmental outcomes as the direct benefits of EVs, no direct tailpipe (air) emissions nor engine noise, are easy to realise.

To better understand the environmental benefits therefore, we first need to need to understand the impacts of existing air pollutants and their sources in the urban context.

Table 2: European Pollutant Limit Values

Pollutant	Concentration	Averaging Period	Permitted exceedences each year
Fine particles ($PM_{2.5}$).	25 µg/m3	1 year	n/a
	125 µg/m3	24 hours	3
Nitrogen dioxide (NO2	200 µg/m3	1 hour	18
	40 µg/m3	1 year	n/a
PM_{10}	50 µg/m3	24 hours	35
	40 µg/m3	1 year	n/a

Health impact of Air Pollution

The World Health Organisation (WHO) has identified air pollution as the world's single biggest environmental health risk[5]. According to their estimates, approximately 7 million deaths in 2012 were due to air pollution with the causes being traffic fumes and combustion sources – this is more than smoking, road deaths and diabetes combined.

The growing body of epidemiological and toxicological research has shown the clear causal link between poor air quality and increased mortality. With the International Agency for Research on Cancer classifying outdoor air pollution as carcinogenic to human in October 2013, the impact of air pollution on health is unequivocal.

Across Europe, substantial clean air legislation and other regulatory activity has led to the reduction of ambient air pollution so that we no longer experience the high visible pollution episodes of the past, e.g. the great London smogs of the 1950s. However, notably in March 2014, much of Western Europe was affected by a pollution episode attributed to dust being blown in from North Africa. While visibly noticeable, in many areas the actual level of air pollution had been higher in the weeks preceding the dust.

The importance of air quality is clearly identified in the European Union's objective *"to achieve levels of air quality that do not result in unacceptable impacts on, and risks to, human health and the environment*[6]". This is then further reinforced by the respective national policies, aims and objectives of member states.

To support this, the EU has established a range of standards and limits[7] for these pollutants (See appendix 1 for a full list). It should be noted that as

[4] Air quality is measured in terms of the concentrations of pollutant that is in the air.

[5] http://www.who.int/phe/health_topics/outdoorair/databases/FINAL_HAP_AAP_BoD_24March2014.pdf?ua=1

[6] http://ec.europa.eu/environment/air/review_air_policy.htm

[7] Air Quality Directive 2008/50/EC

these levels are higher than those recommended by the WHO, responsible authorities should always be seeking to achieve lower levels than those specified.

"Air pollution is bad for our health. It reduces human life expectancy by more than eight months on average and by more than two years in the most polluted cities and regions"

Janez Potočnik, EU Commissioner for the Environment[8]

Road transport emissions is the leading urban source

The European Environment Agency has identified the main sources of air pollution[9] as industrial, power generation, agriculture and road transport. With most European cities having seen a significant decline in industrial activity, power generation being often remote to urban areas and agriculture being primarily a rural activity, road transport is the largest contributor of urban air emissions. While there are a range of pollutants that come from vehicles, the main pollutants of concern include Carbon Dioxide (CO2), Particular Matter (PM) and Nitrogen Oxides (NOx).

Emissions and Health Impacts

The pollutant specific impact on human health has been well researched and numerous studies have increased the volume, and breadth, of evidence available.

With regard to the key pollutants, the World Health Organisation's 2013 Review of evidence on health aspects of air pollution (REVIHAPP) has found:

$PM_{2.5}$

- *Short and Long term effects of exposure with mortality and morbidity* as observed in epidemiological, clinical and toxicological studies
- Long term exposure linked to atherosclerosis, *impacts on pregnancy and foetal development*
- Long term exposure potential impact on neurological and cognitive development, as well as chronic conditions such as diabetes

NO2

- Many studies have shown the association between daily NO2 concentrations & exposure with mortality, hospital admissions and respiratory systems
- Both short and long term studies have found the adverse health effects at concentrations at or below current EU limit values

Table 2: **Impact of pollutants over time on vulnerable groups**

Pollutant	General Population	Older people	Children	Impacts
Short term[10]	At Very High levels of air pollution, some people may experience a sore or dry throat, sore eyes or, in some cases, a tickly cough even in healthy individuals.	More likely to suffer from heart and lung conditions which may exacerbated during pollution episodes	Children with asthma may notice that they need to increase their use of reliever medication on days when levels of air pollution are higher than average.	Affected persons may be encouraged to limit exposure – minimise exercise/exertion
Longer term[11]	Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases, as well as of lung cancer.			The mortality in cities with high levels of pollution exceeds that observed in relatively cleaner cities by 15–20%. The EU average life expectancy is 8.6 months lower due to exposure to $PM_{2.5}$ produced by human activities.

8 http://www.eea.europa.eu/themes/air/intro

9 http://www.eea.europa.eu/publications/2599XXX/page010.html

10 Air Quality Bands Health Information (2012) http://www.londonair.org.uk/london/asp/airpollutionhealth.asp

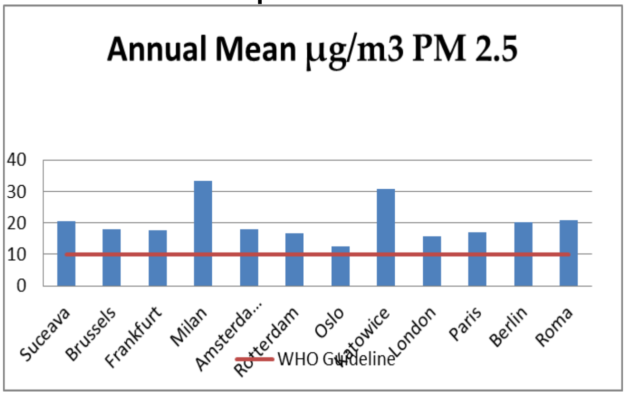
11 Air Quality and health Fact **Sheet** No 313, World Health Organisation http://www.who.int/mediacentre/factsheets/fs313/en/index.html

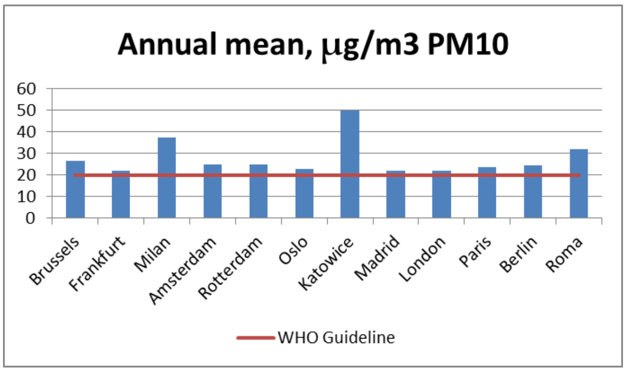
City Levels

Most national, regional or local authorities have implemented an air quality monitoring programme. These often look at a wide range of indicators and can be used to assess the level of pollution locally.

Table 3 shows annual pollutant levels for $PM_{2.5}$ & PM_{10} in the EVUE partner cities[12] as well as key European comparators. The WHO air quality guideline standard is indicated by the red line. While the WHO standard is different to the EU guidelines, it has been included here to reflect the research findings that there are adverse health outcomes at or below the EU guidelines.

Table 3: Annual PM pollutant levels[13]

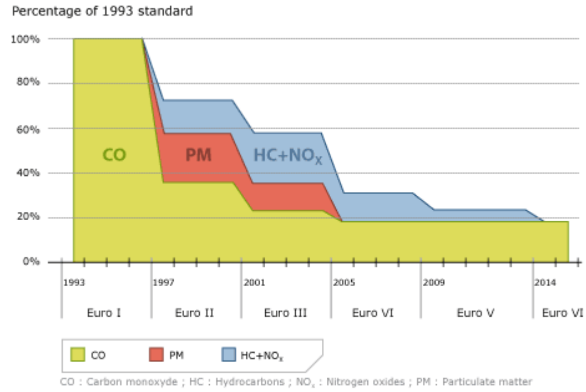




So what comes from the internal combustion engine?

Figure 1[14] illustrates the progressive reduction in Euro Diesel emission standards (CO, NO_x and PM) with similar reductions seen in petrol vehicles. As can be seen, while the applicable Euro standards have been tightened over time, the full effects will not be realised until the vehicle fleet has turned over. The EC's Directorate-General for Environment has provided data[15] that shows that in 2009, the average age of passenger cars in Europe was 8.2 years with significant variation by country, for example Luxembourg recorded the lowest average at 3.8 years while in Greece it was 14.6 years.

Figure 1 Euro I – VI Emission Reductions



On this basis, it can be assumed that it will take until 2022 before the Euro 6 standards that are introduced in 2014 will represent the *average* vehicle emission level based on the above figures.

In addition, as seen in Diagram 1, the continuing growth in vehicle use means that efforts to reduce emissions from individual vehicles are likely to fail due to increases in the volume of traffic.

The link between transport emissions and pollutants can be seen in the image below showing the modelled annual mean NO2 air pollution in Greater London. While non- vehicle emissions are a contributor, the image clearly shows the correlation between the road network and emission levels – especially noteworthy is the central London area where emission levels significantly exceed annual objectives as well as the contribution that Heathrow airport makes in the west.

So what can we do?

The link between air pollution, transport based emissions and its impact on human health is clear.

While additional research is always being undertaken, in areas of significant traffic concentration such as our cities and urban areas, the relevant authorities have a clear duty to act.

Although progress is being made with regard to reductions in overall vehicle emission limits, due to both the turnover in the vehicle fleet and the

[12] No PM10 figure is currently available for Suceava
[13] http://www.eea.europa.eu/data-and-maps/indicators/average-age-of-the-vehicle-fleet/average-age-of-the-vehicle-3
[14] http://www.pi-innovo.com/engineering/engine-emission-control

[15] http://www.eea.europa.eu/data-and-maps/indicators/average-age-of-the-vehicle-fleet/average-age-of-the-vehicle-3

increasing number of vehicles on the roads, reductions in pollution levels will lag considerably.

While it may be difficult to remove all pollution sources, all authorities should seek to minimise the instances and impacts of pollution and keep reducing levels of air pollution.
Measures to address transport derived air pollution include:

- Reduce emissions from transport (macro-level)
  - Encourage sustainable transport modes e.g. walking, cycling, public transport
  - Promote cleaner low and zero emission vehicles
  - Introduce emission control zones e.g. low emission zones
- Target priority locations (micro-level)
  - Area specific emission restraints
  - Local measures to reduce traffic flow e.g. shared surfaces or car-sharing
- Reduce emissions from the built environment
  - Promote energy efficiency schemes
  - Planning controls to limit emissions

While traditionally the available mitigation measures have been limited due to our dependence on motorised vehicles for the economic, commercial and social functioning of our cities, this situation is now changing.

Electric vehicles provide the opportunity to provide a direct, viable alternative to the ICE engine in urban areas and therefore reduce the harmful pollutants that are impacting on the environment and our health.

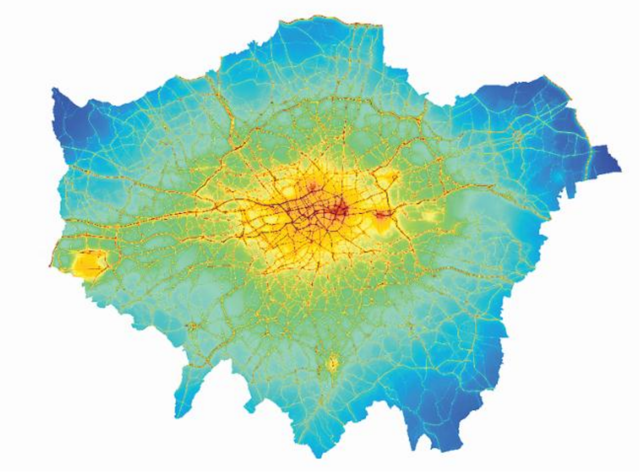


Figure 2: Modelled Annual Mean NO2 air pollution London (2010)

Suggestions for Action

The purpose of this chapter has been to share the latest research on air pollution and its effects on human health. For European cities, road transport is clearly a leading source of air pollution and public authorities, businesses and individuals all have a role to play in addressing this. For stakeholders seeking to improve their local environment, we would recommend that consideration be given to the following:

Establish baseline situation and existing policy and practice

- Establish the local levels of NOx, PM 2.5 & 10
  - Data on this should be available from your local or regional authority
- Check the location of monitoring stations
  - Are there stations in high population/pedestrian areas
  - Do they show increased exposure for schools or other areas with vulnerable individuals
  - Do they show impacts due to any key pollutant sources e.g. factories or power generation plants
- Compare this to the relevant EU and National guidelines
  - Including the WHO air quality guidelines can also be positive
- Identify if there are any key pollutant sources contributing to these readings
- Review local transport/mobility and air quality plans to assess the level of current activity being undertaken
  - For example, are the plans and policies in place but are they lacking enforcement

Construct local policy to guide development

Where policy does exist:

- Clarify how the policies are implemented
- Confirm what monitoring and reporting processes are in place
- What enforcement or remediation activity is taken if policies are not achieved?

Where policy does not exist:

- Check what national or regional policy guidelines apply in your area
  - Local policies may not be required if governed at a different level
- Speak to local environmental or political groups as to why there is no policy
  - Provide evidence of emissions and health impacts
  - Raise the issue with local community groups

The environmental case for electro-mobility is very strong. However this is only one aspect that must be considered when seeking to encourage the uptake of electric vehicles.

If you have successfully addressed the above issues, consideration should also be given to the financial, technical, regulatory and communication barriers that may be faced. For more suggestions on addressing these challenges, please see the accompanying advisory notes.

3. REGULATION

Among the EVUE2 considerations, regulation was a key challenge as the regulatory framework varies across all cities, regions and states. Its inclusion in this report however, reflects the important role it plays in what can and cannot be achieved when seeking to implement e-mobility.

Regulations may limit or prevent certain activities being undertaken when applied to zero emission vehicles, which were often not considered when the regulations were originally devised. The introduction or amendment of regulations requires careful consideration of environmental, technical and financial factors to ensure that the desired goals are achieved and prevent unintended consequences.

For example, in Amsterdam access restrictions have been implemented prohibiting large (18 tonne) trucks from certain corridors to combat air pollution. These regulations however do not provide exemptions for zero emission vehicles (as this would not have been considered when the policies were drafted) and in effect may exacerbate pollution as cargo is put onto multiple smaller trucks, increasing congestion and overall emissions.

As regulations vary considerably, this chapter will look at some of the key opportunities to support e-mobility as well as provide examples of the counter-productive approaches at both the national and local level.

The relationship between national and local level activity also needs understanding. Frequently costs are incurred at a local level (charging stations or tax exemptions) with the results expected at the national level (to achieve reduction targets for the whole country). Similarly, problems caused at the local level (congestion or driver frustration) are not visible at the national level. National policy should be focused on setting local targets to achieve a global impact.

National Regulations

As noted in chapter 2 on the policy framework, the European Alternative Fuels Infrastructure Directive requires member states to:

- Develop national policy frameworks for the market development of alternative fuels and their infrastructure
- Foresees the use of common technical specifications for recharging and refuelling stations
- Pave the way for setting up appropriate consumer information on alternative fuels, including a clear and sound price comparison methodology
- Develop and implement national plans.

