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Urban sprawl processes characterize the landscape of the areas surrounding cities. These landscapes show different features according to the geographical area that cities belong to, though some common factors can be identified: land consumption, indifference to the peculiarities of the context, homogeneity of activities and building typologies, mobility needs exasperatedly delegated to private cars.

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CITY AND MOBILITY

TOWARDS AN INTEGRATED APPROACH TO RESOLVE ENERGY PROBLEMS

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ABSTRACT

The issue of integration among city, mobility and energy plays a central role in the current EU policies, aimed at achieving energy saving targets, independence from fossil fuels and enhance of the urban systems resilience, but the strategies of the single states are, however, still far from its implementation. This paper proposes a reading of the current policies and of the recent initiatives aimed at improving the energy efficiency of settlements, implemented at both Community and national level, aimed at laying the groundwork for the definition of an integrated approach between city and mobility to resolve energy problem. Therefore, the paper is divided into six parts. The first part describes the transition from the concept of sustainability to the concept of resilience and illustrates the central role played by this one in the current urban and territorial research; the second part briefly analyzes the main and more recent European directives related to city, mobility and energy, while the third part describes how the energy problem is afforded in the current programming and planning tools. The fourth and fifth parts, are intended to describe the innovative practices promoted in some European and Italian cities concerning energy efficiency aimed at the integration between urban and transport systems. The last part of the paper, finally, deals with the definition of a new systemic approach for achieving objectives of energy sustainability. This approach aims at integrating strategies and actions for strategies of mobility governance, based on the certain assumption that the core for the most part of energy problems is mainly represented in medium and large cities.

KEYWORDS:
resilience; urban transformations; sustainable mobility; energy efficiency

1 FROM THE CONCEPT OF SUSTAINABILITY TO THE CONCEPT OF RESILIENCE

In the different fields in which the concept of resilience has been used it has always taken a positive sense, from physics where it indicates the ability «to withstand hardship and disturbance and to regain one's original shape after deformation» (Dosch, Porsche 2011) to ecology and social sciences in which the resilience of a system is defined as «the capacity to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks» (Holling 2004). However it is the debate on climate change that has contributed, in the last ten years, to the popularization of the term so that some authors consider resilience as the key issue of the future (Levin et al. 1998, Perrings 2006). The effects of climate change on urban areas are widely treated in literature, thanks to the authoritative report developed at world and EU level as the IPCC IV Assessment Report (IPCC 2007) or the European Environment Agency's report "The Impacts of Europe's Changing Climate: 2008 Indicatorbased Assessment" (EEA 2008). It is important enhancing resilience of urban systems so that they can resist and adapt to threats from both natural and anthropogenic risks (Boscher 2008), because the built environment and the urban infrastructure provide the setting for human activity and in Europe about 75% of the population lives in urban areas (EEA 2010).

Fig. 1 The building of resilient cities is based on strategies of mitigation and adaptation and requires a multidisciplinary approach related to the ability to integrate economic, ecological, technological innovation within National government policies.

In this regard, there are many authors and institutions that have only recently transferred the concept of resilience in urban and regional sciences (Alberti et al. 2003, EEA 2005, UN 2012, IPCC 2012), identifying in building resilient cities the guiding principle for the future development of the cities (Galderisi et al. 2010). Cities play simultaneously actions of opposite sign: on the one hand they represent one of the principal source of pollution and global warming and, on the other hand, they try to develop strategies of mitigation and adaptation to help combat the effects due to climate change.

Therefore, in this field, resilience can be defined as «the ability of a socio-economic region, to absorb the endogenous or exogenous disturbances by change processes, so that the main functions, structures and relationships being essential for the well-being and sustainability of the region remain intact» (Lukesch, Payer, Winkler, Rieder 2010).

The definition given above underlines the connection between the concept of resilience and that one of sustainability; some authors emphasize that: «resilience is to the 2000s and 2010s what sustainability was to the 1980s and 1990s» (Foster 2010) and also that «a development strategy is not sustainable if it is not resilient» (Perrings 2006). The concept of sustainability considers the evolution of urban systems as mainly related to endogenous factors and tends to achieve a stable equilibrium state when the present generation meets his own needs «without compromising the ability of future generations to meet their own needs» (WCED 1987). Instead the concept of resilience looks at urban development as a process that evolves as a result of both endogenous and exogenous events, unexpected and unpredictable, involving the reorganization of the urban system towards a new dynamic equilibrium state.

For over twenty years the urban system has been defined by some authors as a system whose equilibrium state is only apparent because, in reality, it is in stationary equilibrium or in dynamic stability. In line with the "catastrophe theory" elaborated by Thom and according to Morin's philosophy of heterogeneity, they consider city as «a system characterized by an inextricable complementarity between "disordered phenomena" and "organizers phenomena", who regulate themselves in a subsequent state of stationary equilibrium» (Papa , Gargiulo 1993). In this sense, urban system is characterized by its own structure, which can be understood as an aggregate of additional factors in relation to each other to form a complex unit, as the product of interrelationships/interactions between the constitutive elements, the internal organization, the conditions and the external constraints (Papa, Gargiulo 1995).

Because of its complexity, within the definition of strategies to counteract the effects of climate change we must take into account the potential impact that a local event may lead to the overall functioning of the system. The effects of climate change, in fact, affect the different urban components (physical, functional, anthropic ones and so on) on different levels and with different intensity (Fistola 2010). In summary, it is necessary that the tools and techniques of territorial transformation government «are no longer static projection tools or techniques of formal control, but they should adapt to the dynamism and diversity of the city» (Papa, Gargiulo 1995).

Despite the several definitions of resilience provided in urban science and the difficulties of controlling and managing complex phenomena, it is obvious how complicated is to identify strategies for building resilient cities. From the reading of international treaties and of policies and projects at European level, it is clear that the only strategies able to enhance resilience of urban systems are of two types: mitigation and adaptation. Mitigation strategies are aimed at reducing anthropogenic emissions of greenhouse gases and simultaneously at implementing natural mechanisms of absorption (carbon sinks);instead adaptation strategies are intended to anticipate the possible negative effects of climate change and to prepare plans, actions and measures for the construction of settlements that are able to conform to the consequences of climate change (IPCC 2001).

