Towards low/zero-carbon urban mobility in Europe

Recommendations following the Transport White paper ‘Roadmap to a Single European Transport Area – Towards a competitive and resource-efficient transport system’

Given its intrinsic advantages in terms of GHG avoidance and reduced carbon emissions as well as its potential for further improvement, public transport must be at the core of any climate change mitigation strategy.

Public policies on mobility, funding included, should give priority to the development of smart, integrated urban mobility concepts. High quality, efficient and attractive public transport networks bring economic and environmental benefits and can be complemented by car and bike sharing schemes, as well as taxis. Public funding that encourages private mobility options (including the electric car) over collective mobility should be called into question.
Recommendations for the European Institutions:

- **Officially support sector initiatives that will help deliver the targets set by the Transport White Paper.** In June 2009, the International Association of Public Transport (UITP) set out an ambitious aim for the sector, namely to double the market share of public transport worldwide by 2025. Many cities have already taken up the challenge and are working towards this goal, in line with their specific political, geographical and historical contexts. Those efforts should be officially recognised and promoted by the European Institutions.

- **Propose guidelines for local authorities on low-carbon urban mobility.** Such guidelines should be based on best practice and should also cover funding and financing of investment.

- **Sending the right message to citizens by ensuring that prices are fair and reflect the true cost of transport to society.** Urban mobility patterns are the result of individual choices made by citizens each time they plan a journey. There is a need to establish guidance for cities at the European level on the different possible ways of reflecting the external costs of mobility in the price of transport. These guidelines should also address the question of how to use the money collected, which should be reinvested in the development of more sustainable modes of transport, such as public transport. This is crucial to enable these modes to reach their full potential.

- **Act as enabler and facilitate the massive investments required through appropriate frameworks and instruments,** including ensuring easier access and attractiveness for private capital.

- **Earmark more resources for the development of sustainable urban mobility based on high quality public transport networks,** in particular within the possible future European Transport Fund, the Cohesion and Structural Funds and the next Framework Programme for Research.

- **Support the development of multi-modal journey planners following a distributed and decentralised approach.** Some European funding should be made available for pilot projects. Multi-modal journey planners are important tools to better inform passengers; they influence modal choices and have the potential to increase usage of environmentally friendly modes. In this context, it is crucial to make sure that the information given to the customer is reliable, updated and complete. The responsibilities in this area have to be very clear. For this reason, UITP proposes a bottom up approach, using existing information sources at local/regional/national levels to guarantee the quality of the information. Such a pilot project could be started very quickly.

- **Provide adequate support to Research and Development programmes** based on coherent roadmaps recognised by the sector (such as the EBSF/ERTRAC Roadmap for urban bus systems or the ERRAC roadmap for urban rail systems). Particular attention should be given to clean technologies adapted to the requirement of public transport.

- **Take into account specific operating conditions and drive cycles when setting CO₂ limits for heavy duty vehicles.** In the case of urban buses, the number of passengers transported should be taken into account and CO₂ measurements should be based on relevant urban drive cycles, as described by the SORT methodology. A more realistic urban drive cycle would help ensure Euro standards deliver on reducing air pollutants.

---

1 SORT: Standardised On-Road Tests Cycles (UITP methodology)
Executive Summary

To tackle the problem of global warming, the concept of ‘decarbonisation’ of transport has been put forward. The public transport community supports the ambitious targets proposed in the recently published EU Transport White Paper.\(^2\) Public transport is already helping cities to master their transport energy consumption and is willing to contribute more towards low-carbon mobility.

In Europe, urban public transport ensures 21% of total motorised mobility and is responsible for roughly 10% of transport related Green House Gas (GHG) emissions. Currently, between 40 and 50% of public transport is already powered by electricity. Public transport has therefore been a major, reliable electromobility provider for decades. In addition, the greatest GHG good created is avoidance by enabling a substantial reduction of energy usage for every kilometre travelled by passengers!