While many states already have these, some such as Poland and Romania are still to develop these plans.
These plans, supported by a comprehensive and understandable regulatory, legal and policy landscape are crucial to secure the deployment of EVs and the supporting charging infrastructure deployment on a large scale. They should also encompass the key relevant elements of the system: charging infrastructure, distribution grid, ancillary services, as well as the information and communication infrastructure.

Several actors may play a role in the provision of EV charging infrastructure, such as Distribution Network/Service Operators (DNO/DSO) or suppliers who can use the charging points to sell electricity. Other commercial actors may also provide access to EV infrastructure, such as private investors and independent e-mobility providers who may supply electricity bundled with other services.

At the early stage of the EV development, public agencies may offer free access demonstration or limited scale project initiatives. Over the longer period these are unsustainable due to both cost, as well as commercial operational factors, which may preclude longer term involvement.

Countries have implemented a range of different approaches to the framework regulations which may be implemented from highly centralised to market led. While a centralised framework may be beneficial in the early stages, over the longer term this may be found to be limiting.

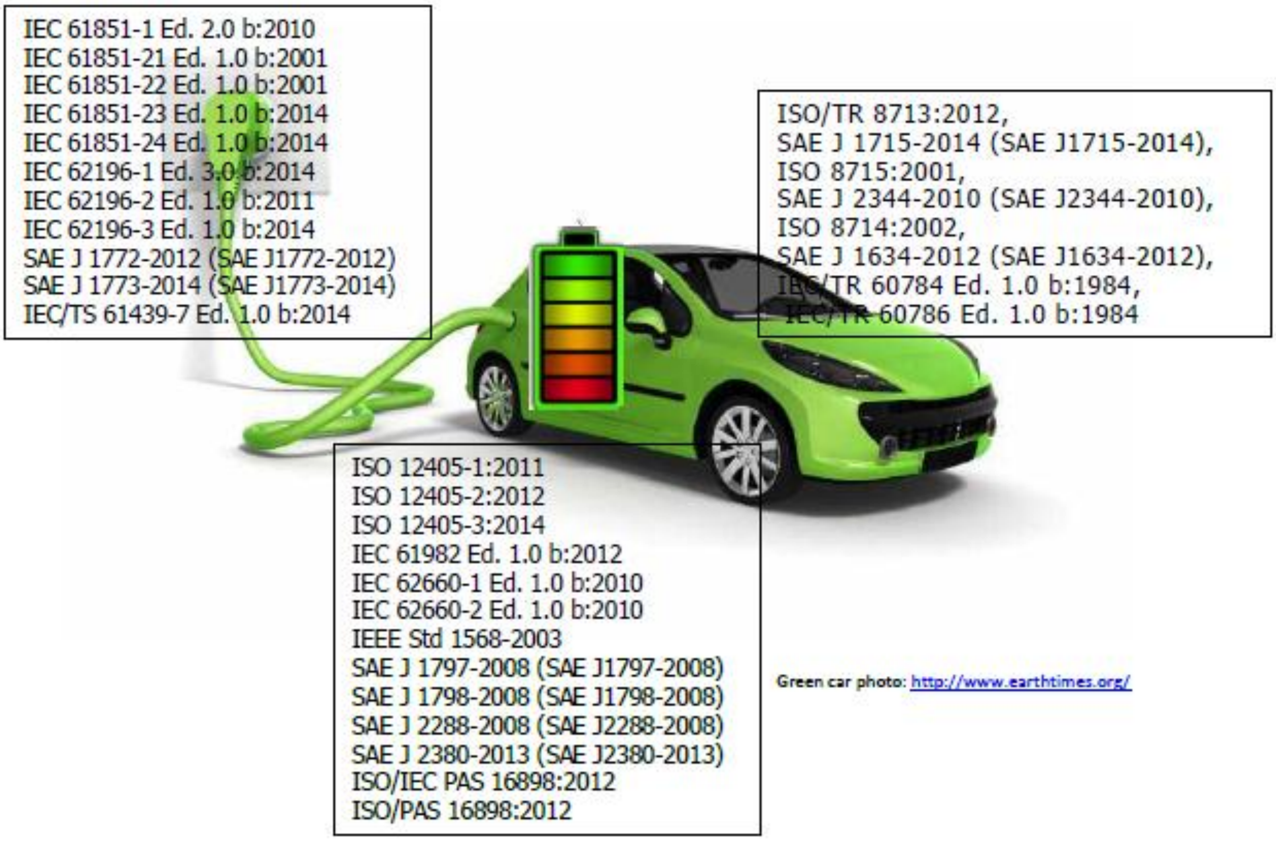
Standards

A wide variety of national and European standards apply to EVs, charging infrastructure and the various procedures involved to ensure that an integrated, and safe, network can operate.

Figure 3 lists the many regulations and standards for vehicles, energy storage and charging infrastructure

Any local regulations or standards pertaining to electric vehicles, energy storage or charging stations should be simple, consistent and clearly described.

Figure 3: List of regulations and standards



Regulatory Environment

Due to the cross-cutting nature of e-mobility, national and regional authorities addressing the topic are faced with the difficult task of aligning multiple policies and regulations involving transport, energy and land use.

Although changes can be made on a piece-meal basis, coherent and comprehensive assessment is recommended to ensure the many benefits of EVs are realised.

The EU White Paper has the goal of fossil fuel free urban logistics by 2030. In many cities, electric trucks and vans are already operating effectively and efficiently. Whilst individual vehicles and their charging requirements may not create any difficulties for the energy distribution grid, the electrification of entire fleets will pose significant difficulties. This highlights an often overlooked, but essential regulatory issue – how do we ensure that the (regulated) energy distribution grid can cope?

As a regulated industry, most countries must seek to balance out costs between different parties. However, when drafted, the regulations never considered the impact that electrification of the transport network would have, but rather how new commercial or residential developments would need to contribute to the cost. This has led to a situation where an EV operator, wishing to run three or four electric trucks could have to make a significant payment to the grid operator to upgrade utility infrastructure – with no scope for negotiation due to the regulation.

Until this matter is addressed, the electrification of the freight sector for example, will be limited by regulation imposing disproportionate costs on vehicle operators.

Regulations can impact activity in two key areas:

1) **Legal requirements** – particularly where regulations may now be inconsistent or contradictory due to changing technology or approaches no longer reflect the 'old' reality (such as the prohibiting of large EVs in areas due to air quality regulations based on vehicle size rather than emissions).
2) **Procedural barriers** – while occurring in all jurisdictions, this is best exemplified in more regulated/centralised bureaucracies (such as in newer EU member states) where excessive regulation can hinder responsive decision making and meeting customer demand. For example, when connecting charging infrastructure to the grid, the technical

complexity may be overshadowed by the procedural requirements with getting connection to the grid and any permissions for access etc.

With consistent regulations concerning charging infrastructure at national and local level it will be possible to have a flexible approach to the new operating models:

- EVs may provide energy storage opportunities from renewable generation, e.g. for municipal companies producing biogas from communal waste
- Provide grid reinforcement through enabling vehicle (battery) owners to sell energy back into the grid (other customers)

National regulatory issues will need to be solved to take into consideration further development of e-mobility:

- Will the EV's owners be able to freely decide what to do with the stored energy in an EV battery (e.g. produced by in renewable energy sources, consume or sell)?
- Will there be restrictions on the amount of energy purchased by large EV rental networks?
- Will restrictions of electric power linked to large EV networks be introduced?
- In case of accident/failure or incorrect forecast will the DSO be able to disconnect certain EV owners?
- Will EV owners be obligated to discharge/charge the vehicle battery upon the DSO request?
- Will the EV owner be able to sell energy from the EV battery at any charging point?

In many cases, the key regulatory barriers will occur with regard to the DNO and electrical requirements. To minimise the potential for conflict, it is recommended that good and early communication should occur with the energy companies.

Careful research is also recommended on a national basis for instances and experiences of how other agencies may have implemented their EV activities. The development of best practice guidelines or detailed examples can help clarify how rules may be applied and, with early agreement, eliminate potentially arbitrary interpretation affecting implementation.

It is also suggested that a comprehensive review of all rules and regulations is undertaken to not only ensure an understanding of regulatory requirements, but enable inconsistencies to be identified and improvements recommended to the regulatory authorities.

While often constrained by a lack of resources, the ability to take an holistic approach to regulatory conditions can be very beneficial. In normal daily activity, such as with implementing EV infrastructure, a project plan will have been developed with specialist technicians or engineers responsible for individual tasks as part of the work programme. However, an electrical engineer who must apply their industry regulations will have little knowledge or regard for, highway regulations which may conflict such as with the siting of electrical equipment for (different) safety reasons. Through identifying and addressing these conflicts, costs and time delays may be mitigated.

National Regulations

A supportive regulatory environment can be particularly beneficial in achieving the policy goals at both the national and regional levels. The main objectives being to:

- Enable the deployment of a public charging infrastructure including energy from renewable sources and energy sales for individual users,
- Provide a rational model of funding support for electric mobility,
- Enable the electric car owners to share in the electricity market services

As there is a wider variation in national regulations, (appendix 8 lists national incentive schemes) operating across Europe, it is not within the scope of this report to analyse these.

Table 4: Relative importance of regulatory incentives in Oslo

Incentive	Importance
No VAT	++
No initial registration fee	+
Reduced annual registration fee	+
Discounted ferry fees	++
Reduced company car taxation	+
Special number plates	+
Priority lane access	++
Free parking	+
Toll road exemption	++

However, the following list details some of the key incentives from Oslo:

- No road tax, no showroom or luxury vehicle tax
- Annual fee of only 425 kr (€45)
- Higher mileage allowance write down when you have an electric car (4.20 nok per km (€0.45))
- Bus lane access
- Exemption from initial car tax and VAT, 50% discount on company car tax
- Free pass in all of the country's toll roads and congestion charge exemption (many companies pay employees toll charge when driving into Oslo for example)

- Taxi driver qualifies for an exemption for income tax purposes of 1.5 kr per km (€0.16/km) for the commuting distance from home to the workplace and back. After 50,000 km, this rate is decreased to 0.70 kr per km.

Local Regulations

At the local level, regulations fall primarily into two categories:

1) Functional: where they relate to achieving policy aims and objectives with no direct financial impact e.g., provision of charging points
2) Financial: where monetary impacts (positive or negative) may be used

With regard to EVs these can be seen in:

- Dedicated parking spaces for electric cars
- Free public parking
- Publicly accessible charging stations
- Access privileges e.g., congestion charge exemption, environmental zone permissions, or bus lanes

When initially implemented, these types of regulatory incentive may be seen as having a low financial, political or operational cost. With increasing uptake however, they may result in negative outcomes such as:

- Un(der)-used parking places for EVs which create frustration for other vehicle drivers when parks are not being used
- Contributing to congestion or delays to public transport when access privileges are provided
- ‘Silent’ running of EVs at low speeds can be seen as a hazard for vulnerable road users who cannot hear the vehicles approaching

Example 1: Victim of own success?

Access to bus lanes is a very popular and effective incentive in Oslo where it can reduce commuting times by hours per week. As more EVs hit the roads however, their cumulative impact on bus lane operation is reducing the effectiveness of the lanes by delaying public transport and is counter to wider sustainable transport policies.

While the regulatory incentives can be beneficial, research carried out with municipalities across Europe has reinforced the need to ensure clear, consistent regulation is applied. For local authorities it is problematic, nor in most cases appropriate, to introduce direct financial incentives.

Similarly, significant variation occurs in what, if any, regulations are implemented across Europe.

Example 2: Sunset Periods

While regulatory measures are a ‘hard’ option i.e., comply or be penalised, with the correct design they further stimulate change. At the launch of the London Congestion Charge in 2003, vehicle engines which emit less than 100g/km of CO_2 were given a 100% discount on the congestion charge under the ‘Greener Vehicle Discount (GVD)’. While the initial range of vehicles meeting this standard was small, by 2012, vehicles qualifying for this discount eroded the congestion and emissions benefits of the Congestion Charge scheme. This has resulted in the introduction of a new Ultra Low Emission Discount (ULED) to replace the GVD (and accompanying Electric Vehicle Discount). To qualify for the new exemption, vehicles will have to be 100% electric or emit 75g/km or less of CO_2 and meet the Euro 5 standard for air quality.

In recognition that drivers invested in low emission cars, the owners of cars registered for the GVD before the introduction of the ULED continue to receive a full discount for that vehicle for a further three years until 24

At present there are no specific regulations aimed at supporting the development of electro-mobility in Poland. Being in the development stage, some progress is being made such as in Warsaw where the municipality, together with the Ministry of Economy, have prepared a document called "Conditions for the implementation of an integrated system of e-mobility in Poland." In Katowice and Wroclaw paid parking zones are free for EV’s and hybrids.

Wider regulation aimed at supporting sustainable mobility has been implemented however in regulating traffic improvement and infrastructure, such as speed restriction, limited and paid traffic and parking areas. With such regulation it is possible to create vibrant and attractive public spaces, enhancing safety and improving the quality of the natural environment. E-mobility can fully complement these goals without restricting mobility and opportunities exist for capitalising on their advantages.

A further example of supporting regulation could be changing planning policy to ensure that all new developments (or alterations requiring permission) provide EV ready car parks.

Suggestions for action

Operating within legislative frameworks at EU or national level, regulation is an important tool providing a structure for incentive as well as enforcement. Whilst some regulatory option occupy a long term perspective, others require regular review and adaptation, as is also the case regarding the adoption of financial incentives.

The identification and implementation (or removal) of e-mobility impacting regulation is a challenging area. In many circumstances, national agencies or bodies are responsible and may only review regulation on an infrequent basis. With careful consideration however, if effectively implemented, regulation can provide significant impetus for the transition to e-mobility.

Establish baseline situation and existing policy and practice

- Research and assess local barriers to EV uptake
- Assess existing (if any) policies, plans or regulations that support or hinder actions to address
- It should also be remembered that regulations are often introduced to address specific issues, and when drafted (often some time ago) e-mobility would not even have been considered. As such, caution is advised if trying to amend regulation, however if specific barriers have been identified, it can be beneficial in investigating whether any change (exemption) can be achieved
- Research and assess how other cities have implemented regulations and incentives to assist EV uptake

Construct local policy to guide development

- Identify incentives to encourage EV uptake that could work in your city, such as:
  - Parking privileges e.g., access, discounts or exemptions
  - Installation of charging infrastructure and supporting requirements
  - Regulations for new buildings and renovations to be e-mobility ready
  - Relief from local vehicle taxes or charges
- Any local regulations or standards pertaining to electric vehicles, energy storage or charging stations should be simple, consistent and clearly described
- Legal or regulatory constraints that may limit market entry should be removed where possible. Foe example, in many member states, specific licenses are required to ‘sell’ electricity (as this is seen as a utility function) which can distort market entry and functioning
- Engage with local policy officers and elected representatives throughout the process – it is important to have all the relevant stakeholders on board from the start
- Seek the development (or review) of a local alternative fuels infrastructure directive compliant plan

Implementation considerations

- Hold regular stakeholder meetings to create the e-mobility readiness plan, and check-in on implementation at regular intervals to ensure that appropriate progress is being made to meet the key objectives of the plan
- Encourage logistic companies to use clean vehicles e.g. through incentives such as no congestion charge during the transition phase or through the introduction of regulation such as a low emission zone

4. TECHNICAL

Irrespective of the regulation pertaining to EVs and their supporting infrastructure, it is often the technical requirements and/or challenges that enable or restrict local implementation. By identifying the challenges and solutions, mistakes can be avoided and implementation improved.