The essential role played by land use policy (mixed use, compact settlements) may cause a lower consumption of fuel for travel by private means, and therefore may have an indirect but crucial role in the pursuit of strategies for mitigation. For their own purposes, mitigation strategies determine changing lifestyles mainly related to mobility and energy production and consumption in urban areas (Provincia di Siracusa 2011). Moreover, while mitigation strategies act at local level but are dictated by international, Community and national policies, adaptation has mainly a local character.

This is related to the effects of climate change that assume different declinations according to the characteristics of the territory on which they act and need a structured and flexible response of the community in terms of defense actions, urban planning and social organization (Nguyen Xuan A. 2011).
In consideration of the foregoing it is clear that mitigation and adaptation strategy are complementary and need an effective integration to counteract the causes of the changes already in place and prepare urban areas for the unpredictability of future events. Integrating mitigation and adaptation strategies means, finally, focus on the integration between urban and mobility system in order to achieve high levels of urban resilience as soon as possible.

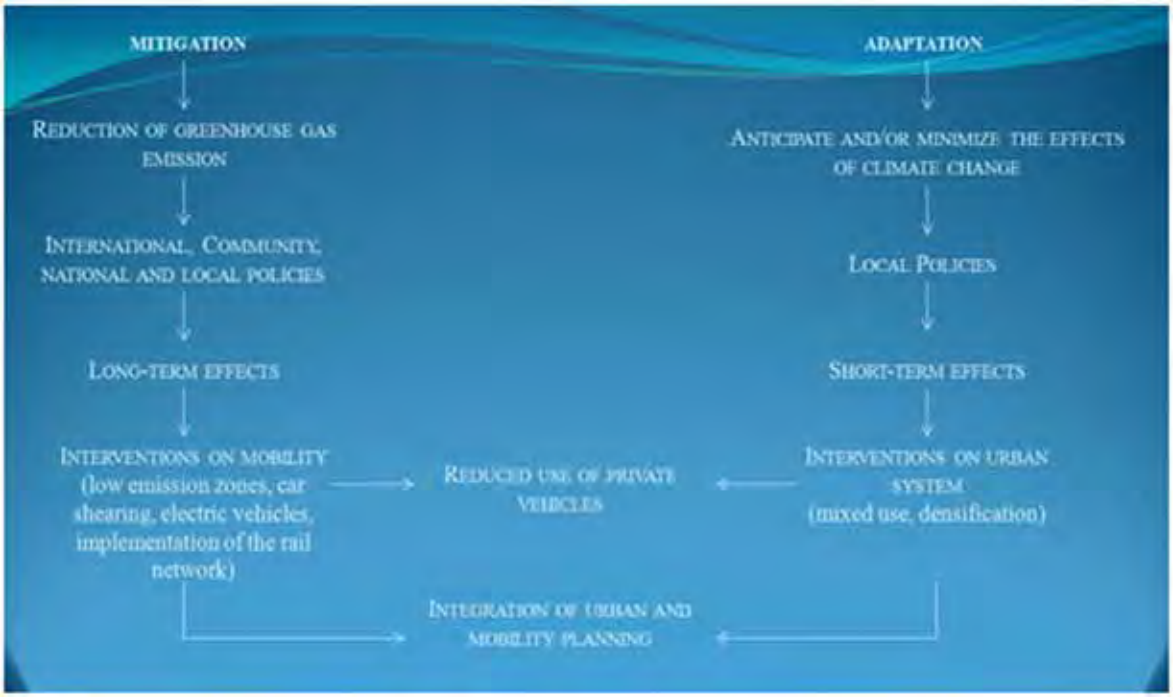

Fig. 2 The strategies to put in place to enhance the resilience of urban systems are mitigation and adaptation whose effectiveness cannot be separated from their integration and, given the areas on which they act, also from the integration of the territorial transformation government and mobility management.

2 CITY MOBILITY AND ENERGY: EU POLICIES

The European Union (EU) has been committed to tackling climate change and has placed it high on its agenda since 1992, when the UN Intergovernmental Panel on Climate Change's (IPCC) first assessment report warned of rising global temperatures caused by greenhouse gas emissions. The EU committed itself that same year to stabilizing its carbon dioxide (CO_2) emissions at the 1990 level by 2000.
The EU intensified its actions after the Kyoto Protocol was agreed in 1997. In 2000 the European Commission set up the European Climate Change Programme (ECCP) as the key vehicle for identifying and developing, with Member States, policies and measures that can be taken at EU level to reduce greenhouse gas emissions (EU 2005). After then, there have been numerous directives issued on climate change aimed at integrating different levels of government and the various disciplines involved: from the Green Paper "Adapting to climate change in Europe – options for EU action" published in 2005, to the White Paper "Adapting to climate change: towards a European framework for action" in 2009, until the most recent strategy "Europe 2020 – for smart growth, sustainable and inclusive".

The last one provides by 2020, to reduce greenhouse gas emissions by at least 20% compared to 1990 levels, to increase the share of renewable energy sources in our final energy consumption to 20%; and to improve the energy efficiency of 20%. According to the European Commission «environmental problems prevailing in the city are mainly related to the use of fuels derived from oil, emitters of CO_2 and air and noise pollutants» and especially «the transport sector is one of the most difficult to manage in terms of emission of CO_2» (EU 2007).

Most of the actions on the mobility system promoted by the EU are therefore related to mitigation strategies, with the aim of obtaining a significant reduction of greenhouse gas emissions by well-defined time horizons and a reduced dependence of the transport sector by oil, for a more sustainable mobility.

