# ITACA Executive Summary

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ITACA aims at lowering carbon output of urban transport through the use of sustainable innovative technologies and demand management models. Historically, economic growth, transport activity and transport related carbon emission are known to grow in synchrony. On the other hand, the EU is determined to reduce transport related carbon emissions by 60% below 1990 levels by 2050. The European commission is regarding the decoupling of economic growth and transport carbon emissions as an “immense challenge”.

ITACA wants to face this challenge and reduce carbon emissions in metropolitan areas by identification, assessment and exchange of information about innovative technologies and management plans for public and private transport. This entails the development of public sector strategies for optimising the design and delivery of sustainable transport solutions, comprising several approaches like the identification of innovative and eco-friendly technologies suitable to be used in urban areas both in public and private transport, realistic assessment of impacts, benefits, costs and requirements for infrastructure and supply chains, barriers and gaps, R&D and Innovation priorities.

ICATA counts seven partners from four EU member states, namely: The Emilia-Romagna Region (Italy) as lead partner, Instituto Nacional de Técnica Aeroespacial (INTA) (Spain), Province of Rimini (Italy), Municipality of Ferrara (Italy), Stichting Brabantse Milieufederatie (The Netherlands), Diputación Provincial De Huelva (Spain), City of Lidingö (Sweden). This diverse mix of cities, provinces, regions, organizations and research institutes has boosted the transfer of information on low-carbon transport technologies from experts to decision makers and the exchange of real life experiences in demand management practiced in different European cities. The core of ITACA are 25 documented show-cases in the field of urban transport demand management and testing of vehicles with alternative propulsion systems under real operational conditions. The showcases have been analyzed and strategies have been built upon those results.

The transport demand management show-cases have been categorized, evaluated and compared with best practice cases from other European projects. For most showcases, the transport demand and the carbon reduction potential have been estimated and the “lessons to be learned” have been assessed as to avoid repeating mistakes in the future. The demand management show-cases have been divided into the following categories:

- “Direct behavioural change” are incentive-, disincentive- or educational schemes that aim at changing directly the mobility behavior of the user, without actually changing the transport services or infrastructure. ITACA showcase examples are: road charge (Stockholm, Sweden), incentive schemes to avoid peak hours (Spitsmijden, Netherlands), access restrictions (Bologna, Italy) and traffic education. A good example for educational measures is the Piedibus, practiced in many Italian cities: children at an early age walk in groups to school, mimicking a bus, parents and teachers play the driver and controller. With this initiative children will gain confidence in reaching their destination by walking.

- "Land Use Planning Policies" are measures aimed at reducing transport related carbon emission by changing the use of the territory. Mixed land use and urban densification are two measures that are thought to reduce travel distances. An example for mixed land use is the ITACA showcase at a small industrial site (APEA near Rimini, Italy), where a canteen has been opened with the help of the city. The new canteen has the goal to prevented a significant share of the workers from driving home for lunch. An example for urban densification is the show-case "Comprehensive and Environmental Plans of Lidingö", Sweden.

- "Transportation Supply/Demand Management" are measures where new, more sustainable transport services or infrastructure are offered with the aim to reduce car use. Examples are the offer of on-demand bus services; dedicated school or worker buses as suggested for the APEA industrial site; the creation of parking space for carbon-free vehicles only; the improvement of foot-paths and cycle tracks, bike- and car-sharing schemes, etc.

The results achieved by demand management indicate that significant gains can be achieved by a better use of the available transport resources: 20% of traffic reduction in London and Stockholm through congestion charging; 20% of traffic reduction in Bologna centre by restricting access to residents, local businesses, public transport and delivery vehicles. Road charging and restrictive measures do have limits as they must ensure equity to protect citizens with lower income and provide sustainable alternatives like public transport and cycle-path). Most charging and restrictive schemes make exceptions for disabled and zero-emission vehicles. The peak hour avoidance scheme in the Netherlands achieved a traffic flow reduction of up to 50% during peak hours by paying 4€ incentive for traveling outside the peak hours period. Also, minor, well designed additional transport services can make a big difference: connecting the industrial site APEA to the surrounding villages by a bike path has the potential to double bike use; the introduction of a dedicated "school and workers" bus service to the same site may increase public transport share from virtually nothing to at least 8%. But such short term achievements have been found to address only a part of the true potential: major improvements can be expected if citizens start to reflect their life-styles and change the location of their activities and the way they move in-between them. The Plan for Integrated Transport (PRIT 98-2010) of the Region Emilia Romagna is pointing in this direction. It has been mentioned in the handbook that in times of crises, humans are more likely to accept changes. This is an opportunity, but it has been pointed out that behavioural changes require also that the normative perception is giving clear indications. As for example if a citizens decided to start cycling to work and does not feel welcome on the city's roads by bike, then she/he is likely to revert her/his decision. The redistribution of urban road space between cars, cyclists and pedestrians can be seen as a normative measure, a question of political priorities rather than financial and other constraints. The Emilia-Romagna Regional Mobility Plan does send a positive normative signal by giving a good example for the citizens: the region applies incentives for public transport use and disincentives for private parking to its own employees.