There are numerous organisations, publications and other sources of information regarding the technical processes and/or challenges associated with EVs.

Particularly recommended organisations include:

- Sustainable Cities Institute
- Community Planning Together
- European Association for Battery, Hybrid and Fuel Cell Electric Vehicles
- European Network of Electric Vehicles and Transferring Expertise

As such, this chapter will not exhaustively discuss the detail of the technical challenges, but highlight the key factors for consideration that impacted on actual implementation activities.

Grid Capacity

From a municipal authority perspective, consideration needs to be given to the distribution grid capacity within the target area. While in most circumstances, this would not be a factor of concern for the local authority, increasing energy demands being placed on older utility infrastructure are leading to supply constraints.

In certain areas of central London, electricity demand is so great that existing infrastructure capacity is reaching its limits. While the installation of one or two charging points will not create any difficulties, if a number of fast chargers were to be installed, there would be insufficient supply to meet the (potential) demand. Similar challenges to the grid constraints in London have also been seen in the Netherlands and Portugal showing that this is not an isolated issue.

Grid capacity will also impact on the rate of charging that is possible, as higher speeds have a greater electricity requirement

Location and Siting – On or Off-street

The (relatively) rapid shift to advocating for e-mobility has created a key challenge with regard to infrastructure provision. Although the industry, vehicle manufacturers and energy retailers, have assumed that charging will occur at home or workplace locations, primarily in smaller conurbations and areas with high levels of off-street parking provision, it does not apply in most dense urban areas. Nor is the assumption that workplace charging is desirable, consistent with longer term sustainable transport planning which in many cases advocates for public transport or cycling and walking for commuting purposes.

This has created a key issue for many authorities in how to address this demand (chicken & egg scenario).

While in the initial stages of EV adoption, limited on street charging may be advised to assist with promotion and marketing, however longer term implication should be considered. For example, should on street CPs be replaced by EV charging stations (similar to current petrol stations). If (when) the transition to EVs fully occurs, the business case for charging stations, similar to existing petrol stations, will be quite strong. However, the widespread proliferation of on-street charging may act as a disincentive to market development. In addition, the current approaches to public realm design often encourage 'de-cluttering', that is the removal of non-essential installations in public space which helps those with mobility issues through removing obstructions and improves the overall aesthetic. Deploying large numbers of EV charging points on street would be counter to this objective.

Charging point type and connectors

When it comes to charging equipment, it is necessary to consider the desired charging speed. Depending on the longer term strategy, it may be preferable to only provide slower charging rates so as not to affect the development of a private market with regard to fast and rapid chargers.

Standard charging points, providing either 3kW or 7kW can charge a standard 24kWh battery pack (as seen in the Nissan Leaf) in approximately 8 or 3.5 hours respectively. This time can be reduced through either rapid or fast chargers which can achieve an 80% battery recharge in as little as 30 minutes.

As the power supply increases however, the technical requirements of the charging unit and electricity change, increasing cost and installation impacts.

While there has been debate in recent years regarding the connector (the physical plug that connects the vehicle to the charging unit) in 2013, the European Commission confirmed that the Type 2 (mennekes) connector is to be adopted. All new vehicles should be supplied with this connector. It should be noted however, that vehicles sold before 2013 are likely to have been supplied with a standard European or UK (two or three pin) connector and continuing access for these vehicles should be considered.

How long you may want a vehicle to be occupying the charging space will also impact on your choice of charging type. Where pressure on parking may be low, normal charging speed may be acceptable however in higher demand areas, faster rates can encourage better turnover or enable parking time duration to be limited,

Any discussion of charging point type should also consider whether ‘smart’ or ‘dumb’ CPs are desired. Smart i.e., internet enabled, generally allow for remote access and monitoring and access is usually granted through electronic means such as an Radio-Frequency Identification (RFID) card or remotely such as through phone activated SMS systems.
Dumb units in contrast are generally stand alone points which require physical access for any monitoring purposes and utilisation of the points may or may not require a key.

Figure 4: Left- ‘dumb’ charging point, Right – ‘smart charging point

The selection of which CP type to select is primarily dependent on cost and scale. If only a few units are likely to be installed, the additional trade-off (and cost) for having remote access, monitoring and management facilities (e.g. the ability to request payment) will unlikely outweigh the cost of the units. However, if a larger, integrated network is considered desirable, the functionality of smart points is a minimum requirement.

System monitoring can include reports detailing the number of charging occasions, duration of charging, amount of energy consumed etc. which can be used for financial assessment (revenue capture) or for future development and adjustment of the system.

While at its simplest the only requirements to charge an EV may be an electrical socket and connection, this is not recommended.

In London, there have been numerous examples where, due to a lack of off-street parking and installed charging points, residents have been known to run an extension lead from their houses across the footpath to charge their vehicles. In addition to the public trip hazard that this may cause, the significant electrical current that may be drawn over a considerable period of time can cause the cabling to overheat and has the potential to generate an electrical fire.

System Administration

Unless the local authority has chosen not to be involved with the provision of charging infrastructure, decisions over the administration of the system will need to be made. Questions to be considered include:

- How will access to charging points be provided?
- Will the system be free to use or will payment be required? If charged, how will money be collected?
- How will the charging points be maintained?
- How with the system be monitored, including demand and energy consumption?
- How will the operation adapt to changing conditions or external pressures?

While there are no issues with taking an incremental approach to system administration, it is best to consider the likely approach from the outset to ensure that all decisions are compatible with the long term vision.

Many cities that have implemented on-street charging points, such as Oslo or London, have chosen not to (yet) require payment for vehicles, using their charging facilities as an additional incentive to encourage uptake. There are a variety of methods by which usage can be paid for including:

- Including a flat fee, as part of any parking charges for the site[16]
- Annual fees, which levy a flat 'access' payment, for instance paid an annual subscription
- Per kWh rates which can be monitored by smart CP with the user billed at any agreed rates

Many authorities also consider how occasional/non-residents may access the system and whether to levy a different rate to reflect the different beneficiary types.

London vs Oslo – which was the smart approach?

Oslo

As a demonstration of governmental support for electric vehicles, the City of Oslo has been installing public, on-street charging points since 2008. The approach that was taken however was to install low cost 'dumb' units with access provided by a physical key. Although electricity consumption is metered, these need to be read manually alongside any usage monitoring – undertaken by traffic wardens as part of their normal duties.

The cost for this scheme was €510,000 for 400 charging points through to 2011.

Due to increasing demand and reducing costs for smart units, Oslo is now making the transition to smart units.

London

In 2009, the Mayor of London produced an EV Delivery Plan for London [1]which included a target of 500 on-street charging points. Based on guidance from central government, these points were to be 'smart' and enable remote communication and monitoring.

With the cost of installing CPs from design to operation between €22,000 and €30,000 including installation, the cost of these 500 units was approximately €11-15million. The initial targets have now been met and further installations are occurring in response to demand.

[16] This can also be used to avoid any constraints where the selling of electricity is regulated as the fee is an 'additional service charge', rather than payment for electricity.

Suggestions for Action

Establish baseline situation and existing policy and practice

- Given the rapid development in this area, review the various guidance documents and other sources of information regarding the technical processes and challenges, e.g. European Network of Electric Vehicles and Transferring Expertise

Construct local policy to guide development

- Agree on approach to be taken by the local authority with regard to charging facilities – on street vs off street, standard vs rapid charging, smart vs dumb charge points

Implementation considerations – best practice installation guide

- Assuming indicative location has been identified (feasibility survey):
  a. Confirm with DNO's that location is suitable
  b. Depending on consultation requirements, ensure adjacent landowners are notified
  c. Undertake site visit to confirm viability
  d. Consideration should also be given to:
     - Footpath width – will a charging point or related equipment (feeder pillar/meter box) block access particularly for wheelchairs or push chairs
     - Proximity to power feeds, especially if fast charging is planned
     - Underground utilities/voids – check that existing pipes, cabling or spaces e.g., basements, will not affect installation
  e. Depending on local regulations, complete necessary traffic orders affecting the public highway are made.
     - This factor is very much dependent on local regulations. For example in Germany, dedicating public parking spaces for electric vehicles is prohibited whereas in the UK, it is permitted.
  f. Undertake the detailed design and implementation stage. Liaise with:
     - CP supplier is required to ensure specific installation requirements are met
     - Energy supplier (in deregulated energy markets when the energy retailer is separate from the distribution network operator, you should also contact the DNO to ensure that the lines and substation can meet potential demand)
  g. Complete installation including necessary safety checks
  h. Integrate CP with system administration
  i. Opportunities for added value

j. The installation and operation of a unified charging system may impose a significant financial burden on the managing authority. The seeking of sponsorship or joint promotion arrangements with third parties can reduce the financial impact and help achieve greater success

k. Costs associated with air pollution and health impacts need to be considered

l. If regulation is going to be strengthened regarding air quality, positive revenue streams can result for the provider of charging infrastructure.

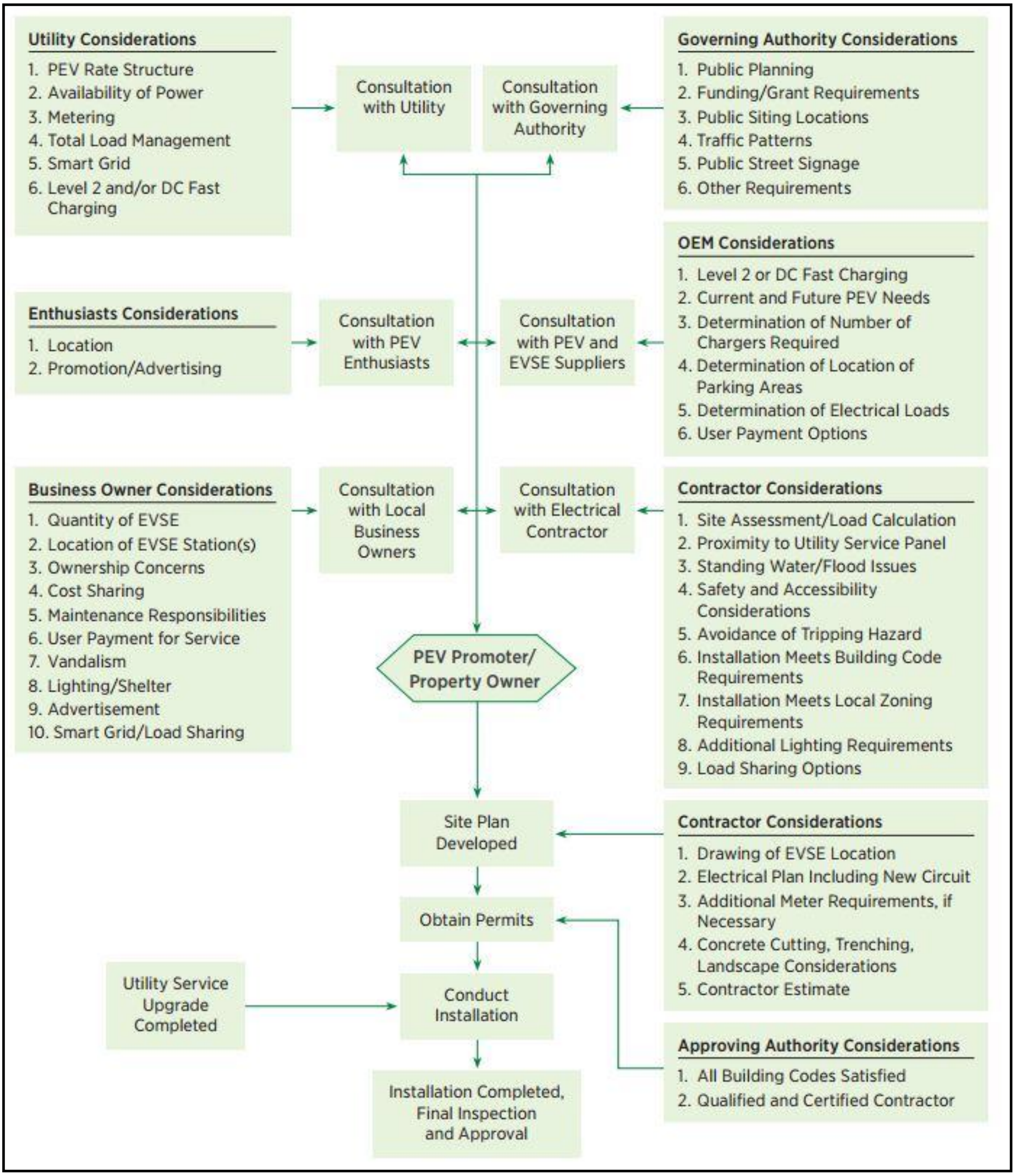


Figure 5: Charging Point installation stakeholder mapping and considerations, Sustainable Cities Institute

5. FINANCIAL

From a local authority perspective, the financial case associated with e-mobility can be difficult to assess.

Policy makers generally take a technology neutral stance and seek to achieve the desired outcomes through encouragement and education rather than direct measures such as specifying technology or behaviour.

This is one of the reasons why the European Commission sets targets to reduce vehicle carbon emissions, but leaves the methods to achieve the targets to the manufacturers; should it be hydrogen or electric, natural gas or bio-diesel.

The impetus of local authority intervention in this area however was set out in chapter three; the air quality in our cities, primarily due to vehicle emissions is unequivocally hazardous to human health. While any low emission vehicle is better than traditional ICE vehicles, why should a citizen be expected to endure poor air quality when a viable and effective solution is available?

Financial approaches taken by municipalities to supporting e-mobility are dictated by local conditions and the above regulatory and technical challenges, this chapter will look at the external drivers for local action and also how some it is approached in some member states.

Cost of Air Pollution

The European Environmental Agency (EEA) calculates the cost of air pollution from road transport to be €100 billion per year due to worker absenteeism (sick days) and premature deaths[17]. This is split between heavy good vehicles (~45%) and light goods and passenger vehicles (~55%).

In 2011, the EU funded Aphekom project estimated the monetary health benefits from complying with the World Health Organisation guidelines for certain pollutants such as $PM_{2.5}$ & PM_{10} at €31.5 billion annually due to savings on health expenditure, absenteeism as well as intangibles such as life expectancy and quality of life[18].

[17] http://www.eea.europa.eu/media/newsreleases/reducing-the-20ac-45-billion

[18] http://www.actu-environnement.com/media/pdf/news-22968-etude-air-invs.pdf

Irrespective of the methodology used, the cost of air pollution to our cities, and citizens, is substantial. Using a simple per capita assessment, the annual financial cost of air pollution to the cities has been calculated to be:

City	Health Cost	Road Transport
Frankfurt	€29m	€50m
Katowice	€12.9m	€22.5m
London	€348m	€608m
Oslo	€24.9m	€43.4
Suceava	€4.5m	€7.8m

Table 5: Potential annual financial cost of air pollution

While simplified, these figures provide an initial baseline for comparison. Each city should be able to make assessments based on local, regional and national factors. For example, the cost of air pollution in the UK (all sources) is calculated at €22billion[19] per year.