In the Green Paper published in 2007 entitled “Towards a new culture for urban mobility”, the European Commission, identifies among the challenges that European cities will face for the construction of “a new urban mobility culture” the one related to the “improvement of urban traffic”. Promoting walking and cycling, improving the attractiveness and safety of travel by alternative means of transport to the private car, promoting co-modality, adopting a parking policy aimed at reducing traffic, further integrating the distribution of goods within the city limits are the solutions proposed to overcome this challenge that have indirect effects on the reduction of polluting emissions.

The actions strictly related to the reduction of polluting emissions focus, instead, on sustainable urban transport projects, and are aimed: at the promotion of the use of clean and energy efficient vehicle technologies and alternative fuels, such as biofuels, hydrogen and fuel cells; at the application of restrictions for heavy polluters and the realization of privileged access for low-emitting vehicles in sensitive areas; at the introduction of local traffic restrictions and urban charges. The most recent White Paper on transport “Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system” (EU 2011) provides also, by 2050, a reduction of greenhouse emissions by at least 60% compared to 1990 levels, including intermediated stages by 2020 and 2030.

In line with the flagship initiative “Resource efficient Europe” set up in the Europe 2020 Strategy (Communication of the European Commission n. 2020 of 2010) and the new Energy Efficiency Plan 2011 (Communication of the European Commission n. 109 of 2011), « the paramount goal of European transport policy is to break the transport system’s dependence on oil without sacrificing its efficiency and compromising mobility and to help establish a system that [...]offers high quality mobility services while using resources more efficiently. In practice, transport has to use less and cleaner energy, better exploit a modern infrastructure and reduce its negative impact on the environment and key natural assets like water, land and ecosystems» (UE 2011).

For this purpose the document identifies three strategies for the reduction of polluting emissions which are divided into ten objectives:

- Developing and deploying new and sustainable fuels and propulsion systems:
  1. Halve the use of ‘conventionally-fuelled’ cars in urban transport by 2030; phase them out in cities by 2050; achieve essentially CO_2-free city logistics in major urban centres by 2030.
  2. Low-carbon sustainable fuels in aviation to reach 40% by 2050; also by 2050 reduce EU CO_2 emissions from maritime bunker fuels by 40%.
- Optimising the performance of multimodal logistic chains, including by making greater use of more energy-efficient modes:
  3. 30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors.

4. By 2050, complete a European high-speed rail network. Triple the length of the existing high-speed rail network by 2030 and maintain a dense railway network in all Member States. By 2050 the majority of medium-distance passenger transport should go by rail.
5. A fully functional and EU-wide multimodal TEN-T “core network” by 2030, with a high quality and capacity network by 2050 and a corresponding set of information services.
6. By 2050, connect all core network airports to the rail network, preferably high-speed; ensure that all core seaports are sufficiently connected to the rail freight and, where possible, inland waterway system.

– Increasing the efficiency of transport and of infrastructure use with information systems and market-based incentives

7. Deployment of the modernised air traffic management infrastructure in Europe by 2020 and completion of the European Common Aviation Area.
8. By 2020, establish the framework for a European multimodal transport information, management and payment system.
9. By 2050, move close to zero fatalities in road transport. In line with this goal, the EU aims at halving road casualties by 2020. Make sure that the EU is a world leader in safety and security of transport in all modes of transport.
10. Move towards full application of “user pays” and “polluter pays” principles and private sector engagement to eliminate distortions, including harmful subsidies, generate revenues and ensure financing for future transport investments.

3 THE ENERGY ISSUE IN THE CURRENT PROGRAMMING AND PLANNING TOOLS

In 1992, 28 European nations signed the United Nations Framework Convention on Climate Change (UNFCCC), which states that parties are committed to« formulate, implement, publish and regularly update National and, when appropriate, regional programmes containing measures to facilitate adequate adaptation to climate change» (UNFCC 1994).

The European countries involved are at different stages in forecasting, formulating and implementing adaptation and mitigation strategies at national level. Starting from Finland who was the first European country to implement an adaptation strategy in 2005 with the FINADAPT, 23 other European nations including Spain, Germany, France, United Kingdom have adopted national strategies in the field of climate adaptation and some countries, such as Denmark, have already released the third update of its national action plan. Italy, Cyprus, Luxembourg, Poland and Slovenia are the only countries that have not yet developed a national adaptation strategy.

The only national environmental and energy plans developed in Italy are related to specific aspects such as energy efficiency and renewable energy. The PAN (National Action Plan for Renewable Energy 2010), implementing the Directive 2009/28/EC, promotes the production of energy from renewable sources and aims at reaching a share of renewable energy equal to 17% of gross final consumption by 2020; at the same time, the EEAP (Italian Action Plan for Energy Efficiency 2011) is aimed at reaching the Community objective of saving energy corresponding to 9.6% by 2016.

Italian Regions have acquired energy competences in recent years without the necessary equipment of regulatory and synthesis tools promoted by the central administration (Camera dei Deputati 2009).