A second area of the ITACA project is concerned with transport technologies, and more specifically propulsion/fuel technologies and Intelligent transportation systems for CO2 reduction. ITACA collected data of real-life operation of bus and car fleets using the following propulsion technologies: Pure battery electric vehicles (BEV), Hybrid Electric Vehicles (HEV) and Fuel-Cell Electric vehicles (FEV) running on hydrogen gas. In addition, different biogas and compressed natural gas/hydrogen gas blends have been tested with conventional internal combustion engines (ICE). Intelligent transportation systems for CO2 reduction include: Mass monitoring of traffic flows, where individual cars can be recognized (such system are the practical tool to implement road tax, access control and peak hour avoidance schemes); Sustainable Traffic Management (STM), where intelligent traffic light systems reduce the number of stops at traffic lights and as a consequence the decrease of CO2 emission can be avoided; Fare and ticketing integration systems allow the citizen to access different public transport networks with a single ticket. The STIMER project of the Region Emilia Romagna has used such electronic ticketing to favour the highest level of integration among different transport modes and to provide the users with a flexible, transparent and easy to use fare system.

The carbon reduction potential of new propulsion technologies requires a short and a medium - long term assessment as technical systems are in a constant evolution: high capacity batteries (which increases the range of electric vehicles) and low-cost fuel cell technologies are under active development; carbon neutral electrical power is the energy bases for all alternative propulsion (except for bio-fuels), but renewable electrical energy is expected be introduced only gradually; the time to install a dense network of battery recharging stations or hydrogen stations will take years if not decades; Biofuels are almost carbon-neutral and already available, but extending their production would ultimately result in an ethical conflict with food production (when producing fuel yields a higher price than producing food). By considering all these opportunities and constraints together a roadmap has been drawn towards carbon neutral propulsion systems:

In the short term, low-emission conventional ICE motor will continue to dominate the car-market but the share of hybrid electric motors and natural gas motors will continue to rise. Electricity is already the cheapest fuel and electric vehicles become more attractive as oil prices rise. Even today's battery technologies are perfectly suitable for light, weight and small size vehicles such as electric bikes, E-scooters and E-boards. The last two are, low cost, and can be folded and brought into buses and trams as hand luggage. However, it is mandatory to establish national and European safety regulation for such devices in order to speed their diffusion. Small size, low-cost pure electric battery cars are already available and are expected to have a growing share in intra- urban applications. Access schemes that allow only emission free vehicle in city centres will accelerate their diffusion.

In the medium and long term, battery technology is expected to improve and allow even family cars to achieve ranges of several hundred kilometres; compact cars with 200km practical range have recently been tested under real operating conditions. However, for heavier vehicles like trucks or distances above 700km there are only two feasible carbon free solutions: Hydrogen fuel cells or biofuels. The ITACA databases showed that the fuel cell vehicles need almost twice as much electrical energy per km compared with battery electric vehicles, if the hydrogen is produced by electrolyses. This means the operating costs of Hydrogen fuel cells cars might be much higher compared with electric cars. In addition, the hydrogen production and distribution infrastructure needs to be built up from scratch, while the electricity grid does already exist. These results have suggested a long term strategy where batteries should be preferred for most person transport and light freight; whereas for distances above 500km a multimodal trip with car and high speed rail may often be the faster and more convenient solution. Rail and ship would also be the most energy efficient solution for long distance freight transport. The remaining short distance, heavy freight transport could be powered by biofuels as substitute for diesel. It has been argued that with this strategy, the high costs of a new hydrogen infrastructure and hydrogen production could be avoided, while the need for biofuels would be limited. However, more detailed economic studies should verify this hypothesis.

One key finding of the ITACA handbook has been that neither technical solutions nor demand management measures alone can eliminate carbon emission from transport. Demand management can reduce carbon emissions overnight as for example by the introduction of road charge or traffic restrictions. The complete elimination of carbon emission by electric vehicles will only realise as fast as high capacity batteries become available and coal and gas can be eliminated from electricity production. It has also been shown that the use of electric battery power does require a certain level of behavioural changes, such as the use of small vehicle for short trips and multi-modal solution for longer trips. But even if each private vehicle had zero emission, many traffic related problems would remain. The energy and resources used for a dispersed urban land use designed around automobile are inherently costly, and the social costs for accidents and health problems due to a lack of physical exercise are immense, in particular for an ageing population. This means planning for a mixed land use and high urban densities have been recommended. Incentivizing the use of public transport, multi-modal transport, trip-chaining and car-sharing, all are useful measures that have been shown to accelerate the introduction of carbon free mobility. The encouragement to shift from car use to more healthy modes like cycling and walking is mandatory, in particular for small and medium size towns where approximately half of all trips are below 5km. Such a modal shift would reduce carbon emission and simultaneously increase the quality of life. The most dramatic effect has been reported from carfree quarters, where cycling and walking are the primary modes: Half of the citizens who decided to live in this environment sold their car after moving in. There are only a few of such quarters in Europe but none of them has reported marketing problems, which has led to the conclusion that there is a genuine demand for a carbon free mobility today.

The ITACA handbook ends with the call for taking action urgently, incentivizing new technologies or demand management measures, no option should be left unconsidered.