Where municipal authorities and agencies have a public health role, there is also a direct financial cost which must be met from public funding.

Penalties for non-compliance

As noted in chapter three, the European Commission under the Air Quality Directive (2008/50/EC) outlines a concentration value for each pollutant and a target or limit value[20].

For member states, the National Emission Ceilings (NEC) directive (Directive 2001/81/EC) sets upper ceilings (or limit values) from 2010 for a number of key air pollutants including nitrogen oxides (NO_x) and Particulate Matter (PM_{10}).

Although the NEC Directive is a legal limit, most national governments have taken a less than stringent approach to compliance. For example, the UK government admitted that under current plans, three major UK cities (London, Leeds &

[19] http://archive.defra.gov.uk/environment/quality/air/airquality/strategy/documents/air-qualitystrategy-vol1.pdf%20-%20see%20page%203

[20] Under EU law a limit value is legally binding from the date it enters into force subject to any exceedance permitted by the legislation. A target value is to be attained as far as possible by the attainment date and so is less strict than a limit value

Birmingham) would not meet the legal limits for NOx until at least 2030[21] – 20 years after the deadline.

However, due to a recent European Court of Justice (ECJ) ruling, that is likely to change.

In response to a legal challenge, the UK Supreme Court found that the UK government was failing to protect people from the harmful effects of air pollution. As the challenge was based on the NEC limit values, the matter was referred to the ECJ for further clarification. In November 2014, the ECJ confirmed that:

"When a Member State finds that the limit values cannot be respected before the deadline fixed by the Air Quality Directive and wishes to postpone that deadline for a maximum of five years, that Member State is required to make an application for the postponement of the deadline by drawing up an air quality plan demonstrating how those limits will be met before the new deadline"[22]

Furthermore, if no postponement has been agreed, "*Member States are equally required to establish an air quality plan that sets out appropriate measures so that the period during which the limit values are exceeded can be kept as short as possible."*

Failure to comply therefore will open the member state up to infraction proceedings. If a member state is found to be in breach, it must take steps to remedy. Alternatively the member may be brought back to the ECJ for financial sanctions to be imposed.

Although any respective national legislation will need to be adhered to, there is a significant risk for all local authorities that if they are found to be breaching their air quality responsibilities, they will be found to be legally and financially liable if prosecuted.

Penalty Calculation

Under the Maastricht treaty, financial sanctions can be imposed against member states (Article 228 of the EC Treaty[23].) For a full breakdown of the calculation see appendix 7.

On the assumption that all states are equally at fault, the penalties that may be applied would be:

Germany	€306 million
Poland	€112 million
Romania	€47 million
United Kingdom	€260 million

A local responsibility?

While any penalties will be levied against the member state, depending on national legislation, responsibility for these fines may be passed onto regional or local authorities.

For example, the UK's Localism Act (2011)[1] devolved powers to public authorities and reduced the 'oversight' of role of central government. Public authorities are therefore responsible for their actions or inactions and with some responsibility for local air quality measures may be liable for their share of any EU penalties.

While the EC only formally initiated infraction proceedings in early 2014, the level of financial penalties has been suggested as €260 million plus on-going penalties. If only a small percentage of this was to be levied on any municipal authorities e.g., 1%, the authority would still be responsible for paying €2.6 million.

Risk to Cities

When it comes to evaluating the case for environmental enhancements, the financial case is often assessed in terms of direct costs, such as the cost of air pollution noted in chapter 3.

However, in the highly globalised world cities now compete in for investment and workers, Cities need to consider broader factors such as:

Reputational Risk

- In April 2014, news reports in Paris, New York and London noted that the adverse air pollution affecting the city had led to the Prime Minister giving up his '*regular morning jog because of the toxic smog that has descended on the capital'*[24] and subsequent health warnings[25]

[21] http://uk-air.defra.gov.uk/assets/documents/no2ten/140708_N02_projection_tables_FINAL.pdf
[22] http://curia.europa.eu/jcms/upload/docs/application/pdf/2014-11/cp140153en.pdf
[23] http://ec.europa.eu/atwork/applying-eu-law/docs/sec_2005_1658_en.pdf

[24] http://www.huffingtonpost.co.uk/2014/04/03/cameron-gives-up-jog-sahara-smog-pollution_n_5081977.html
[25] http://www.nytimes.com/2014/04/03/world/europe/britain-pollution.html?_r=0

Financial Risk

- For Particulate matter alone, the damage in inner London has been calculated at €240,000 per tonne[26] (2010)
- Where regulation is in force, or will be enacted to improve air quality, such as with emission zones, the direct monetary impact could be significant – for example, London is proposing €140/day for HGVs & coaches, and €12/day for passenger cars

Citizen Risk

- The Greater London Authority has estimated that per year, over 4,000 extra deaths are attributable to particulate matter alone[27]

Corporate Risk

- The growing threat posed by climate change and a desire for improved environmental performance is increasing the pressure in the business world

CDP (previously known as the Carbon Disclosure Project) on behalf of 722 global financial funds and investors representing $87 trillion in funds, annually surveys businesses (for example 350 companies listed on the London Stock Exchange) on the emissions and environmental impacts. Clear investment decisions are being made on the basis of environmental performance and cities that do not provide supportive conditions, risk losing companies to other cities

City Perspective

To make the necessary paradigm shift towards electro-mobility and sustainable transport the potential EV buyers must either be economically motivated to change behaviour, and/or forced through regulator devices.

In many European countries, EVs are still too expensive compared to a similar sized conventional car; as much as €10,000-€15,000 more expensive.

On the other hand, in countries like Norway and Denmark, the governments have used the sales tax on new cars to make EV price competitive ICE vehicles. This is probably the single most important reason why Norway today holds the highest number of electric vehicles per capita in the world.

A recent survey from the Nordic countries shows that price is an important barrier for potential buyers of an electrical vehicle. 49% of the respondents in Sweden, Denmark and Finland stated that price is a major barrier for buying an electrical vehicle; only 12% of respondents in Norway say the same[28].

In addition to subsidies on the purchase of new electrical vehicles; there are a number of other financial incentives and support mechanisms that can be used to boost e-mobility, including incentives and benefits on the use of EVs and incentives to develop the necessary charging infrastructure.

It is also important to see all financial incentives together; and also to consider regulative measures needed, and to make the right technological decisions.

Sometimes the best way to boost the use of EVs is to use the right financial incentives, other times the right regulations; more often, it is a combination of both. Through being reflexive and responsive to change, the combination of measures can evolve and adapt as adoption increases.

Financing charging infrastructure

One major barrier to be addressed is the lack of EV charging infrastructure. EV users need readily available access to electricity in the same manner as conventional car users' require access to petrol or diesel. Recognising this obvious, but important fact, many European cities have contributed to the proliferation of an adequate charging infrastructure, for instance in the Netherlands, Norway, Germany, Portugal, Denmark.

Examples of different market models include:

- **Integrated infrastructure model (Italy, Luxembourg, Portugal)** is an example of the DNO (or other entity) responsible for operating, maintaining and, if necessary, developing the distribution system in a given area, to ensure the long-term ability of the system to meet reasonable demands for the distribution of electricity. In this approach, publicly accessible charging infrastructure is fully integrated into the DNOs assets i.e. part of the regulated business of network management by the DNO. Costs related to EV charging points are therefore recovered from the network charges (socialized). The DNO is in charge of installing and operating the publicly accessible charging points. A variant is that DNOs only technically operate the charging stations and leave the commercial

[26] https://www.gov.uk/air-quality-economic-analysis
[27] www.london.gov.uk/sites/default/files/Air%20pollution%20issues%20paper%20pdf_0.pdf
[28] http://mb.cision.com/Main/55/9611263/263090.pdf

provision of services fully to e-mobility service providers thus establishing a multi-vendor platform. The DNO manages an ICT back-end system to link the customer to an e-mobility service provider. The ICT system is used for clearing house purposes between e-mobility service providers (financial, authorisation, information, billing, etc.).

- **The independent e-mobility model (UK, Germany, Sweden, Spain)** is an example of the liberalised market structure whereby publicly accessible charging infrastructure can be provided any willing party. Theoretically29, costs of EV charging points are solely recovered by the beneficiaries (customers). New connection points for charging stations are treated as any other new connection points to the distribution grid. In a regulated metering market the DNO provides a "network" meter for the charging station, while in a liberalized metering market a third party may perform the duties of the Metering Point Operator and provide relevant data to the DSO for the networks fees calculation.

The deployment of public charging infrastructure should be market driven and open to all actors with a supportive regulatory framework.

An integrated framework can work best to achieve rapid deployment, particularly where there may be limited initial market penetration. A clear exit strategy should also be specified for when the market reaches the necessary level of maturity to prevent longer term market distortion i.e. monopoly providers or access constraints.

The independent model, with an emphasis on innovation and market forces, can work better in more mature markets, helping reduce the public cost while stimulating action.

The City of Oslo, for example, installed 400 EV charging points between 2008 and 2011, and reached 700 public on-street charging points by the end of the 2014. A similar approach is now taken by the City of Rotterdam.

This not only makes driving an EV attractive and convenient, but also helps raise public awareness and increase the understanding about electric vehicles.

Some cities are financing and operating the normal charging infrastructure independently, while others cooperate with private consortium and are dividing the costs in one way or another.

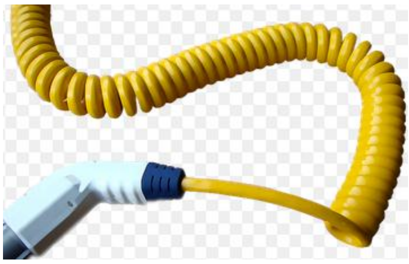
[29] In many cases, initial public subsidies are provided to support the system.

Often there is a different approach for building up the net for fast and quick chargers, compared to standard charging points. In most countries the quick charger network is run by private companies, or private consortiums, often fuelled by state or regional financial contributions. This can be seen in The Netherlands and Norway.

Curly Cables?

As a pioneer in supporting EVs, Westminster City Council (London) required that yellow curly cables were needed when using public, on street infrastructure. This was due to perceptions over trip hazards and safety. While a seemingly simple requirement, as charging technology changed (including vehicle to grid communication) this became a barrier to uptake as it imposed an additional constraint.

Following careful consideration, this regulation was subsequently removed and no longer inhibits EV uptake.



Public, private mix

In recognising current market failures inhibiting the wider adoption EVs among potential users, some countries and/or cities have taken a 'driving seat', while others rely heavily on new market solutions.

In most areas however there are some form of financial incentives to kick-start the adoption of EVs, and to make their purchase and usage more attractive.

Many projects require a close collaboration between the private and public sector, for instance in the field of electric freight vehicles (EFVs), or environmentally friendly public transport. Often there are many stakeholders involved, including central and local government, freight companies, R&D institutions, chambers of commerce, public transportation companies etc., for instance as demonstrated in the Urbact Local Support Groups in London, Frankfurt and Oslo.

Some cities have decided to establish on-street charging points, including free parking and electricity. In others the EV users have to pay the parking fee, but the electricity cost is included for free. This is often combined with regulatory means, like prioritising parking places for EVs in central areas of the city.

Recognising the need to stimulate the proliferation of a new costly infrastructure network for fast chargers, most cities give some form of financial support to private operators. This helps private consortiums to build a network of quick chargers without undermining the various private initiatives. This is for instance the case in Norway, the Netherlands and Sweden.

Additionally, many cities have adopted a supporting scheme for the implementation of charging points in non-public areas including private companies, apartment complexes, shopping centres etc., where owners can apply for subsidies in order to establish charging points on their own property to mitigate against range anxiety.

For fast chargers, there also exist different private-private cooperation where for instance energy companies, service station chains, EV producers and retailers are jointly building necessary charging infrastructure to attract customers.

In Norway, Nissan has recently signed an agreement with the Norwegian food chain KIWI to build 100 new fast chargers through-out Norway for their customers[30]

Other manufacturers like Tesla are building up their own infrastructure of quick chargers free of charge for their customers. The infrastructure is financed by a one-time fee upon purchase of the vehicle and demonstrates how different models may be applied for great success.

Calculating the costs and benefits – a Norwegian example

As mentioned, direct financial comparisons are difficult to achieve due to the variety of different constraints, regulations and approaches. A good example as a case study however, has been the experience of Oslo where 15% of new cars are now EVs.

Costs: Charging infrastructure in the city:

- Oslo is currently spending 8 million NOK (€1 million) per year on 200 additional on-street charging points
- Maintenance of the charging infrastructure. Costs amounts to approximately 2 million NOK per year (€254,000)
- Loss of revenues from parking due to the converting ordinary chargeable parking places with free EV-parking approx. NOK 21 000 (€2,700) per charging point. For 350 charging points in 2015 (some are free) the loss of revenues will amounts to NOK 7.35 million (€873,000)
- Subsidies from the Climate and Environment Department for grants to private installation of charging points has amounted to approximately NOK 3 mill (€381,000) since 2008
- Free use of electricity is costing approximately. 2 million NOK (€254,000) per year

Relevant costs for the central government have been:

- Loss of tax revenues for purchase of new cars (average) is 100 000 NOK per car. So far, the Norwegian Government has spent 1.3 billion NOK (€115 million) – this is revenue forgone rather than money expended. A new report from the Norwegian Institute for Transport Economy also shows that the loss of revenue can be more than levelled out over time by including heavier taxes on the most polluting cars, and that the national target to reduce new passenger vehicles average CO2-emission to 85 g/km in 2020, can be achieved by reforms in the vehicle registration tax
- Loss of VAT on new cars approx. 80 000 NOK per car. For 15 000 new vehicles the yearly cost will be NOK 1.2 billion (€153 million)
- Subsidies to environmental funds like Transnova that support projects connected to EVs, for instance to build a net of fast charger in Norway. Transnova is going to use 150 million NOK (€19 million) on such projects the next two years

Benefits from these measures:

- A better and cleaner environment.
- Reduced cost of congestion and traffic accidents.
- A possibility to meet ambitious political goal like the reduction of CO2 Emission by 50 %, and become climate neutral by 2050 etc.
- Reduced health cost connected to local pollution.

[30] http://www.gronznbil.no/nyheter/na-kan-du-snart-hurtiglade-pa-kiwi-article379-239.html

- An incentive for the proliferation of new green business development, and spin-offs through cooperation between key stakeholders
- A more rational and efficient traffic management, including integration of ITS and smart grids
- Reduced oil demand and oil dependency. As an example; 36 000 EVs in Norway reduces the need for gasoline and diesel with at least 324 million litres per year based on today's motor technology and average driving range per year.
- *Reduced emission of CO2*. For new cars the reduction would be an average of 130 g/km per EVs. The transportation is the main source of local CO2 emission in most cities. With 0.7 Mt. in Oslo alone as an example. A larger cut in local produced CO2 emission is not possible without replacing a larger number of conventional cars with CO2 free vehicles, both for private cars, public transportation and commercial vehicles.
- Reduced emission of NOx, SO2 and CO and other pollutants, which will save urban cities billions of euros in health cost, and increase quality of life for its citizens.
- Mitigate the impact of GHG emissions and its increasing cost on the wider society.
- Reduced costs for vehicle operation, e.g., less maintenance, reduced fuel cost and greater control - not subject to fluctuating fuel costs.
- Avoid future penalties for low air quality.