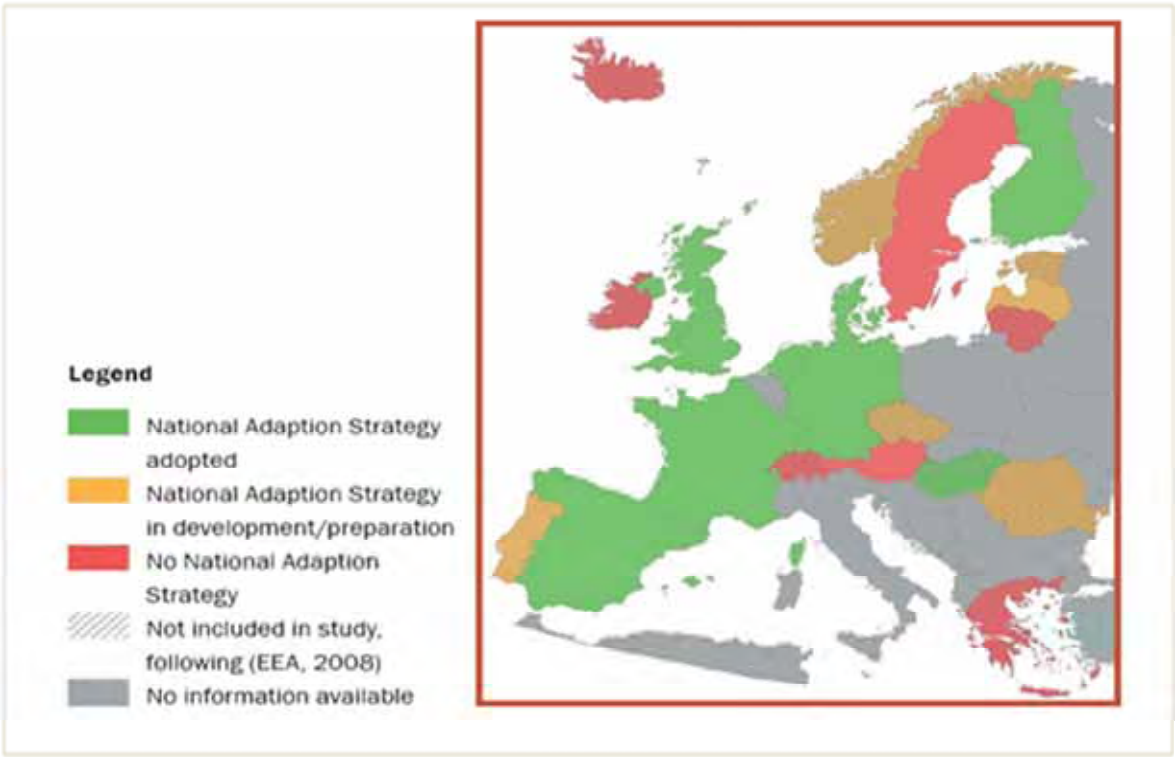

Fig. 3: The status of adaptation strategy developed in Europe: Italy is one of the few European countries that has not developed a unified plan of action at national level.

There are a lot of Regional laws that govern the territorial energy planning (Lombardia Regional Law n. 11/12/2006 24 “Acts for the prevention and reduction of air emissions to protect the health and the environment”, Basilicata Regional Law n. 1 of 19/01/2010 “Acts on energy and Regional Environmental Energy Plan”).

Emilia-Romagna Region was the first in Italy to regulate, through the Regional Law 3/1999, the energy issue by giving to the regional administration the task to define the objectives and the guidelines of regional energy policy within the Regional Energy Plan (20007). This Plan is implemented through three-year Action Plans and Annual Programs. Among the various actions related to the seven lines of action developed in the Second Three-year Action Plan of the Region Emilia Romagna (2011), those connected to the 5th axis of intervention "Promotion of sustainable mobility", are:

- improve the attractiveness of local public transport;
- promote modal interchange and pedestrian mobility;
- integrate planning and database of indicators concerning mobility and transport;
- support measures aimed at spreading low emission vehicles;
- support measures aimed at furthering the rail transport of goods and people;
- support measures aimed at optimizing the logistics business.

All regional laws are characterized by detailed measures on renewable sources, energy saving of buildings and rational use of energy. The role played by the transport sector in reducing polluting emission, however, is still marginal and the regional guidelines don’t find practical application in specific action plans at local level (both provincial and municipal).

At regional level, therefore, energy policies affect only some components that contribute to high energy consumption without recognizing the benefits due to their synergistic effects. A similar situation is recorded

at the provincial level, although at this level there is a greater integration between aspects regarding climate, energy and mobility.

For instance, Modena Province has in its Provincial Territorial Coordination Plan (PTCP) "Strategies on sustainable energy" which defines the goals for the planning tools at the local scale:

- trigger processes of urban "densification" and promotion of a more compact city model;
- increase the energy performance of new settlements;
- implement environmental policies for the regeneration of urban areas;
- polarize the major urban functions and units of new housing in relation to energy and public transport network;
- promote procedures for energy certification of buildings (Province of Modena 2009).

To achieve these objectives in the section n.84 of the Technical Implementation Rules "Addresses and guidelines for energy sustainability of Municipal Structural Plan" is expected that «in defining the physical and functional structure of the urban system, the urban densification policies must be implemented in order to distribute the demographic weight with respect to energy sustainability of settlements both from the availability of resources and the indirect effects of mobility on energy consumption» to «draw up demand and supply of energy and reduce energy consumption related to mobility».

The relationship between urban planning and sustainable transport in order to reduce energy consumption. is supported by the section 99 of the Technical Implementation Rules: «the achievement of sustainable forms of mobility involves first the presence of correct spatial relationships between urban services, above all if of daily access (schools, neighborhood shops, etc..), and distribution of residences and work places»; the same section suggests specific indicators (average distance of residential areas, weighted with respect to the resident population, from the primary services; percentage of population in comparison to the total one that resides within the catchment of the principal axes of public transport; percentage of areas, compared to the total, that host tertiary, commercial and production activities of high density of employees) that the municipalities must use in setting up its planning tools.

Also Venice PTCP aims at adapting its territory to climate change and combat its negative effects through «the precautionary principle in assessing opportunities and alternative actions and policies of mitigation and compensation of impacts» (Provincia di Venezia 2010). The PTCP sets that the urban planning tools will pursue the following objectives (section 35):

- minimize the increasing mobility of people and goods and in any case not produce increased levels of air pollution beyond the normal limits;
- make accessible by public transport the new urban areas, and provide them with bike paths, foot paths and public parking space car.

Even in Venice PTCP, hence, the reduction of polluting emissions is pursued by integrating interventions on the urban system and interventions on the mobility system.

