International Association of Public Transport
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A UITP position paper

Focus

Towards low/zero-carbon urban mobility in Europe

0. Introduction

To tackle the societal problems of global warming and security of energy supply, the EC[1] 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 CO_2 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 these benefits will be delivered in the distant future, while electrically powered public transport is already delivering low-carbon transport to many people at the moment; and it can do more. This paper aims to highlight this alternative solution and to show that future urban mobility cannot be sustainable if it relies solely on electric cars.

1. Vision

In 2009, UITP forged its development strategy for the sector worldwide up until 2025. Based on this vision, urban mobility will have succeeded to reduce 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 from 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.

[1] White Paper *Roadmap to a Single European Transport Area?* Minus 20% CO_2 emissions in the transport sector until 2030 (compared to 2008 levels) and minus 60% CO_2 emissions until 2050 (compared to 1990 levels).

2. What is the carbon footprint of our sector?

2.1. Today?

In Europe today[2], urban mobility consumes 140 million tons of oil equivalent per year and emits 470 million tons of CO_2 equivalent (i.e. 8% of total emissions). Public transport in urban areas is carrying 200 million people everyday (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%[3]. 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[4]. **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.).

Despite energy efficiency improvements in private cars in recent years, public transport keeps 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.

2.2. And in 2025?

Using the Mobility Model of the International Energy Agency (IEA), UITP were 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[5]).

	2005	2025 BAU	2025 PTx2
Urban mobility (trips/day in millions)	1,310	1,650 (+ 26%)	
CO_2 equivalent emissions (million tons)	470	440 (-7%)	380 (-20%)

This shows that the intermediary objective of the Transport White Paper 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[6], GHG emissions of electric cars range from 76 to 262 grams per passenger-kilometre (138g for the so-called EU electricity mix) and are not significantly different from today's diesel or gasoline cars. With emissions between 17 and 48 grams per passenger-kilometre, public transport is unbeatable.

Photo: SSB

The special 'Blumenbus', decorated for the 85th anniversary of buses in Stuttgart, Germany.

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2 *Urban mobility scenarios 2005-2025*, UITP, 2011.

3 Average for 44 European cities above 250,000 inhabitants, *Mobility in Cities Database*, UITP; Prof. Dr. A. Müller-Hellmann, *Elektromobilität im ÖPNV – Erreichtes und weiteres Vorgehen*.

4 UITP internal sources consolidated in: *Suburban and Regional Railways Landscape in Europe*, ERRAC, 2006 and *Light Rail and Metro Systems in Europe*, ERRAC, 2011.

5 It is possible to envision a disruptive technological breakthrough with superior GHG mitigation perspectives. However, this option will not deliver significant changes before 2030.

6 Austrian Federal Ministry of Transport, Innovation and Technology, 2009, quoted by VCÖ, factsheet *Wie hohe Lebensqualität in Städten durch Elektro-Mobilität entsteht*, 2011.

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 **hundreds of thousands** of new green local jobs
- ✓ **Congestion: 300 million less 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.

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[7] (car-sharing, car pooling, taxis, etc.).

Offensive modal shift policies include supply and demand measures to make an attractive service part of 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[8].

3.2. Traffic management

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[9].

Reserved bus lane in Manchester, United Kingdom.

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

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7 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.

8 Further reading: *Public Transport, the smart green solution – doubling the market share of PT worldwide by 2025*, UITP, 2009, www.ptx2uitp.org

9 UITP Project *SORT, Standardised On-Road Tests cycles*, 2009, page 8, figure 3.

3.3. 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[10].
- **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[11].

  Long-term decarbonisation efforts obviously include electric buses, including the robust and reliable trolleybuses, but also second-generation biofuels from biomass and waste valorisation. 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.

  Bus fleets in Europe, i.e. 16,000 buses and coaches produced annually in Europe for the European market, could be massively modernised 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 very largely on electricity. In the last decade, passenger rail transport succeeded in decreasing its specific energy consumption by 22%[12]. There are further energy savings to be achieved by using lighter weight/composite materials (10% potential energy savings), and by optimising energy recuperation devices (up to 20-30% potential energy savings) and train operation management (up to 5-10% potential energy savings).
- **Electric cars** are enjoying massive attention and development. UITP believes that the easiest and most logical deployment strategy would be to focus first on captive car fleets. 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.

Electric car sharing fleet 'Flinkster' in Frankfurt, Germany.

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[13], as well as voluntary corporate schemes. **Eco-driving** has proven 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.

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10 Frank Burkhard, *Energy efficiency of public transport, and industry view*, UITP 2011.

11 *Latest Figures on the Urban Bus Fleet in the European Union*, UITP, 2007.

12 Verband der Bahnindustrie in Deutschland, *Politikbrief*, January 2011.

13 e.g. *Dir. 2003/59/CE on vocational training* requires a minimum of 35 hours every 5 years.

4. 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. 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 offer space-efficient attractive urban mobility.

Any decarbonisation strategy will cost society a colossal amount of money. 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[14].

[14] *A Roadmap for moving to a competitive low-carbon economy in 2050*, COM(2011) 112 final, page 10.

Photo: Wiener Linien

A holistic mobility concept in Vienna, Austria.

Recommendations

In its efforts to provide low-carbon mobility in European cities, UITP calls for the support of government at all level (EU, national, regional, local) to develop attractive and efficient public transport. To this end they are invited to:

- **Ensure that prices are fair and reflect the true cost of transport to society**. Cities need guidance on the different approaches to reflect the external costs of mobility in the price of transport. The resources should be earmarked to develop more sustainable transport, such as public transport;
- **Act as enabler and facilitate the massive investments required** through appropriate frameworks and instruments, to ease access and to raise attractiveness for private capital;
- **Earmark more resources for the development of sustainable urban mobility** based on high quality public transport networks;
- **Support Research and Development programmes** based on coherent roadmaps recognised by the sector;
- Use **contracts** with operators **as proactive tools towards gradual decarbonisation**, in a concerted and planned approach and in full transparency and awareness of costs;
- **Create incentives for the purchase of renewable electricity** to offset the price premium;
- **Create incentives** and build capacity to mainstream **eco-driving programmes**;
- **Use life-cycle carbon footprint analysis to select transport infrastructure projects**.

This is an official position of UITP, the International Association of Public Transport. UITP has over 3,400 members in 92 countries throughout the world and represents the interests of key players in this sector. Its membership includes transport authorities, operators, both private and public, in all modes of collective passenger transport, and the industry. UITP addresses the economic, technical, organisation and management aspects of passenger transport, as well as the development of policy for mobility and public transport world-wide.

This Focus Paper has been approved by the UITP Policy Board.

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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**. 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 mobility 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!

We must take 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, like priority at traffic lights and reserved corridors/lanes, 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 captive car fleets complementary to public transport, such as taxis or car sharing.

Smart, integrated urban mobility concepts based on public transport systems and complemented by car and bike sharing schemes, as well as taxis, are best suited to achieve the targets of low-carbon mobility in urban areas.