According to The European Commission Clean air policy package the direct costs to society from air pollution, including damage to crops and buildings, amount to about €23 billion per year. The benefits to people's health from implementing the package are around €40 billion a year, over 12 times the costs of pollution abatement, which are estimated to reach € 3.4 billion per year in 2030, see http://europa.eu/rapid/press-release_IP-13-1274_en.htm

A recent Norwegian study has shown that road traffic is inflicting a cost to society of 0.78 NOK/km, divide on 1.92 NOK/km in urban areas, 1.01 NOK/km in smaller villages and 0, 39 NOK/km in rural areas. Divided across types of fuel the cost is equivalent to 7.36 NOK/litre gasoline (€0.09) and 9.16 NOK/litre diesel (€1.12), however, the cost is more than double as high in the largest cities, like Bergen and Oslo.

There are reasons to believe that the cost is even higher in the larger European and more densely populated urban cities.

Estimating local costs and benefits for e-mobility

E-mobility is a necessity if we are to meet the ambitious environmental goals that have been set as well as reduce the significant costs imposed by transport on society.

While the costs may be substantial, particularly in the initial stages, the cost of inaction will be far greater. Unless the present trends are corrected, the economic costs of traffic congestion will increase by about 50% by 2050, the negative health consequences will rapidly increase

Transport derived air pollution is imposing billions in costs on our health and the wider environment, with consequential effects on the economy and our quality of life.

To minimize the costs however, we need to achieve a critical mass of both privately and commercially owned EVs. This will enable economies of scale to be achieved, lowering costs and capitalizing on the benefits for all of society. Oslo considers that they need a market share of 10% for EVs to realise a measurable impact on air quality.

Research indicates however, that it is possible to create a win-win situation through a strong environmental tax on the purchase of new vehicles and reduce the CO2 emission by 50% in the next 25-30 years without losing any potential revenues in the long run.

Some of the regulatory measures like low emission and ultra-low emissions zones, combined with a congestion charge (financial incentive), have similar effects.

At the same time the shift allows a transition towards a smarter and greener city policy, with abundant business opportunities and new entrepreneurial skills based on innovations and synergy between new stakeholders from the energy, ICT and transport sectors, as well as research & development and the public sector. This will also ultimately call for increased cooperation between public and private businesses and research institutions.

Some of the investment costs and subsidies in the EV sector, especially in the charging structure, will be phased out in the short to medium term, but they are critical in the early adoption phase. Over time, some form of user payment can be implemented to finance the costs however, this is not recommended at the beginning.

A similar focus should be given to the commercial transport sector where the transition is already under way for lighter freight and parcel service vehicles, taxis, waste collection vehicles, and for public transportation vehicles including buses.

In summary the whole tool box of financial incentives should be considered, including:

- Incentives on purchase (registration tax, VAT)
- Incentives on daily use (fuel prices, energy prices, free charging, free parking, no circulation tax, free use of toll roads, free access to bus lanes, tax deduction rules etc.)
- Investments in charging infrastructure (standard chargers, fast chargers, quick chargers)
- Support schemes for new charging infrastructure on private locations (standard, fast and quick chargers)
- Other financial incentives, congestion tax, incentives for green car sharing etc.
- Supporting mechanism for businesses that wish to invest in green mobility, company taxes, support for infrastructure etc.
- Financial support for R&D in green mobility

It is also important to consider alternative or supplementary regulative measures, and tailor-make the combined solutions based on differences and peculiarities of each city.

For most cities there are subtleties when it comes to the consumers' preferences for cars, tradition, fuel prices, tax on new vehicles, environmental challenges, and congestion problems, financial situation etc. Different solutions and approaches should be selected as appropriate.

It is important however, to make EVs the right financial choice for the buyer. Experience shows that for a substantial increase in the sales of EVs, consideration of how to make the price more affordable for potential car buyers in an early diffusion stage, both on purchase and use, is necessary; including any supporting regulative measures.

When selecting strategies, it must then be consistent over time but also flexible enough to adapt to technological innovations.

Suggestions for Action

Cities can be a major mover in the shift towards e-mobility and a greener and smart electrification of the transport sector. Experience has shown that national and local authorities need to step in to address the inherent early market imperfections and smooth the process in the early adoption phase. Additionally, this will require firm political backing, preferably across the political spectrum and at all levels.

EVUE cities have wrestled with the problem of understanding and defining an acceptable and functioning business model(s). There is consensus that EV changeover depends on initial financial support from the public sector. However it is generally recognised that the desired transformation cannot be subsidised indefinitely.

Establish baseline situation and existing policy and practice

- Consider business model(s) adopted elsewhere and whether these could be replicated in your city
- Particularly consider the funding mix that would be most suited to your city e.g. all public, public/private mix etc.

Construct local policy to guide development

- Introduce the most appropriate support to kick-start EV momentum – targeted short term incentives. While there are a range of measures that can be applied, it is most important to ensure that they are tailored to local conditions.
- Public procurement measures should encourage public authorities, individual departments and agencies to use EVs are part of their operations

Implementation considerations

- Approach should be proactive, intensive, coordinated and involve private stakeholders
- Seek external funding sources for development phase pilot initiatives, e.g. The success seen in Suceava through the Swiss-Romanian Cooperation programme is a key example of what can be achieved through this integrated support
- Financial and non-financial incentives for the purchase and ownership of EVs have been introduced by several national and local governments around the world. It may include tax credits, reliefs, free parking, and unrestricted access to high occupancy commuter lanes on major roadways
- Monitor closely the cost-benefit equation and take steps when the balance hits pre-set

values, e.g. the cost of the loss of parking revenue against the benefit of growth in EV numbers

In short, the correct approach is that which makes EVs the right choice for consumers, through financial incentives and/or through regulations. The pressure on authorities from the increasing cost of air pollution, financially, legally, reputationally and in terms of human health is significant. Local authorities must act to address this growing issue.

6. COMMUNICATION

Although electric mobility has had to face the challenges associated with vehicle and infrastructure supply and cost, at a societal level, a greater challenge is acceptance among the general population. For the consumer, whether individually or collectively, the psychological mental barriers associated with moving to a new drive system can be very significant.

In 2014, consultants PwC conducted a survey of potential new car purchasers in the top three markets of Europe (Germany, UK and France). From an e-mobility perspective, the findings are of great concern - 99% of respondents indicated that electric mobility plays no role in their decision when considering a new car purchase. While consumers may demand that manufacturers provide economical and environmentally friendly cars, half of the respondents were not willing to give up large, luxury segment vehicles such as SUVs.

The survey highlights a fundamental problem for e-mobility: the car has strong socio-cultural significance across Europe and the maxim "Show me your car and I'll tell you who you are" still enjoys prominence in large parts of the population.

Criteria such as size, price, and performance still play a significant role when determining a purchase. While EVs can compete in most, if not all areas, it does require the consumer to make additional effort to identify and understand the market offerings. If you ask the average person on the street to name an executive sedan, they are more likely to answer BMW, Mercedes or Jaguar than Tesla.

Successfully introducing EVs to the market therefore requires much more than the necessary infrastructure and vehicles. It also requires a change in the thinking of the population and their elected representatives in relation to the car and sustainable mobility. For this reason broad-based communication on e-mobility is a fundamental part of any electric mobility strategy.

Existing communication approaches

The rationale for the adoption of EVs vary across Europe. Communications on the topic of e-mobility typically focus on the demand for efficient and environmentally friendly vehicles, especially in urban environments. Terms such as smog, noise pollution, or particulate pollution are now part of the day-to-day work of every municipality.

Many cities have also adopted measures in an attempt to comply with air quality targets such as congestion charging or environmental zones which restrict the number of cars or pollutant emissions with low emission vehicles.

Upon closer inspection, the country specific particularities quickly make the different motives for use of e-mobility clear. In London, communication on e-mobility is focused on the reduction of environmental and noise pollution (or exemption from the congestion charge zone). The key messaging therefore focuses on the improvement of air and quality of life in the cities for the protection of one's own health. This is also of growing importance at the municipal level where local authorities are also now responsible for public health.

By comparison, Norway, as a country that owes its prosperity to oil production and recognises that it is a finite resource, sees e-mobility as a way to secure energy independence; particularly as almost 100% of its electricity production is from hydro generation. E-mobility provides a method to achieve fossil fuel independence[31]. The government provides incentives for the purchase of electric vehicles to such an extent that EVs are currently cheaper than comparable ICE vehicles.

In Germany however, while aspects such as environmental impact and independence from fossil fuel play a role in the communication approach, they are secondary to economic considerations. As one of the largest industries, and employers, in Germany, the automotive manufacturing sector views e-mobility as a way to maintain its strong position in the global auto industry in the future. National measures such as the 2020 target for a million EVs on German roads are due less to environmental motives rather than economic policy objectives.

It is also important that the automotive industry maintains its role with the development and marketing of the internal combustion engine, thereby protecting the economic position of the German automotive industry. For this reason, the topic of e-mobility in Germany sometimes lacks a nationwide approach to charging infrastructure or a holistic model for incentives to increase the use of electric vehicles.

[31] Further information can be found in chapter XX on Norwegian incentives

In reviewing the differing methods of communication in respective countries, it is necessary to consider the influencing factors which lead to acceptance or rejection of electric vehicles compared to the combustion engine.

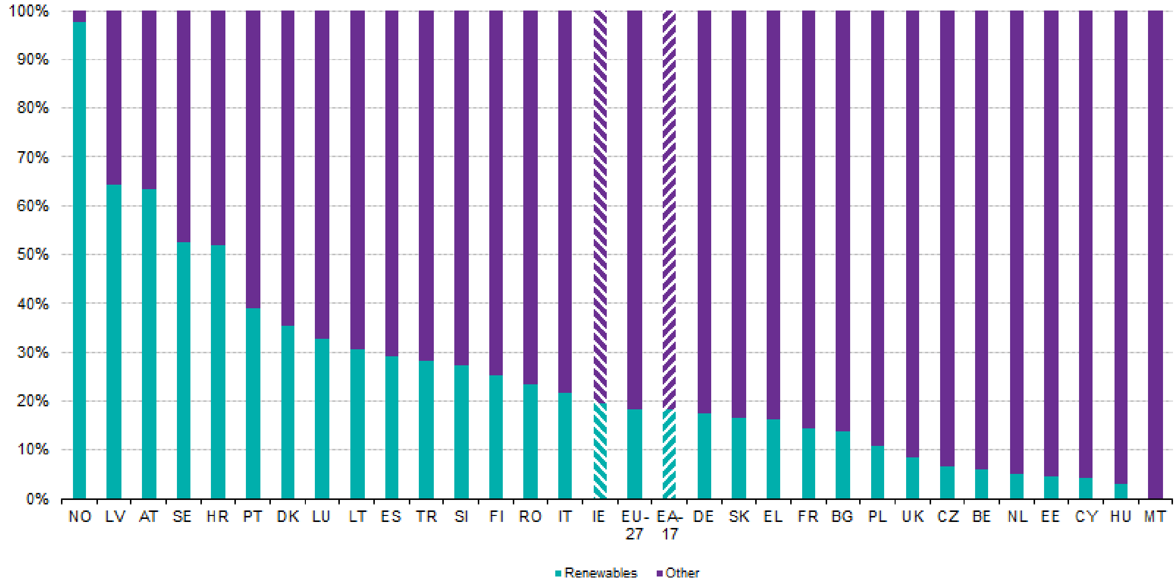


Figure 6: European Energy Grid Mix[32]

"In market studies in recent years, it has been noted that the expressed expectations of electric cars are strongly geared toward the characteristics of conventional vehicles. Electric vehicles therefore seem to only have a chance if they can keep up with conventional cars in terms of price and performance characteristics such as range, charging time, and top speeds." (TAB, 2013)

An important role is therefore played by the acceptance and dissemination of technical innovations in a society. While it is generally more difficult to do something in the adoption of new (technically) marketable products in Germany, in the Scandinavian region you find a significantly higher willingness to use them.

Electric mobility is more than just a technical innovation, because for many people a car is more than just a method of transport. In many cases, the purchase is associated with a high financial burden, so that the car has to fulfil many more purposes than transporting people solely from A to B. The purchase and use of an innovation is preceded by the assessment of the product by the buyer. Particularly where a high financial outlay is concerned, it is human nature to purchase what is familiar in order to avoid a costly purchasing mistake. This behaviour means that innovations such as EVs pose a variety of challenges for society.

"To increase acceptance by potential customers, education and information work along with the use of appropriate instruments to increase willingness to buy must be pursued." (P3 Group, 2013).

Environmental Messaging

Although environmental performance plays an important role in the marketing of e-mobility, caution is also required to ensure that message is consistent with the operational reality.

The environmental performance of an electric car does not just relate to the tailpipe emissions, or lack there of, but rather on the energy sources from which the electric car is powered.

Figure 6 shows the current energy generation mix across Europe divided between renewables and non-renewables others.

The two countries in Europe that have the highest proportion of EVs in their fleets are Norway and Estonia, but only in Norway with the high renewable energy generation are they truly sustainable. Energy generation in Estonia is primarily accomplished by shale oil which is considerably less clean than other sources.

The use of non-renewably generated electricity can complicate the environmental messaging associated with e-mobility. However there are two key arguments for refuting this argument:

[32] http://epp.eurostat.ec.europa.eu/statistics_explained/images/0/0d/Share_of_renewables_in_electricity_production%2C_2012_%28in_%25%29.png

1) Improving air quality in densely populated urban environments through EVs will result in a greater net human and environmental benefit than continuing to use ICE vehicles. So while this may displace pollution, it mitigates the impact on the population
2) Under European and national legislation, all member states (including Estonia) must reduce the use of 'dirty' power generating sources either by the use of renewable generation or through treatment options such as carbon capture and storage systems (CCS)

Accordingly, there must be consistent messaging about the importance of the 'right' choice in the context of e-mobility. Communication strategies should emphasise the use of renewable energy sources. With a long-term focus in particular, the proviso that electric cars not only need to be free of emissions but that the same applies to the electricity sourced, should be a high priority.

This will strengthen market uptake for e-mobility as a comprehensive and consistent message can be given for the purchase of a EVs (P3 Group, 2013).

Figure 7: Example of EV awareness campaign

Disruptive technology in a disrupting world

As discussed previously, the car (including the ICE) has had 100 years to define and secure its place in society. It has transcended its purpose of being a mode of transport, into a vehicle of social prestige. The more expensive and luxurious one's own vehicle, the more status that is conferred on the owner. Previously this was seen as a key barrier inhibiting market uptake of EVs as the vehicles were generally smaller, with less substantial construction, posing a direct psychological difficulty for potential customers.

Compare the REVA with the Citroen C3, although both are 2 door compacts, the marketing appeal of the Citroen far surpasses the motive power source.

Figure 8: REVA (above) and Citroen C3 (below)

Over the last few years however, this has started to change as EVs become 'normal' (compare the Tesla Model S with the Jaguar XF) but more importantly, a paradigm shift is occurring.

Figure 9: Which one is electric? Tesla Model S (above) Jaguar XF (below)

While the car still plays a major role in society, the value ascribed to it by the (potential) consumer is changing. Increasing urbanisation along with wider developments, particularly in western Europe, is making car ownership more difficult and expensive.