Unlike the Provinces of Modena and Venice, the Province of Syracuse in its Provincial Territorial Plan only outlines the possible scenarios. The annex "Strategies for mitigation and adaptation to global climate change" of the Syracuse PTP defines scenarios and mitigation and adaptation strategies, related to mobility and energy systems, to the management of water resources and to the reduction of urban heat islands. Even if the proposed measures are purely proactive, it is interesting to note the relevance given to the mobility system. In particular, in this plan the promotion of sustainable transport modes represents the main mitigation measure to reduce emissions of greenhouse gases and suggests that the municipal planning tools should promote public transport through:

- the management and the rationalization of existing road system through the activation and the expansion of pedestrian areas, the institution of low emission zones in the historical centers and residential areas where the speed limit is 30 km/h;
- the reduction and the slowdown of the road traffic promoting pedestrian mode;
- the activation of car-sharing and car-pooling;
- the implementation, the upgrading and the rationalization of public transport systems, giving priority to environmentally friendly vehicles or low emission vehicles;
- the construction of reserved lanes for public transportation system or roads exclusively reserved to the public transport (dedicated roads).

The approved draft Provincial Territorial Coordination Plan of Naples (2007) has dedicated a specific annex (Annex A) of its Technical Implementation Rules to “tackling climate change" (2007) identifing mitigation and adaptation strategies scheduled by the PTCP of Naples. The entries for the mitigation strategies provide interventions related to:

- sustainable mobility, through the promotion of public transport : «in the PTCP is designed a provincial tramway complementary to the regional metro system. Municipalities in the drafting of the Municipal Urban Plan should give priority to public transport, through the creation of reserved routes, low emission zones and the redevelopment of public spaces served by public transport»;
- renewable energy by requiring that each program for the implementation of the PTCP shall provide the use of alternative energies (wind, solar, etc.);
- building construction, optimizing building in terms of energy through interventions on both the building envelope and the electrical, plumbing, and heating systems;

Regarding adaptation strategies, instead, priority is given to the use of water resources «according to the latest IPCC scenarios climate change will lead in the Mediterranean area and in Italy to a reduction in water availability». The PTCP also contains a set of laws concerning the permeability of soils:

- urbanization containment through the technique of densification;
- preservation of open space within urban areas;
- obligation percentage of permeable surfaces in building projects.

The guidelines set out in the planning tools at provincial level are implemented in the Municipal Energy Plans drawn up by some Italian municipalities as provided by the law 10/91 "Acts for the implementation of the national energy plan on energy efficiency, energy saving and renewable energy sources", which at the section 5 provides that: «the the municipal planning tools, in the city with more than fifty thousand inhabitants, must include a specific plan regarding the use of renewable sources of energy». From the analysis of some of the Municipal Energy Plans and their associated Action Plans (City of Bergamo 2011, City of Udine 2009, City of Reggio Emilia 2008) it is interesting to observe that the actions for the mobility sector would lead back to:

- promote sustainable transport modes, encouraging a greater use of public transport and innovative transport modes;
- rationalize and enhance the public transport system, through direct actions on the physical system (upgrading the transport system) and actions to improve livability of urban areas (institution of low emission zones, pedestrian island, etc.).

These actions result substantially in individual initiatives promoted by the municipalities and, even if they represents good examples, they are not integrated in an unitary point of view. The City of Ferrara, for example, has promoted the initiative "C'entro in bici" with the aim of increasing sustainable transport mode by providing free bicycle rental outlets.

Similarly, the City of Rimini has promoted the project "Riminibici" started in 2008 and upgraded in 2010 that allows use bikes, provided by the municipality, for free. The city of Genoa has adopted the innovative service of car sharing: vehicles may enter the Low Emission Zones, along the bus lanes and use for free the fee parking.

In Florence since 1998, contributions have been paid, from 200 € to 3,000 € for the purchase of electric vehicles and 107 free charging stations for electric vehicles have been realized (Florence municipality 2005).

Beyond the individual initiatives, during the last few years, there are many municipalities that, on a voluntary basis, have joined the Covenant of Mayors promoted by the European Commission, in the second edition of the EU Sustainable Energy Week on 29 January 2008. This initiative aimed at involving European cities in the path towards energy and environmental sustainability. By their commitment, Covenant signatories aim at meeting and exceeding the European Union 20% CO2 reduction objective by 2020, according to the European Union strategy 20-20-20. In order to translate their political commitment into concrete measures and projects, Covenant signatories notably undertake to prepare a Baseline Emission Inventory and submit, within the year following their signature, a Sustainable Energy Action Plan, that many Cities have already adopted, outlining the key actions they plan to undertake to achieve the objectives of reducing carbon dioxide emissions by 2020 (Covenant of Mayors website).

In the coming years, then, our country should integrate the actions promoted by single municipalities into an unitary action plan at national level for addressing the problem related to climate change in the perspective of "think globally and act locally." The tools promoted at national level for sustainable energy should then be implemented and integrated with the planning tools at local level in order to make compatible and synergic the mitigation and adaptation strategies, contextualizing them in reference to the main socio-economic variables that characterize the territory they are referred to. The path to follow thus requires a multidisciplinary approach, linked to the ability to integrate interventions on the urban system with interventions on transport system which, as detected by the Chamber of Deputies, is the responsible for around one quarter of national emissions of greenhouse gases (Camera dei Deputati 2009).

The definition of a national strategy, however, seems increasingly remote because during the last Conference of the Parties COP17 held in Durban, South Africa in December 2011, the nations who attended the conference have agreed to enter only by 2015 a formal and legally pact that legally bind the different country to reduce greenhouse gas emissions by 2020. This means that until 2020 the signatory countries of the IPCC should only respect the voluntarily commitments made in past years.

4 MAJOR EXPERIENCES IN EUROPEAN CITIES

The key role that urban mobility is hiring in building resilient cities is evident from the description of some of the most current planning experiences that are bringing forward in Europe. Global warming, climate change, and the next lacking of oil are topics for which the transport sector has a significant weight.