Taking advantage of readily available solutions to achieve the intermediary objective of decreasing GHG emissions by 20% by 2030:

- **Strong modal shift ambitions** are needed, as technology alone cannot deliver the required change within the time frame. This option will also generate a number of additional benefits in terms of employment, congestion, accidents and energy supply.

- **Increasing commercial speed and reliability** for collective modes of transport, by providing priority at traffic lights and reserved corridors/lanes, etc. is vital. An increase of 5km/h in buses’ commercial speed on a busy line leads to 20% less energy consumption and attracts more passengers.

In addition, public transport is able and willing to further decrease its carbon footprint:

- The **smart use of the resources** through an efficient management of the energy on board and in the whole system is a key point.

- **Buses** account for 50-60% of the total public transport offer in Europe, and 95% still use diesel fuels. Long-term decarbonisation efforts obviously include buses powered by electricity, but also by second-generation biofuels. The fragmentation of alternative technologies is an obstacle for the manufacturing industry in terms of allocating R&D funds. Any alternative to diesel buses comes with a price tag.

- **Rail transport** in urban areas already runs almost exclusively on electricity. In the last decade, passenger rail transport has decreased its specific energy consumption by 22%.

- **Electric cars** should be deployed in areas complementary to public transport, such as taxis or car sharing (captive car fleets) and in areas with poor public transport whether rural communities or outlying suburbs.

---

\(^2\) “...a reduction of at least 60% of GHGs by 2050 with respect to 1990 is required from the transport sector, which is a significant and still growing source of GHGs. By 2030, the goal for transport will be to reduce GHG emissions to around 20% below their 2008 level.” COM(2011)144 final, page 3

---
Introduction

To tackle the societal problems of global warming and security of energy supply, the EC have put forward the concept of ‘decarbonisation’, together with increased resource-efficiency. Low or zero carbon mobility with low energy consumption is essential for a sustainable future and competitive cities where people, businesses and culture can thrive.

The public transport community represented by UITP welcomes this concept and supports the CO₂ reduction targets proposed in the White Paper on Transport Policy. Public transport is already helping cities to master their transport energy consumption and is willing to contribute more towards low-carbon mobility.

Individual electromobility has been enjoying strong political interest and press coverage lately. It is depicted as the solution for future clean urban mobility, however, much of the benefit will be delivered in the (distant) future, while electrically powered public transport is already delivering low-carbon transport to many people right now - and it can do more. This paper aims at highlighting these alternative solutions. Future urban mobility cannot rely solely on electric cars though they might form part of an integrated approach.

1. Vision

In 2009, UITP forged its development strategy for the urban public transport sector worldwide up until 2025. Based on this vision, urban mobility will have succeeded in reducing its carbon footprint and dependency on fossil fuels by 20% as the result of clever initiatives undertaken in policy and technology areas.

Energy-efficient collective transport will have become the preferred choice in policy decisions, based on systematic carbon footprint evaluation of projects. Cities will be regenerated and their density increased along major transport corridors. Most mobility assets will be shared instead of owned by users, and range from conventional public transport to taxi, car-sharing, bike-sharing, and car pooling.

Convenient and reliable lifestyle services will be offered to connected citizens who can easily access a diversified portfolio of integrated mobility services within walking distance of their home, work or recreational areas. Systems and technologies will have been developed and improved to achieve long-lasting, reliable and affordable decarbonisation of most of these shared assets.

2. What is the carbon footprint of our sector?

2.1 Today?

In Europe today, urban mobility consumes 140 million tons of oil equivalent per year and emits 470 million tons of CO₂ equivalent (i.e. 8% of total GHG emissions). Public transport in urban areas is carrying 200 million people every day (i.e. 21% of total motorised mobility) and is responsible for roughly 10% of transport related GHG emissions in cities.

It is estimated that the proportion of public transport already powered by electricity today ranges from between 40 and 50%, with Germany in the lead with 66%. This reflects the fields of well-established, proven and reliable commuter railways, metro, light rail, trams and trolleybuses operated in the EU and carrying each day 90 million passengers on 189 LRT systems, 45 metro systems, 90 trolleybus systems and in regional and suburban railway networks. Public transport has thus already been a major and robust electromobility provider for decades!