From licensing and insurance to parking, the personal car is becoming more of a burden than a benefit. The car is losing its status symbol and reverting to a means of mobility. Car-sharing companies, which are increasingly popular, provide mobility without requiring drivers to concern themselves with parking, ownership and maintenance costs. Public transport, cycling and walking is also increasing in most cities across all demographics, where previously only the young and old were seen as users. E-cycles for instance are increasingly common in Belgium and the Netherlands.

It should be noted however, that in the evolution of societal views on the private car, significant disparity also exists across Europe. Among the new member states, a much shorter history of individual car ownership exists and as such, the psychological status of vehicles is substantially higher so a higher value is attached which needs to be addressed.

The attributes and paradigms that applied to cars a few years ago are crumbling. It is no longer just “big and strong”; but how can mobility needs best be met. There are great opportunities for electric mobility in this change. Should paradigms with efficiency and environmental friendliness perhaps define the status symbol of the car in the future?

Vehicle manufacturers are now asked to combine the generational change in the automobile and electric drive with new features. Therefore, in addition to traditional product advertising, further communication measures must be taken by policymakers and stakeholders in the field of e-mobility. Here the topics of economic efficiency, environmental friendliness and the experience of driving an electric car need to be addressed, as these are the areas for which the consumer still needs reassurance.

No car has unlimited range, yet why are only EVs are labelled as range limited?

In addition to these new questions, the fundamental hurdle however is still cost. It should be noted however, that is usually only the higher initial purchase price of the EV that is considered. A rational discussion of the cost of an electric vehicle does not take place. Referred to as the TCO (Total Cost of Ownership), this is an important component of communication, since the economic benefits of EVs are seen over time. Lower fuel and service costs can often mitigate or even entirely negate, any initial price premium. This needs to be understood, communicated and demonstrated.

Identification of key messages

E-mobility is not a solution to the transport problems facing our cities. Congestion, accidents and associated urban blight from the highway network will still be challenges. It can however provide a solution for the pressing problem of air pollution. It is important to recognise this difference so that the wider goals of sustainable transport and mobility are not overlooked.

E-mobility is part of the solution, not THE solution

The internal combustion engine will no longer be the exclusive method of vehicle propulsion and increasing market share will go to alternative fuels. While distribution and market acceptance is highly dependent on technical development as well as purchase prices, improvements in battery technology (range) and falling prices are positive and leading to a growing acceptance of electric vehicles. This provides the opportunity however for a greater ‘re-thinking’ of mobility and transport.

The communication methods and messages employed must take advantage of this social change. For example, for young people who want to take advantage of mobility and for whom the ownership of a car is not a priority must be specifically addressed. There is a greater openness to innovation and willingness to sue them.

Place innovation and technical evolution into context – who would still want to use a 1990s mobile phone? Why would you still want to use an engine developed in the 1900s

Increasing awareness of environmental factors and health, which has risen continuously in recent years, gives electric mobility wide leeway to develop successfully.

The comparison can be seen in perception of smoking, now banned in most indoor public areas, or sustainable/organic food production to reduce pesticide and chemical usage,

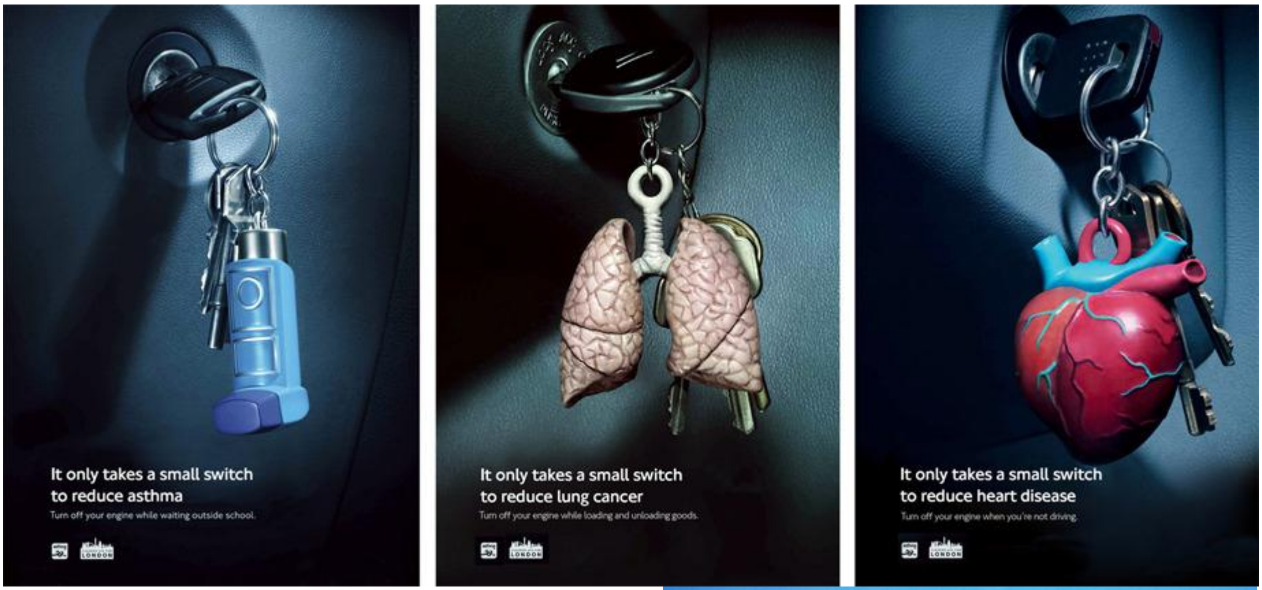


Figure 10: Outdoor poster campaign of Asthma UK and Cleaner Air for London

As seen in the example above, an approach used in London has been to directly connect car usage with its health impacts for which all people can identify.

Ensure that the personal benefits of behaviour change are identified so that the individual has a personal stake in improving the actions

It is undeniable that time is needed before a measurable impact will be seen in the market or on air quality. Policymakers need to be aware that the introduction of electric mobility requires perseverance and resilience. While there are undeniably doubts in regarding alternative fuels and their efficacy, there is no alternative if we want to achieve the goal of emission free driving.

Electric vehicle technology has been tried and tested and is suitable for most urban requirements.

As well as the rational arguments for e-mobility, the emotional (irrational) side of the equation must also be considered. In regard to the “key message” that it can be fun to drive an electric car, the observer can have a different opinion. Differing approaches to marketing campaigns by the manufacturers also reflect the challenge associated with the positioning of this message.

Nissan has taken an approach that appears to predominantly focus on the Leaf’s green credentials whereas Tesla’s focus is on fun and performance.

Figure 11: Examples of different EV advertising techniques

The reason people choose cars are a carried as there are types of vehicles. However the experience of the partners of the participating cities has clearly shown that people's thinking about electric mobility before and after a test drive changes considerably.

While preconceptions and doubts may exist prior to a test drive, these are generally dismissed with just one test drive, and enthusiasm for this new way of driving can be seen with only scepticism about the range and purchase price continuing to exist.

Noteworthy here is that it was not the rational arguments that convinced people during the test drive, but the driving experience.

This can be particularly effective with EVs in the fleets of car rental and car-sharing companies as a high multiplier effect can be achieved with these offers.

Events with high public visibility must be organized in cities in order to make it possible to test and experience electric mobility. With these measures, it is important that policymakers be involved and give a clear commitment to electric mobility.

The value of people directly experiencing an EV cannot be under-stated in changing their opinions and is an essential component that needs to be taken into account.

Consumer resistance is still currently focused on concerns over battery range and charging times. E-mobility, although not a viable alternative for all journeys, is suitable for most requirements. These concerns need to be addressed directly and not discounted or minimised. In the urban environment however, there are very few instances where an EV is not suitable.

Be open and honest about range concerns, while highlighting the wide range of vehicles available that can meet requirements –from the Renault Twizy(100km) to the Tesla Model S 420km

While a lot of the discussion is focused on passenger cars, e-mobility should also be considered for public transport and commercial (freight) purposes. Given the growing dominance of urban traffic by these vehicles types, and in particular their resulting emissions, e-bus (or hybrid) and e-trucks have a lot of potential.

A significant number of research and demonstration projects (e.g., FREVUE –electric freight vehicles, ZeEUS – electric buses) already exist which demonstrate the efficacy and effectiveness of these vehicles and greater awareness will lead to increased usage. This is particularly important when considering that the EC goal of fossil fuel free transport by 2050, has an intermediate step of fossil fuel free urban logistics by 2030.

Demonstrate the range of uses where EVs can be successfully employed across public transport and the freight/logistics sector as well as in the car segment.

Encouraging behaviour change

The EVUE2 cities involved have all used different types, levels and media to convey the advantages and benefits of electric mobility to the population.

In London, the focus has been on developing the messaging around air pollution and human health. The evidence showing the causal link between air pollution from urban traffic is strong and clearly leads to significant numbers of people suffering from diseases such as asthma, cancer, or heart disease.

With corresponding market penetration, electric mobility can contribute to reducing pollution in the air. Thus the communication should include the message that through the use of an electric drive system every car user can contribute to a reduction in pollution and also personally reduce the risk of being affected by the linked illnesses.

Research undertaken in 2014 by ParHill has identified six principles by with public authorities can communicate and affect behaviour change related to air quality and health.

1. Use information about air pollution is e.g what is in particular matter, and where and how it goes to get it on the agenda. Do not use statistics about health consequences as it does not gain or keep the public's attention.
2. Do not raise public concern about air pollution unless you can at the same time satisfy people's desire to do something to reduce their exposure.
3. Focus on what is known for certain about the health consequences of air pollution.
4. Talk about air pollution as a problem linked to specific place and not as a general problem of the atmosphere.
5. Keep the focus on practical improvements – not just longer term solutions
6. Demonstrate leadership and empower communities, instead of just expecting individuals to change their behaviour.

	Financial/economic	Health	Environmental	Personal/future
Political	- Energy independence - €1bill/day spent on importing oil - how could that money be spent better? - There are significant opportunities for jobs and growth if countries can capture a share of the expanding global market in ultra-low-emission vehicles (ULEVs). - Effective government policy to create an attractive business environment for manufacturers will help countries develop comparative advantage in ULEVs to match its existing strength in ICEVs. The transition has the potential to create jobs, promote manufacturing and exports, and economic growth.	- Poor air quality in cities is having a growing impact on mortality and increasing the pressure on health care costs. Irrespective of whether the health costs are borne centrally e.g. NHS in UK or privately as in the German situation, this is an avoidable cost where the money could be spent more productively elsewhere.	- The growing impact of the human activity on the environment is becoming better understood and citizens are demanding more action to minimise the negative consequences. - -International, national and local policies on emissions.	- The longer actions to mitigate climate change are delayed, the greater the cost of remediation. Extreme climatic events are being seen across the globe and politicians who fail to act when responsible, will be held accountable.
Business	- Reduced costs for vehicle operation (less maintenance, reduced fuel cost and greater control – not subject to fluctuation fuel costs	- Illness is the most common reason for employee absence and poor air quality is known to cause/exacerbate heart and lung conditions (of particular note is impacts on children where the caregiver needs to take time off work)	- Companies are being increasing expected to monitor and report on their emissions (Greenhouse Gas Protocols, ISO 14001 standards, Carbon Disclosure Project). As vehicle related emissions (including inward & outward supply chains) are a significant generator of emissions, utilising zero emission supply chains supports business objectives.	- Pollutants & other (air, noise) emissions are a negative externality with the costs borne by society. As awareness increases, unless improvements are made, regulation and enforcement will be enacted to mitigate these costs, increasing the direct cost on business through taxes etc
Individual	- Total cost of ownership can be cheaper in many cases than traditional ICE vehicles	- Emissions from ICE vehicles are **Certain** to cause lung cancer, asthma, bronchitis symptoms especially in the young.	- Personal responsibility in minimising environmental impact is the quickest and easiest way to achieve environmental improvements	- ULEVs are likely to bring motoring costs down over time. Although the purchase costs are currently higher for ULEVs than for ICEv, these are expected to fall over time as the technology matures, while the fuel costs are already far lower.

Table 6: Examples of EV messaging for stakeholder groups

In contrast, Frankfurt's approach has been to introduce the public to electric mobility through concrete examples and increased visibility. The communication is based on the increasing numbers of vehicles on public roads, making it possible to draw attention to the fact that electric mobility already exists on the streets and can be used by anyone today. Some of the vehicles are branded with young and sometimes cheeky campaigns to intensify the attention effect.

In order to generate the highest possible visibility given the many different agents and project sponsors, a communication platform under the label "frankfurtemobil" was established to consolidate all activity and thus achieve the maximum impact. For example, a common website was established which provides answers to the complex questions in regard to electric mobility, disseminates news, and provides information on all events in this area. In parallel, radio spots were purchased for the label to provide better penetration of the subject of Frankfurt and electric mobility. The aim of this approach was to provide citizens with comprehensive information about electric mobility and its current status. As a result, people's interest in electric mobility is stimulated, leading to the public actively concerning itself with the topic of electric mobility and how they can engage.

Figure 12: Frankfurt's initiative "first – the craft goes electric"

Oslo however, has taken a much broader approach based on the City's commitment in 1991 to reduce CO2 emissions by 50% by 2030 and to operate on a climate-neutral basis throughout the city by 2050. The city administration established its entire communications strategy around this goal and initiated appropriate action.

While supported by national incentives, the municipality introduced regional incentives such as allowing electric vehicles to use bus lanes or free parking and charging inside the city limits. All of these measures were used to put together a persuasive communication package which communicates to the citizens the additional benefits from the use of electric vehicles.

With the purchase of an e-vehicle, one saves money not only on the purchase but also on daily costs, and because you can use the bus lanes, it is also possible to save time. In Norway the communication is based on very clear, rational facts; people are persuaded to use electric vehicles through positive arguments regarding electric mobility. The climate objectives remain, but they not the main argument for the use of electric vehicles.

Suggestions for Action

When developing communication strategies, it is necessary to clearly understand the motivation and drivers of the target audience. Across the EVUE partners, similar to the rest of Europe, while the responses are often the same, the motivations are very different. Because of this, it is not possible to define one communication approach but rather a broader range of principles that can be applied reflecting local reasons.

It is much more important that the communication on the topic of electric mobility and its introduction is undertaken as part of a considered strategy and the corresponding measures are supported in the cities. This is necessary because electric mobility is still having significant problems entering the public consciousness in Europe.

The approach should have both a rational basis, providing clear facts and information on the impact of electric mobility on air pollution, as well as reflecting the emotional needs of the target market such as "driving fun" to win them over.

Construct local policy to guide development

- Decide whether to engage with public relations companies or dedicate your own staff to design the campaign
- The city authority should lead by example – add EVs to your fleet and make these highly visible
- Place innovation and technical evolution into context – *who would still want to use a 1990s mobile phone? Why would you still want to use an engine developed in the 1900s*

Implementation considerations

- Identify the most appropriate media channels, e.g. social media, dynamic city websites, and mobilise the local press
- Ensure that the personal benefits of behaviour change are identified so that the individual has a personal stake in improving the actions

- The value of people directly experiencing an EV cannot be under-stated in changing their opinions and is an essential component that needs to be taken into account – get people test driving an EV
- Be open and honest about range concerns, while highlighting the wide range of vehicles available that can meet requirements –from the Renault Twizy (100km) to the Tesla Model S (420km)
- Demonstrate the range of uses for EVs across public transport and freight/logistics sectors as well as for private passenger vehicles
- Most importantly, remember that e-mobility is part of the solution, not the only solution!