Energy consumption linked to mobility is growing, although this trend has slowed down starting since 2008-2009, i.e., from the biennium of deeper international economic crisis from the second post-war period to today; in Europe about 20% of primary energy consumption is accounted for by transport and about 98% of the energy used in this sector comes from fuel use. The current expectation at the European Commission's 2020 also estimate an increase in energy demand of 35% for passenger transport and 50% for freight transport; considering, then, only the power consumption on roads, which grows on 0.8% annually average, it's clear the need to activate measures that encourage a shift of traffic on modalities and energy efficiency technologies.

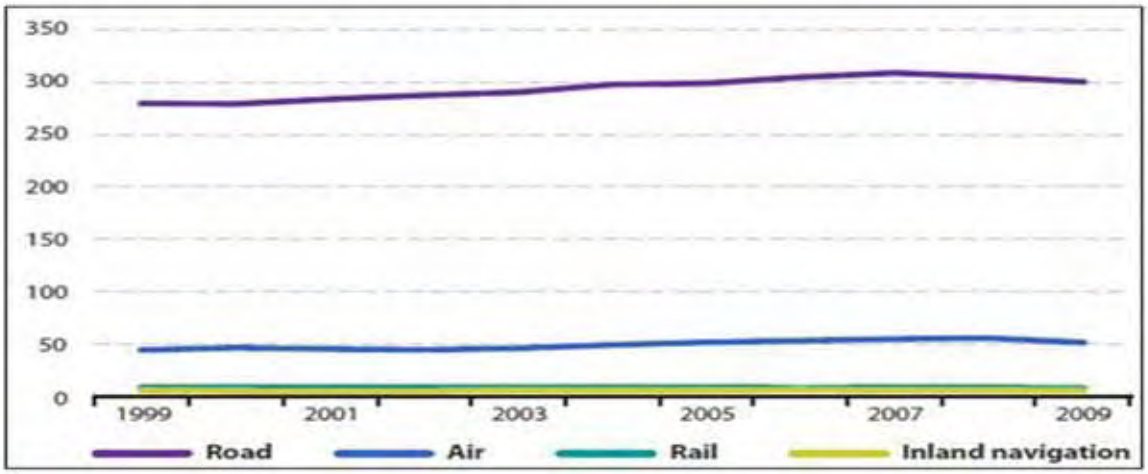

Fig. 4: In 2011 Eurostat energy consumption analysis of the decade 1999-2009, road transport was characterized by greater power consumption in Europe: approx. 300 Mtoe (million tons of oil equivalent).

At the same time, the overall weight of urban mobility in terms of displacements carried out with private vehicles, rises in all Member States so far faster than those made with rail transport and buses. The reasons for the success of road transport are not only tied to clear advantages arising from its use, such as greater flexibility and ease of operation, but that can be also explained by the adoption of policies that favoured the road transport in order to open up the market to the most important industrial production and, therefore, privilege economic development and employment. The ability to achieve progress in sustainability key appears to be sorely tested by the dominance of road transport which limits the possibility of expanding more valuable alternatives from a point of view of energy efficiency and emission reduction.

The new long-term vision for Europe is directed towards a strategy of growth of low-carbon type, based on the strong reduction of greenhouse gas emissions and on independence from non-renewable sources, both recognized as priorities for action in each member country. A good example is represented by London that, was among the first cities in the world to address climate change issue, creating special organizations for study and development of urban policies. Since 2000 London has developed and adopted an effective integrated approach to the themes of energy, sustainable mobility and climate change to ensure that it becomes «the best big city in the world» (Mayor's Energy Strategy 2011), characterized by low levels of carbon dioxide in the atmosphere and a high quality of life. In the numerous planning tools of London the action strategies follow the addresses and purposes contained in higher-level plans, such as the 2008 Climate Change Act aiming at the reduction of 34% in greenhouse gas emissions by 2020 and at least 80% by 2050 through economic development based on renewable sources instead of petroleum or other fossil fuels. Therefore the urban and economic development fits well with the principle of sustainability through densification that involves the use of already urbanized areas and higher building density.

The resulting benefits include both a much lower consumption of soil and the potential reduction of trips (Moccia 2009). These two lines of action are developed in synergy with the Mayor's Transport Stategy (MTS, approved in 2010) that forms the transport plan that has been processed synergically with territorial planning tools (The London Plan: Spatial Development Strategy for Greater London 2011) and economic ones (The Mayor's Economic Development Strategy for Greater London 2010). The main objectives identified in the MTS are all geared to sustainable urban development, the improvement of the offer of transport services and increased resilience to climate change.

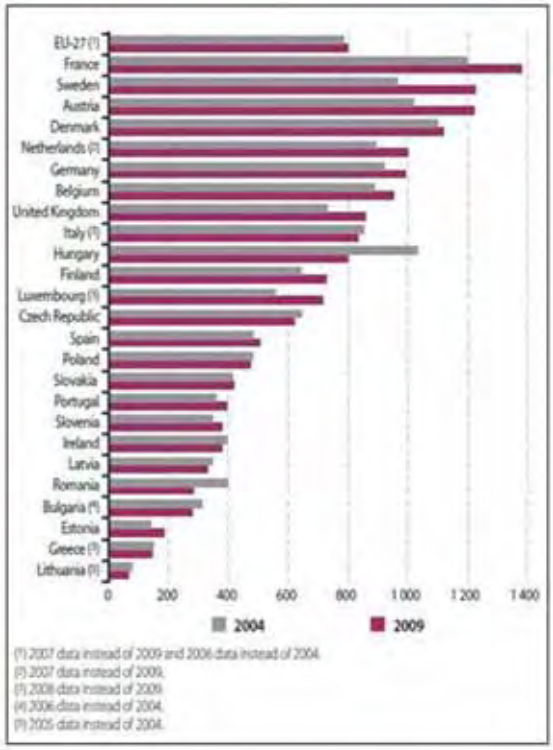

Fig. 5: Number of passenger-per kilometer on rail network in 2004 and in 2009. In 2009 France has the highest rate of use of rail transport; the highest increase compared to 2004 was recorded in Sweden, Austria and Luxembourg.