On the other hand, electrification of cars has yet to move beyond the pilot testing phase, and many elements remain unknown (price, acceptance, business models, infrastructure, etc.). The effect of those vehicles on decarbonisation relies largely on the quality of the electricity supply. Use of electric vehicles will move emissions from the tail-pipe to the power station. They do not avoid carbon generation rather they displace it.

---

3 White Paper “Roadmap to a Single European Transport Area? minus 20% CO₂ emissions in the transport sector until 2030 (compared to 2008 levels) and minus 60% CO₂ emissions until 2050 (compared to 1990 levels)

4 Urban mobility scenarios 2005-2025, UITP, 2011

5 Average for 44 European cities above 250,000 inhabitants, Mobility in Cities Database, UITP, 66% in Germany for 2009 (based on passenger x km) – Prof.-Dr. A. Müller-Hellmann, Elektromobilität im ÖPNV – Erreichtes und weiteres Vorgehen.

6 UITP internal sources consolidated in: Suburban and Regional Railways Landscape in Europe, ERRAC, 2006 and Light Rail and Metro Systems in Europe, ERRAC, 2011
Despite energy efficiency improvements in private cars in recent years, public transport retains a competitive edge in terms of energy consumption: It consumes on average half as much energy per passenger-kilometre. In rush hour, this difference is even greater. Beyond more efficient energy use, there are additional benefits by reducing congestion and pollution resulting from public transport use.

2.2 And in 2025?

Using the Mobility Model of the International Energy Agency (IEA), UITP was able to make predictions for mobility in cities. Projections were made for two scenarios: a ‘business as usual’ (BAU) scenario and an ‘offensive modal shift’ (PTx2) scenario. The former scenario assumes a continuation of current trends for demand (slight increase in PT demand) and for technological progress (incremental improvements at the same rate as the last decade; no revolutionary breakthrough).

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2025 BAU</th>
<th>2025 PTx2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban mobility</td>
<td>1,310</td>
<td>1,650 (+ 26%)</td>
<td></td>
</tr>
<tr>
<td>(trips/day in millions)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO₂ equivalent</td>
<td>470</td>
<td>440 (-7%)</td>
<td>380 (-20%)</td>
</tr>
<tr>
<td>emissions (million tons)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This shows that the intermediary objective of the Transport White Paper (and by the same token the 20/20/20 strategy of the EU) cannot be achieved solely through technological progress, but requires a mix of technology and policy measures aimed at modal shift. More electrical transport is one way of decarbonising transport. However, electricity is not green by nature. The primary energy mix available has to be considered: fossil fuel combustion, nuclear plant or renewable solutions all have different environmental profiles and carbon footprints. According to an official source, GHG emissions of electric cars range from 76 to 262 grams per passenger-kilometre (138g for the so-called EU electricity mix). Taking their whole lifetime’s emissions into account, electric vehicles are not much better than conventionally fuelled cars. In any case, with emissions between 17 and 48 grams per passenger-kilometre, public transport is unbeatable.

3. Action is needed ...now!

In view of the current situation and the intermediary 2030 horizon of the EU Transport White Paper, there is no time to lose. Reaching a 20% GHG reduction on 2008 levels requires strong modal shift ambitions. This option generates additional considerable benefits:

| Employment: creation of 100,000s of new green local jobs |
| Congestion: 300 million fewer trips by car every day in European cities, with associated congestion, space consumption and cost relief. |
| Saving hundreds of human lives through reduced health risk exposure and accidents. |
| Energy supply: preservation of 10 million tons of fossil fuels equivalent per year. |

Despite its excellent record, public transport is able and willing to further decrease its carbon footprint, as the next chapters will describe. Attention must be drawn to the initial and recurrent costs of decarbonisation efforts.