7. CONCLUSION

The motivations and drivers for cities to support the transition to electro-mobility are clear.

The poor air quality in our cities, in large part attributed to vehicle emissions, is affecting the health of the entire community – children, adults, the elderly, those in good health and those in poor. It is the responsibility of local authorities to represent and act on behalf of their citizens to ensure that all appropriate measures and responses are taken to address this.

In general the regulatory and technical instruments are available to cities, although they do need to be matched to the local conditions.

Similarly, while there are a range of approaches that can be taken to financing interventions, it will be what is appropriate for each community. That said, the European and national legislation regarding air quality will force change, and costs, upon cities, if they are not proactive in addressing the challenges facing them.

While our cities are in many cases dependent on private and commercial vehicles for their social, cultural and economic development and growth, the same cannot be said for the internal combustion engine. It is imperative that citizens, businesses, communities and our elected representatives see this distinction and start to take measures to redress the balance.

Communicating this will require a new approach however as, unlike other technological changes, e-mobility is facing an incumbent, the internal combustion engine, that has dominated the market for over 100 years. Although there are still some technical barriers which may impose some additional constraints on use, such as range, the benefits, particularly in the urban environment, clearly outweigh any costs. This message however will require clarity and consistency to address misconceptions in the market, overcome concerns on range and demonstrate that e-mobility is a viable, effective and better alternative than the internal combustion engine.

The EVUE2 partners have faced challenges in each of these and this report has been developed to help all interested stakeholders, identify, communicate and implement strategies and methods to ease the transition to e-mobility. It is not designed to answer all questions exhaustively, but merely to act as a signpost for key areas that EVUE2 cities have found necessary to address when implementing e-mobility.

Annex 1: European Air Quality Limit Values

Pollutant	*Concentration*	*Averaging period*	*Legal nature*	*Permitted exceedences each year*
Fine particles (PM2.5)	25 µg/m3***	1 year	Target value entered into force 1.1.2010 Limit value enters into force 1.1.2015	n/a
Sulphur dioxide (SO2)	350 µg/m3	1 hour	Limit value entered into force 1.1.2005	24
	125 µg/m3	24 hours	Limit value entered into force 1.1.2005	3
Nitrogen dioxide (NO2)	200 µg/m3	1 hour	Limit value entered into force 1.1.2010	18
	40 µg/m3	1 year	Limit value entered into force 1.1.2010*	n/a
PM10	50 µg/m3	24 hours	Limit value entered into force 1.1.2005**	35
	40 µg/m3	1 year	Limit value entered into force 1.1.2005**	n/a
Lead (Pb)	0.5 µg/m3	1 year	Limit value entered into force 1.1.2005 (or 1.1.2010 in the immediate vicinity of specific, notified industrial sources; and a 1.0 µg/m3 limit value applied from 1.1.2005 to 31.12.2009)	n/a
Carbon monoxide (CO)	10 mg/m3	Maximum daily 8 hour mean	Limit value entered into force 1.1.2005	n/a
Benzene	5 µg/m3	1 year	Limit value entered into force 1.1.2010**	n/a
Ozone	120 µg/m3	Maximum daily 8 hour mean	Target value entered into force 1.1.2010	25 days averaged over 3 years
Arsenic (As)	6 ng/m3	1 year	Target value enters into force 31.12.2012	n/a
Cadmium (Cd)	5 ng/m3	1 year	Target value enters into force 31.12.2012	n/a
Nickel (Ni)	20 ng/m3	1 year	Target value enters into force 31.12.2012	n/a
Polycyclic Aromatic Hydrocarbons	1 ng/m3 (expressed as concentration of Benzo(a)pyrene)	1 year	Target value enters into force 31.12.2012	n/a

Annex2 : Frequently Asked Questions

What types of electric vehicles (EV) are available?

The term "EV" refers to all vehicles supplied, partially or fully, by a battery that can be connected directly to the supply network. This document focuses on vehicles intended for individual use.

The term EV contains the following technologies:

- **Pure Electric Vehicles** (Pure EV) – fully electric vehicles operating on batteries. Currently, most builders provide fully electric vehicles with an autonomy of up to 100 miles.
- **Hybrid vehicles with plug supply** (PHEV) – autonomy of over ten miles, after the battery autonomy is exhausted, the vehicle returning to the benefits of the hybrid capacity (using both the battery power and MCI) without loosing its autonomy.
- **Electric vehicles with extended autonomy** (E-REV) – similar to pure EV, but with an autonomy of the battery of approximately 40 miles, the autonomy is extended by an integrated MCI providing extra miles for mobility. In the case of E-REV, the propulsion technology is always electric, unlike PHV for which the propulsion technology can be fully electric or hybrid.

How are EVs driven?

Driving an EV is similar to driving traditional automatic vehicles as pure EVs have generally a forward/reverse selector but no additional gears. Electric vehicles can be driven on a standard driving license.

What advantages do EVs bring?

For the owner/driver, an EV provides:

- Zero tailpipe emissions
- Silent driving at low speeds (over approximately 20kmh, road and wind noise will become apparent)
- A relaxing, practical and easy to drive experience, especially in the stop-start city traffic

What is the maximum speed and acceleration of an EV?

The specifications for electric vehicles differ from one manufacturer too another and provide, in general, similar performance to their ICE equivalents during daily travels. Some high performance pure electric vehicles can reach speeds, of 200 km/h. As the propulsion is delivered through electric power, instant torque is available which can result in greater acceleration compared to ICE vehicles.

What about range?

Same as speed, the range depends on the type of EV. Most pure electric vehicles can travel up to 160 kilometres on a single charge and are ideal for short and medium travels. If you regularly travel longer distances, then an E-REV or a PHV is more appropriate.

In Europe, over 80% of the daily travels are shorter than 100 km.

EV's are also not appropriate for all drivers just as ICE vehicles are recommended for all drivers. Before purchasing an EV, for personal or corporate requirements, you need to assess your requirements (likely journeys, load/passenger capacity). This requirements specification should determine the selection of the vehicle.

Are EVs still a niche vehicle? When will they enter the mass markets?

Most manufacturers already offer EV in their product ranges with sales increasing every period. In Norway, EVs are already the largest selling vehicle in the C class and as product ranges expanded, it is only a matter of time until high sales shall turn EV in a regular presence on roads.

Why will EV sales grow now? Didn't they say this before?

EV provides a series of advantages, besides the reduction of CO2 emissions and implies very low operational costs. Because of this, a series of changes were made to turn EV in a viable proposal:

- EU and the national governments set ambitious objectives to reduce carbon emissions and oil dependence. Therefore, there are a series of incentives available to encourage this
- Increasing the awareness regarding the need to protect the environment and to improve the air quality led to the increase in environmental standards and to the implementation of areas with low emissions supporting the use of EV.
- Technological improvements led to the introduction of newer vehicles for lower prices, providing new levels of services, comparable with MCI vehicles.

CHARGING

How much does it cost to charge an EV?

The charging cost for an EV depends on the size of the battery and the charging capacity of the battery before being charged again. As an approximation, to charge a standard 24 kWh battery (eg Nissan Leaf) from empty, prices start from about €1.50 depending on local electricity prices (€0.06c/kWh). This applies for a pure electric vehicle with a battery of 24 kWh, providing autonomy of 160 kilometres.

If charged during the night, it is also possible to benefit from cheaper off-peak tariffs.. The charging costs for public infrastructure may vary, many of them providing free electricity for short durations.

How long does it take for an EV to charge?

The charging time of an EV depends on the type of vehicle, the battery level and the type of charging point used.

Usually, pure electric vehicles using standard charging need six to eight hours to fully charge and can be occasionally charged at any time to maintain a full battery. Pure EVs that can use fast charging points can be fully charged in under an hour.

What happens if my pure electric vehicle is fully discharged?
Like ICE vehicles, the driver is fully informed about the state of charge left in the battery just like a fuel gauge.

If the driver continues without charging, the consequences are similar to those of ending up without fuel and the recovery services would be required to move the vehicle to a charging facility.

Do I need to install special equipment to charge an EV at home?
EV can be charged by plugging them into a standard plug. If charged outside, a weather resistant plug can also be installed.
At home, it is recommended to install a charging unit on an EV specific circuit, similar to those required for equipment such as an electric oven.
This ensures that your wiring is safe to operate under sustained current without overheating and risk of an electrical fire.

It is recommended to have a safety check carried out by a qualified electrician prior to charging the electric vehicle at home.

For the fast charging, special equipment is required and therefore this is unlikely to be installed at home, where most consumers charge the vehicle over night.

How do I pay for the charging?
If you charge your vehicle at home, the price for the power used to charge your vehicle will be included on your power bill. Power companies are also interested in installing smart chargers for consumers, so that you may choose when to charge your vehicle and also to take advantage of low tariffs (for instance, over night).

How do I charge my electric vehicle from power sources with low carbon content?
If you charge at home, you may request a green power tariff from your supplier.

While the proportion of 'clean' energy generation differs by country across Europe, all states are committed to reducing their reliance on 'dirty' generation under EU legislation. Additionally, from an urban perspective and as noted in Chapter 2, the impact on human health from vehicle emissions is significant. By removing tailpipe emissions in the urban environment, significant improvements will be made to our health.

Are all EV and charging points fitted with appropriate plugs and supply terminals? Can I charge my electric vehicles in other countries as well?
In January 2013, the EU launched the Clean Fuels Strategy [33] to support alternative fuels across Europe with common standards. As such the type 2 (mennekes) connector was defined as the standard for the whole of Europe.

Can anyone disconnect my car during charging?
For vehicles charged at home, this is unlikely and most charging points can be locked. Some (smart) charging points are also able to advise the owner by means of a SMS if the vehicle is disconnected unexpectedly or when charging is complete.

Is the charging safe during rain?
Yes, charging during rain is safe. Weather resistant equipment is installed and, should you install a home charging device, your supplier can provide several recommendations regarding the supply safety.

BATTERIES

What battery technology is used?
Modern EVs use lithium-ion batteries, similar to those used for laptops, etc. These provide good power to weight ratios which allow significant vehicle range to be achieved from a smaller volume of battery compared to older technology such as lead acid batteries.

Is there enough lithium and other material for the battery production or the oil dependence shall become the lithium dependence?
Yes. Lithium and the other 'rare' earth metals used in battery production can be found in many locations and stocks are sufficient to meet demand.

What is the lifespan for an EV battery?
Battery manufacturers usually consider that the end of a battery lifespan occurs when its capacity falls below 80% of its storage capacity – which of course does reduce the effective range. This means that, if your original battery had a range of 160 kilometres when fully charged, after eight to ten years (depending on the kilometres travelled), it *may* have reduced to 100 kilometres.

It should be noted however that in an American study from 2013, battery capacity in vehicles travelling over 160,000kms was still over 80%[34].

Research also presented in 2013[35] found that battery packs "*could be used during a quite*

[33] http://europa.eu/rapid/press-release_IP-13-40_en.htm
[34] http://www.plugincars.com/tesla-roadster-battery-life-study-85-percent-after-100000-miles-127733.html
[35] 245th National Meeting & Exposition of the American Chemical Society (ACS)

reasonable period of time ranging from 5 to 20 years depending on many factors" (Dr Mikael Cugnet)

When the battery pack may no longer be suitable for an EV there is a growing recognition of the 'second life' usage which can include back up power solutions for computers or medical equipment, use in powering remote monitoring or communication stations (supported by solar charging) or in general grid storage.

At the point that the batteries can no longer be used for their designed use, they can then be recycled with normal lithium-ion batteries between 70 and 100% recyclable. Due to their composition, especially the rare earth metals, this make them extremely valuable and as volumes increase greater recycling will occur.

Does the use of radio and lights affect the battery?

Yes, this will have some impact on the energy drain, similar to how using air conditioning in and ICE vehicles increases fuel consumption. The technology in new EVs however is designed to minimise power consumption across the whole vehicle.

Can batteries be recycled?

Yes.

SERVICE, REPAIRS AND DAMAGES

Can I repair an EV?

Just like any other new vehicle, manufacturers provide service technicians detailed instructions and training for services. Moreover, industrial training programs have been implemented to ensure that dealers, technicians, production staff and the emergency services staff are qualified to deal with EV.

What are the service costs for an EV?

Due to the absence of many moving parts, such as the engine and clutch etc, servicing requirements are very much reduced. When other services are required, such as brakes, these are similar to those for ICE vehicles. For hybrid vehicles, normal service procedures shall also exist.

Can an EV be towed just as regular cars?

Like ICE vehicles, different manufacturers may impose different rules so you should always check the vehicle handbook; however EVs are likely to be treated like other automatic vehicles (for instance, speed limit and / or towing distance).

Does an EV operate during cold weather?

Yes. Same as for any other new vehicle, manufacturers have significant testing in extreme weather conditions. Moreover, the country with the highest number of EV held is Norway, where the weather is significantly colder that in most places in Europe.

EMISSIONS, POWER, NETWORK

Will the increase in the number of EV lead to the increase in the emissions (from energy generation plants)?

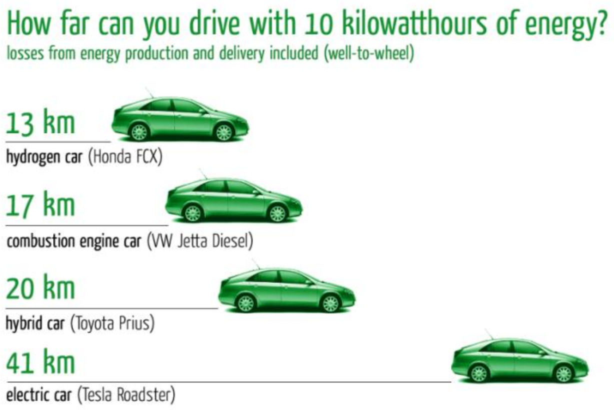
No. The power industry in Europe is limited by the annual values of CO_2. This limit reduces the annual emissions to obtain a total reduction of CO_2 emissions. Should the total power demand grow, as an effect of adopting EV (or for any other reason), the growth of such demand will be met from renewable or carbon free sources.

Are EVs really energy efficient?

In comparing EVs with ICE vehicles, a 'Well to Wheel' measure of efficiency is used. This is a way to calculate the entire process of creating and using fuels to provide power to the wheels of a vehicle). This shows just how much more efficient an EV is over other vehicle types.

Well to Wheel Efficiency[36]

Internal Combustion Engine	●15%
Electric Engine with fossil fuel	●25%
Electric engine with green electricity	●65%



Can the electricity distribution network cope with increased demand?

There were some concerns regarding the fact that the network could not cope with the demand increased by EV.

However, research undertaken by network operators has demonstrated that most charging will be done outside peak periods and that the network should cope with the demand generated by EV.

A benefit of traditional energy generation systems is their ability to quickly respond to increases in energy demand (one of the biggest spikes in UK energy demand occurred after the penalty shoot out between England and West Germany in the 1990 world cup semi-final!).