The current MTS is more strongly geared to promoting pedestrian and cycle mobility compared to earlier versions, that perceived policies of road pricing as the best way to discourage individual motorized movement. Measures such as the Congestion Charging Zone, which represented the most significant measure of 2001, and that established toll charges to access the central urban area, or the Low Emission Zone, the main project of 2006 designed to restrict access to the London area for large vehicles intended for the transport of persons or goods, may be valid systems for reduction of use of private cars as long as properly associated with the promotion of public transport modes. The intention of London Government to adopt the bicycle mobility as a real lifestyle, was reaffirmed in 2010 with the drafting of the document “Cycling Revolution London” which contains projects and actions to make London “cyclised city”. The three main programs are:

- London Cycle Hire Scheme : 400 bicycle rental stations in all public parks and several other points in the city, located in such a way that there is one out of every 300 meters.
- Cycle Superhighways: by 2015 will be implemented twelve "highways" to biking to and from the city centre.
- Biking Boroughs: is a program oriented at implementing strategies and action plans for the development of cycling networks in the municipalities surrounding the city.

The "Cycling Revolution" is one of many valid actions aimed at reducing the dependency on fossil fuels and CO_2 emissions set up in the Mayor's Climate Mitigation and Energy Strategy, that is the Sustainable Energy Action Plan (SEAP) that the signatories of the Covenant of Mayors produce it signing the Pact. The Pact is part of the larger strategy 20-20-20 the European Union which aims at reducing emissions of harmful greenhouse gases by at least 20% by 2020, compared to 1990 levels, increasing at the same time the level of 20% energy efficiency and boost the share of renewable energy to 20% of total consumption of 2020, through the promotion of sustainable development of the territory. These three objectives are closely interrelated, since the release of CO_2 a greenhouse gas, is a consequence of production processes and consumption of electricity from non-renewable fossil fuels. London joined the Pact in February 2009 and presented, then, the SEAP in 2011, developing its own action strategies for saving on three pillars: retrofitting green London (retrofitting existing buildings in order to reduce the energy consumed to heat environments and produce hot water), greening London (increase the arboreal soil of 5% by 2025 for a report of a tree for every Londoner and create a network of green areas) cleaner air for London (improving air quality by focusing on the use of non-fossil fuels).

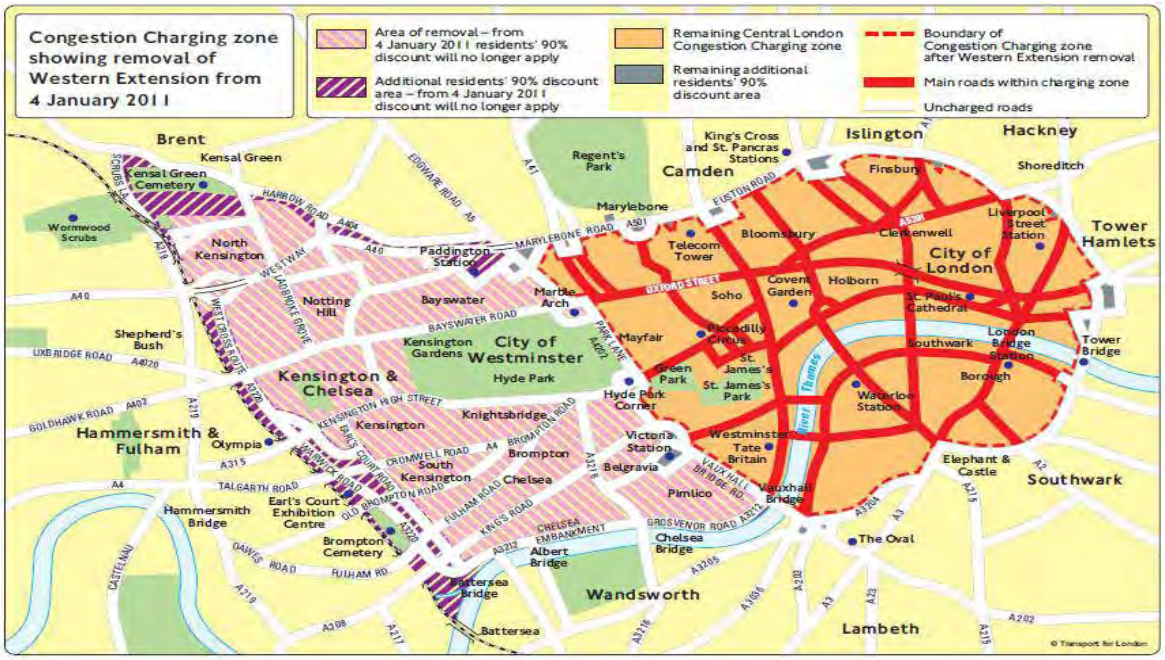

Fig. 6: The Congestion Charging Zone in London since 2011. The excluded areas are purple and lilac ones; in the Congestion Charging Zone (orange area) it is possible to run paying a toll of 10 pounds a day.

Among the many strategies outlined in terms of cleaner air for London, there are those inherent in the urban mobility, on which the Department for transport has conducted a series of studies for the development of more effective measures against dependence on private cars. The 36% of trips, in fact, is still using their cars, despite the British transport system is highly efficient and has also increased the number of people who prefer, instead, riding a bike. But if we consider that almost all of the transfers made by Londoners is referred to a distance less than 5 km, and of these approximately one third is under 2 miles in a straight line, we can easily guess that there is a great opportunity to make a modal rebalancing in favour of public transport, and the possibility of Bikeability.