---

7 Tank-to-wheel value, as opposed to well-to-wheel
8 It is possible to envision a disruptive technological breakthrough with superior GHG mitigation perspectives. However, this ‘all technology’ option will not deliver significant changes before 2030. Can we afford to wait for results?
9 Presidency Conclusions of the Brussels European Council (8/9 March 2007): EU targets of decreasing CO₂ emissions by 20%, reaching 20% of renewable energies and 20% more energy efficiency by 2020.
3.1 Modal shift: the best carbon reducing strategy

- **Strong modal shift ambitions** are needed. The excellent energy and carbon efficiency per passenger-kilometre of public transport is achieved with average vehicle space occupancy of 20% over a full day, based on empirical observations. Increase of this load factor will automatically generate an improvement in the carbon performance of public transport. Therefore, the best and most efficient strategy towards low-carbon mobility is to favour modal shift to public transport, walking, cycling and combined mobility\(^\text{11}\) (car-sharing, car pooling, taxis, etc.).

Aggressive modal shift policies include supply and demand measures to make an attractive service part of the urban lifestyle. Customers expect mobility solutions that are quick, safe and secure, convenient, reliable, clean, comfortable and affordable, with clear information to complete the package. In addition, for public transport to become citizens’ mode of choice, it has to become the mode of choice of decision-makers implementing integrated urban policies to optimise the benefits of public transport and supportive mobility management to steer demand\(^\text{12}\).

- **Traffic management and increased commercial speed and reliability** for collective modes of transport, for example priority at traffic lights and reserved corridors/lanes, are vital. Local authorities can also play a crucial role in the reduction of GHG emissions by providing better operating conditions for buses. As energy consumption is inversely proportional to the average speed (in urban traffic conditions), priority at traffic lights and reserved corridors/lanes are a major GHG abatement factor. An increase of 5km/h of commercial speed on a busy line leads to 20% less consumption, and thus of GHG emissions\(^\text{13}\).

In addition, there is potential for improvement of the emission efficiency of public transport.

3.2 Decarbonisation of urban public transport

- The **smart use of resources** (optimum performance to energy use ratio) through an efficient management of the energy on board and in the whole system is a key point for public transport in general, in order to maintain its sustainability advantage. The manufacturing industry, both for rail and bus, is working on traction efficiency, energy recuperation and weight reduction\(^\text{14}\).

- **Buses** still account for 50-60% of the total public transport supply and demand in Europe, ranging from a 50% share in larger cities with multimodal networks up to 100% in smaller towns and medium-sized cities. Bus fleets have been a testing ground for alternative fuels, engines and drivelines for many years. However, 95% of all buses still use fossil fuels\(^\text{15}\).

Long-term decarbonisation efforts obviously include electric buses, but also second-generation biofuels from biomass and waste valorisation\(^\text{16}\). The fragmentation of this 5% share of alternative fuels and technologies today (CNG, LPG, biofuels and biogas, ethanol and electric) or tomorrow (hydrogen, hybrids, full battery electric, fuel cells etc.,) places the manufacturing industry in an uncomfortable position when prioritising R&D investments; which technology will be the ‘mainstream successor’ of diesel?

Any alternative to diesel buses will come with a price tag. The precise cost increase is not known today, but early empirical indicators suggest +30% for CNG and +50/100% for hybrid vehicles. It is premature to derive full life cycle cost estimations. All efforts must be made to ensure that increased cost of new fuels or technologies do not – in tight budgetary times – result in reduced services. Pushing public transport ridership away to single-occupancy, cars will have adverse GHG emissions implications.

---

11 Further reading: *Becoming a real mobility provider - Combined Mobility: public transport in synergy with other modes like car-sharing, taxi and cycling*, UITP Focus paper, April 2011
12 For detailed reading: *Public Transport, the smart green solution – doubling the market share of PT worldwide by 2025*, UITP, 2009
13 UITP Project Sорт, Standardised On-Road Tests cycles, 2009, page 8 figure 3.
16 So-called first generation bio-fuels are derived from agriculture output and triggered a conflict over the purpose of use of fertile land: energy or food.
As a long term aim bus fleets in Europe, i.e. 16,000 buses and coaches produced annually in Europe for the European market could be transformed into electric fleets without any disruption to the existing grid and installed power. Can the same be said for the entire car fleet, or even a part of it?