Renewables however, particularly wind and solar, can produce highly intermittent or time sensitive

---

[36] http://ecars-now.wdfiles.com/local--files/why%3Aenergy-efficient/welltowheel.png

generation. This can create an issue for the distribution network operators (DNO) who need to balance energy demand and production. EVs provide a significant opportunity to stabilise this demand as they can store the excess electricity which can then be returned to the grid as demand increases. Known as 'vehicle to grid' (V2G) this can provide additional resilience to the network and be a potential source of revenue for vehicle owners as batteries may be charged overnight when electricity charges are low and then discharged back into the grid at peak demand at a higher rate. While still under development, this holds significant potential.

Annex 3 : Good practice example – clean city logistics

The E-City-Logistik project as part of the "Model Region Electromobility Berlin/Potsdam" tested the use of electric freight vehicles and evaluated two areas of application: local distribution in the Courier, Express and Parcel (CEP) delivery sector and the supply of retail stores in inner-city areas.

The test locations were high-density districts with different functions, such as housing and shopping streets (e.g. Steglitz/Friedenau) and retail locations (e.g. Kurfürstendamm). Deutsche Post DHL employed three electric transporters (Iveco Electric Daily 3.5t) for parcel delivery, while Meyer & Meyer Transport Services used electric trucks (modified MAN, 11t) to supply two major retail outlets in Berlin. E-City-Logistik has proven that the use of electric vehicles works for both the CEP sector and the supply of retail stores without any restrictions.

The EC funded FREVUE project consists of industry partners, public sector bodies and research and networking organisations. Eight cities in Europe demonstrate that electric vehicles operating "last mile" freight movements in urban centres can offer significant and achievable decarbonisation of the European transport system. The project covers the breadth of urban freight applications that are common across Europe, including goods deliveries, novel logistics systems and associated ICT, vehicle types and the diverse political and regulatory settings within Europe.

Key Characteristics
With regular routes, limited distances and frequent stops, inner-city delivery and city logistics provide an ideal field of application for electric freight vehicles.

The advantages of using EFV include the reduction of local noise and air emissions. EFVs can also enable greater flexibility such as out of hours (night time) deliveries and access to formerly restricted areas such as pedestrian zones.

Annex 4: Financing schemes for charging stations - good practice

Rotterdam
Rotterdam will implement a minimum of 1,000 public and private charging stations at strategic locations combined with applicable parking places for private and company electric car users throughout the city by the end of 2014.

This will be done in three different ways: (a) on private property, (b) in public parkings and (c) in the public street.

When on private property owners, will be reimbursed for the cost of the charging point along with the first year's of electricity consumption. In public parking areas and on street locations, a charging station and free parking space will be provided to electric vehicle owners until the end of 2014.

The goal is to have a reliable, recognisable and uniform network of public, semi-public and private charging stations throughout the city as soon as possible. As a result of these charging infrastructure plans, altogether more than 380 charging spots are already (July 2013) available, allowing users to charge their vehicles everywhere they go.

Frankfurt
The "Frankfurt Model" facilitates the charging of EVs on streets and in car parks without prior approval by the respective operators. Instead of by electricity, the revenue is generated by selling parking time. The model envisages the use of existing parking ticket machines for the payment of parking and electricity.

Key Characteristics
The installation of charging infrastructure is a necessary condition for the market diffusion of electric vehicles. While private parking spaces are the primary choice of charging, especially overnight, charging stations at (semi-)public spaces are important to promote electric driving.

The main challenge for the installation of (semi-) public charging stations is the establishment of sustainable business and financing models, since the revenue on the electric power usually does not cover the cost of installation.

Innovative approaches for financing schemes include combinations of parking and charging fees, using registration data for generation of additional revenues such as advertising ring, significantly increased prices for electric power at public charging stations and for special services like fast charging, or public-private partnerships.

Key Benefits

Financial schemes for charging stations:

- take technical as well as economic viability into account;
- form the basis for a sufficient and sustainable build-up of charging points within a city;
- make the use of charging points attractive and convenient for customers;
- integrate different stakeholders in the market for charging infrastructure products and services;
- will help to comply with EV legislation.

Annex 5: Policies, strategies and measures providing a framework for the development of the clean public transport in Europe

Policies, strategies and measures reflecting the vision on European urban mobility

- Green Paper ‘Towards a new culture for urban mobility’ (COM(2007) 551)
- Action Plan on Urban Mobility (COM (2009) 490)
- White Paper on Transport ‘Roadmap to a Single European Transport Area – towards a competitive and resource efficient transport system’ (COM (2011) 0144)
- Expected Urban Mobility Package (2013)

Policies, strategies and measures aiming to reduce GHG emissions and improve air quality

- The Ambient Air Quality Directives (Directives 96/62/EC (‘Framework Directive’) and four ‘daughter directives’ 1999/30/EC, 2000/69/EC 2002/3/EC, 2004/107/EC and Council Decision 97/101/EC)..
- The National Emission Ceilings directive (Directive 2001/81/EC)
- The 2005 Thematic Strategy on Air pollution (COM(2005) 446)
- The EU Air Source Abatement Policy Framework
- New Air Quality Directive (Directive 2008/50/EC)
- Regulation 595/2009 on type-approval of motor vehicles and engines with respect to emissions from heavy duty vehicles (Euro VI)

Policies, strategies and measures aiming to reduce CO2 emissions and to address energy security

- A Strategy for competitive, sustainable and secure energy (COM(2010) 639)
- Green Paper - Towards a secure, sustainable and competitive European energy network (COM(2008) 782)
- Action Plan for Energy Efficiency: Realising the Potential (COM(2006) 545)
- Directive on the promotion of the use of energy from renewable sources (Directive 2009/28/EC amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC) and proposal
- Renewable Energy Road Map.. Renewable energies in the 21st century: building a more sustainable future’ (COM(2006) 848)

Policies and strategies addressing noise levels in urban areas

- Directive 70/157/EEC193 concerning the permissible sound level and the exhaust system of motor vehicles (further amending Directive 2007/34/EC)
- Council Directive 97/24/EC194
- Commission green paper on future noise policy (COM(96)540)
- Directive 2001/43/EC
- Environmental Noise Directive (2002/49/EC)

Annex 6: Electric and hybrid bus for public transport

Electric buses can operate fully autonomous via on board batteries or continuously powered such as trolley-buses. With the operational benefits of EV, regular duty cycles and high passenger capacities, they are well-suited for urban public transport operations.

Full battery electric buses represent a new approach with operational charging able to be undertaken overnight at the depot and/or at fixed spots along the bus route (opportunity charging).

Trolley buses have been used for decades and are a very mature technology. Using overhead catenary lines, like with trams, they are continuously connected to the power supply. Research is also being undertaken into semi-autonomous vehicles using lower capacity on-board batteries that enable the vehicle to operate over short distances without the use of catenary lines.

Electric bus
Two types are available:

- Opportunity e-buses aim to minimize the weight of the battery by recharging en route at passenger stopping points. They have medium battery capacity (typically 40-60 kWh) and need regular charging from the grid at intermediate stops.
- Overnight e-buses carry the weight of battery required to drive the entire route without recharging. They have a larger battery capacity (typically >200kWh) and recharge the battery from the grid only at the depot.

Operational performance

- Opportunity – charging buses:
  - Short free range of <100 km.
  - Limited route flexibility
  - Recharging needed multiple times a day
  - Short recharging time: 5-10 min
  - Energy consumption 2012 (based on prototypes): 1..8 kWh/km
  - Energy consumption 2030: 1..58 kWh/km

- Overnight – charging buses:
  - Medium free range: 100 - 200 km;
  - Higher route flexibility
  - Recharging at the end of each day
  - Very long recharging times: more than 3 hours
  - Energy consumption 2012 (based on prototypes): 1.91 kWh/km
  - Energy consumption 2030: 1..68 kWh/km

Both opportunity and overnight-charging buses charging time depends on the power of charging station and battery technology.

In service life is estimated to be 12-15 years, depending on duty cycle, ambient conditions and charge rate.

Appendix 7 : Calculating the cost of financial penalties

The following calculation is to be used when assessing the penalties for member states in breach of their obligations

Dp = (Bfrap x Cs x Cd) x n
where: Dp = daily penalty payment;
Bfrap = basic flat-rate amount "penalty payment";

- Currently this €660 per day

Cs = coefficient for seriousness;

- This factor helps assess the importance of the rules breached and the impact of the infringement on general and particular interests. Of particular note, is that with regard to the effects of the infringement, the Court should expressly take into account *serious or irreparable damage to human health or the environment*

Cd = coefficient for duration;

- This is related to the period between the first Court judgement up to the date the matter is referred to Court and is a multiplier of between 1 and 3 calculated at 0.10 per month from the date the judgement was delivered.

n = factor taking into account the capacity to pay of the Member State concerned.

- The "n" factor is a set multiplier based on, among other things, the GDP of the member state.
- Currently these are set at:

Germany	21.22
Poland	7.75
Romania	3.28
United Kingdom	18.02

Appendix 8: Examples of National Incentives

EU Country	**Incentive description**
AT (AUSTRIA)	EV's are exempt from the fuel consumption tax and from the monthly vehicle tax.
BE (BELGIUM)	EV's are exempt from registration tax in Flanders. They pay the lowest rate of tax under the annual circulation tax in all three regions. "Ecology premiums" are available in Flanders for companies investing in the purchase of pure electric, The deductibility from corporate income of expenses related to the use of company cars is 120% for zeroemissions vehicles and 100% for vehicles emitting below 60 g/km of CO 2. Above 60 g/km, the deductibility rate decreases gradually from 90% to 50%.
CZ (CZECH REPUBLIC)	Electric, hybrid and other alternative fuel vehicles are exempt from the road tax (this tax applies to cars used for business purposes only).
DE (GERMANY)	EV's are exempt from the annual circulation tax for a period of ten years from the date of their first registration.
DK (DENMARK)	EV's weighing less than 2,000 kg are exempt from the registration tax. This exemption does not apply to hybrid vehicles.
FI (FINLAND)	Electric vehicles pay the minimum rate (5%) of the CO2 based registration tax.
FR (FRANCE)	Vehicles emitting 20 g/km or less of CO 2 benefit from a premium of € 6,300 under a bonus-malus scheme. For vehicles emitting between 20 and 60 g/km, the premium is € 4,000. For such vehicles, the amount of the incentive cannot exceed 20% of the vehicle purchase price including VAT, increased with the cost of the battery if this is rented. For vehicles emitting less than 20 g/km, this is 27% of the purchase price. Hybrid vehicles emitting 110 g/km or less of CO 2 benefit from a premium of € 3,300. Electric vehicles are exempt from the company car tax. Hybrid vehicles emitting less than 110 g/km are exempt during the first two years after registration.
GR (GREECE)	Electric and hybrid vehicles are exempt from the registration tax, the luxury tax and the luxury living tax. Electric passenger cars and hybrid passenger cars with an engine up to 1,929 cc, are exempt from the circulation tax. Hybrid cars with a higher engine capacity pay 50% of the normal circulation tax rate.
HU (HUNGARY)	Electric vehicles are exempt from the registration tax and the annual circulation tax.
IE (IRELAND)	EV's benefit from VRT (registration tax) relief up to a maximum of € 5,000. For plug-in hybrids, the maximum relief is € 2,500. For conventional hybrid vehicles and other flexible fuel vehicles, the maximum relief is € 1,500.
IT (ITALY)	EV's are exempt from the annual circulation tax (ownership tax) for a period of five years from the date of their first registration. After this five-year period, they benefit from a 75% reduction of the tax rate applied to equivalent petrol vehicles in many regions.
LU (LUXEMBOURG)	Purchasers of electric or plug-in hybrid vehicles emitting 60 g/km or less of CO 2 receive a premium of € 5,000. The purchaser must have concluded an agreement to buy electricity from renewable energy sources in order to obtain the premium.
LV (LATVIA)	Electric vehicles are exempt from the registration tax.
NL (NETHERLANDS)	EV's are exempt from the registration tax BPM. Other vehicles including hybrid vehicles are also exempt from the registration tax if they emit maximum 85 g/km (diesel) or 88 g/km (petrol) of CO 2 respectively. Vehicles emitting maximum 50 g/km of CO 2 are exempt from the annual circulation tax.
PT (PORTUGAL)	EV's are exempt from the registration tax ISV and from the annual circulation tax. Hybrid vehicles benefit from a 50% reduction of the registration tax.

RO (ROMANIA)	Electric and hybrid vehicles are exempt from the registration tax.
SE (SWEDEN)	**Five year exemption from paying annual circulation tax:** EV's with an energy consumption of 37 kWh per 100 km or less are exempt from the annual circulation tax for a period of five years from the first registration. Five year exemption applies to electric hybrid and plug-in hybrid vehicles that fulfill the new green car definition applied for new registrations from 1 January 2013. The definition is dependent on the CO2 emission in relation to the curb weight of the car. **Reduction of company car taxation:** For electric and plug-in hybrid vehicles, the taxable value of the car for the purposes of calculating the benefit in kind of a company car under personal income tax is reduced by 40% compared with the corresponding or comparable petrol or diesel car. The maximum reduction of the taxable value is SEK 16,000 per year. **Super green car premium new cars:** A so called "Super green car premium" of SEK 40,000 is available for the purchase of new cars with CO2 emissions of maximum 50 g/km. The premium is applied both for the purchase by private persons and companies. For companies purchasing a super green car, the premium is calculated as 35% of the price difference between the super green car and a corresponding petrol/diesel car, with a maximum of SEK 40,000. The premium will be paid for a total of maximum 5000 cars.
UK (UNITED KINGDOM)	Purchasers of EV's and plug-in hybrid vehicles with CO2 emissions below 75 g/km receive a premium of £ 5,000 (maximum) or 25% of the value of a new car or £ 8,000 (maximum) or 20% of the value of a new LCV meeting eligibility criteria (for example, minimum range 70 miles for electric vehicles, 10 miles electric range for plug-in hybrid vehicles). Electric vehicles are exempt from the annual circulation tax. This tax is based on CO2 emissions and all vehicles with emissions below 100 g/km are exempt from it. EV's are exempt from company car tax until April 2015 and electric vans are exempt from the van benefit charge until that date too. EV's and other vehicles emitting less than 95 g/km of CO 2 can claim a 100% first-year allowance for depreciation.
SK (SLOVAKIA), SI (SLOVENIA), PL (POLAND), LT (LITHUANIA), MT (MALTA), EE (ESTONIA), HR (CROATIA), ES (SPAIN), BG (BULGARIA), CY (CYPRUS) - do not have the financial support schemes	

URBACT II

URBACT is a European exchange and learning programme promoting sustainable urban development.

It enables cities to work together to develop solutions to major urban challenges, reaffirming the key role they play in facing increasingly complex societal challenges. It helps them to develop pragmatic solutions that are new and sustainable, and that integrate economic, social and environmental dimensions. It enables cities to share good practices and lessons learned with all professionals involved in urban policy throughout Europe. URBACT is 181 cities, 29 countries, and 5,000 active participants

www.urbact.eu/project

European Union
European Regional Development Fund

EUROPEAN PROGRAMME FOR SUSTAINABLE URBAN DEVELOPMENT
URBACT