- **Rail transport** in urban areas is already today running largely on electricity. In the last decade, passenger rail transport succeeded in decreasing its specific energy consumption by 22%\(^{17}\). There are further energy savings to be achieved by using lighter weight/composite materials (30% potential energy savings), and by optimising energy recuperation devices (up to 45% potential energy savings) and train operation management.

- **Electric cars** are enjoying massive attention and development. UITP believes that the easiest and most logical deployment strategy would be to focus on captive car fleets in the first instance. This can be the case of cars used as shared assets, in such a way as to complement public transport, such as taxis or car sharing schemes, where the whole issue of charging facilities can be tackled more easily, with dedicated or priority access. In addition, public transport operators rely on relatively large fleets of support vehicles, primarily vans. Electrification of these vehicles would enable public transport to further reduce its carbon footprint\(^{18}\). Also privately held business fleets could be encouraged to move to low carbon options such as electrified vehicles.

Finally, public transport also offers additional characteristics that contribute to delivering improved GHG performance and are linked to **operation and infrastructure**:

- **Operational efficiency gains**: Public transport companies employ qualified drivers that have various legal vocational requirements and training\(^{19}\), as well as voluntary corporate schemes. Eco-driving has proved to be a useful tool to increase passenger comfort and reduce energy consumption and GHG emissions by 5-10%. Many companies have already developed such schemes, contributing to a reduction of thousands of tons of CO\(_2\) equivalent.

- There is great potential for energy savings in **infrastructure**, both for new and older assets. This includes escalators, lifts, building insulation, heating, cooling, cogeneration, lighting, etc. Another example is the increasingly popular production of renewable electricity from photovoltaic panels installed on roofs of maintenance and parking/stabling facilities when tax or investment incentives are available.

\(^{17}\) Verband des Bahnindustrie in Deutschland, *Politikbrief*, January 2011

\(^{18}\) Financing of those measures should come from funds other than the public transport budget in order not to cannibalise the financing available for public service obligations

\(^{19}\) E.g. Dir. 2003/59/CE on vocational training requires a minimum of 35 hours every 5 years.
**Conclusions**

Public transport has been providing massive carbon-efficient mobility for more than a century: we don’t promise; we deliver!

Low-carbon mobility in cities requires a holistic concept based on a mix of policy, technology and behavioural changes, the well-known Avoid/Shift/Improve concept.

Modal shift towards public transport, walking and cycling is vital in order to reach the policy targets of the EU.

Individual electromobility does not solve congestion, nor improve traffic efficiency in cities. Replacing cars powered by fossil fuels with electric cars will just result in clean congestion but the loss in productive time will remain the same. A green traffic jam is still a traffic jam.

Further electrification of public transport in combination with green electricity will further improve this situation and will at the same time offer space-efficient attractive urban mobility.

Any decarbonisation strategy will be expensive. Governments, companies and citizens will need to invest billions of euros each year for several decades in order to reach the decarbonisation targets and help mitigate the equally high cost of climate change. The EU Commission estimates that developing low-carbon energy and transport systems will require public and private investments amounting to around EUR 270 billion annually on average over the coming 40 years\(^2\).

Electric cars are currently enjoying massive attention and development. UITP believes that in urban areas, smart integrated mobility concepts should be promoted (and funded) over private mobility patterns based on car usage and ownership. Collective transport modes should represent the core of future multimodal urban transport systems to be complemented by shared fleets of electric cars, bikes, taxis, etc. Such mobility services could be fully integrated with the public transport offer, using common information and payment systems and where appropriate, charging infrastructure.

Mobility based on high quality, attractive public transport networks, offers both economic and environmental benefits. Since mass motorization in emerging economies where car ownership is far below western levels will rapidly show the bearable limits of car usage in cities, the EU Member states should take leadership, paving the way to sustainable urban mobility patterns.