Governmental authorities are conscious of having to face a long and difficult challenge in taking to away to cars the primacy of modes of transport, considered the advantages of flexibility and independence in its use and, in some cases, it is the only way to move around. This awareness has pushed policy makers to draw up specific plans of action, such as The plug-in vehicle[1] Infrastructure Strategy (2011) and the Hydrogen Action Plan (2010), in order to encourage and promote the purchase and use of green vehicles, as those powered by hydrogen, electricity, and even those with low carbon dioxide (ultra-low emission vehicles).

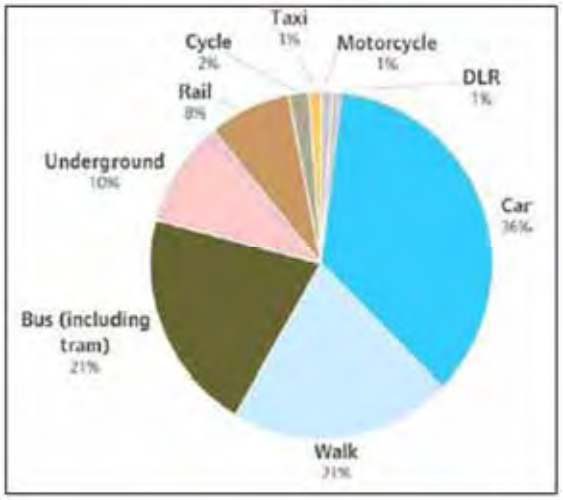

Fig.7: The transport sector analysis conducted by TfL in 2008 show that Londoners, after the car, prefer moving on foot or by bus. However, the comparison made by TfL between 2000 and 2008 has shown an increase in the use of public transport.

[1] The term plug-in vehicle is used to describe a wide variety of different technologies that use electric drive to power, or assist in the powering of, a vehicle (The plug-in vehicle Infrastructure Strategy, 2011).

The Government, in order to «reach the milestone of 100,000 electric vehicles on London's roads as soon as possible» (SEAP 2011), is working in partnership with car companies and those related to the production of electricity, in order to encourage the purchase of electric vehicles or plug-in. By the end of this year, finally, 300 hybrid buses circulate through the roads of London, of which some of them are already hydrogen-fuelled and in service for some years, as a result of the city to join the project CUTE (Cleaner Urban Transport for Europe) which aims at demonstrating the effectiveness and convenience of using this alternative source of energy. All the measures and strategies of intervention contained in London SEAP and in other plans or documents prepared in these last ten years have been developed not only to reduce energy consumption, but also to develop an economy "low carbon intensity" with which to be able to avoid the energy gap in the coming years.

As London also Amsterdam aims at becoming a world leader for green and innovative mobility by 2040. Transport, energy and environment policies of the Dutch capital are integrated, developed and implemented contemporarily with planning model adopted at national level, the Polder Model, which ensure a sustainable future. To encourage change in the use of energy and reduce carbon emissions, Amsterdam has developed two strategic documents: Amsterdam Climate Program and the Amsterdam Smart City, both in line with the recommendations of the Intergovernmental Panel on Climate Change (IPCC) which aims at reducing greenhouse gases of 80-90% by 2050 for developed countries. In particular, the Amsterdam Smart City appears as a great opportunity for collaboration between government agencies, the community and entrepreneurship to design and implement projects in the fields of labour, housing, mobility and production of renewable energy, in order to demonstrate «how energy can be saved, now and in the future» (Amsterdam Smart City 2011). Amsterdam has joined the Covenant of Mayors in early 2009, with the goal of 40% reduction in CO_2 emissions compared to 1990, the reference year of the BEI (Baseline Emission Inventory). Actions identified by its action plan are aimed at energy saving, sustainable energy exploitation and efficient use of non-renewable sources and are articulated with respect to short, medium and long term (up to 2015, 2015-2025-2025, 2040). In this document there are two key actions for energy sustainability: the total use of renewable resources and the diffusion of electric vehicles. Using solar and wind energy, or that produced thanks to a sustainable waste cycle, in practice a form of clean energy to meet not only the city's energy needs, but also and above all to feed the cars means to allow a truly sustainable development of the city, acting on all its components. Moreover, if we consider that the city has already undertaken this process of technological and social transformation, thanks to the active involvement of all stakeholders, to large research funding and policies aimed at changing travel patterns, then we are already half done.

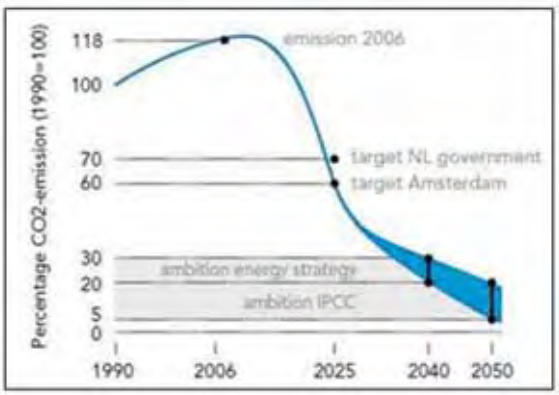

Fig.8: Amsterdam aims at reducing its carbon dioxide emissions of 75% by 2040 to achieve IPCC targets. the actions of environmental and energy plans were developed to achieve an even more ambitious goal: independence from fossil fuels in the near future.

Fig. 9: In Amsterdam all the charging points (for cars, scooters, vans, boats, electric bicycle with pedal assistance) are user friendly and they are in strategic areas for accessibility to central areas

Since the market for purchase of electric cars is still early in its expansion phase, the Dutch Administration wants to privilege local businesses as primary users as they are “heavy users” that account for a large number of road-kilometres each year so as to increase the visibility and demonstrate the valuable alternative that these vehicles compare with traditional fuel combustion cars. In addition to the electric Amsterdam is investing even hydrogen, to become a world leader in both sectors: tourist boats have been so powered since 2009 and in 2010 for local bus transport as well. Amsterdam is one of the founding members of the National Hydrogen Coalition that brings together Governments, research institutes, public institutions that wish to work together to use hydrogen on large-scale, rapidly developing this technology and creating new job opportunities.

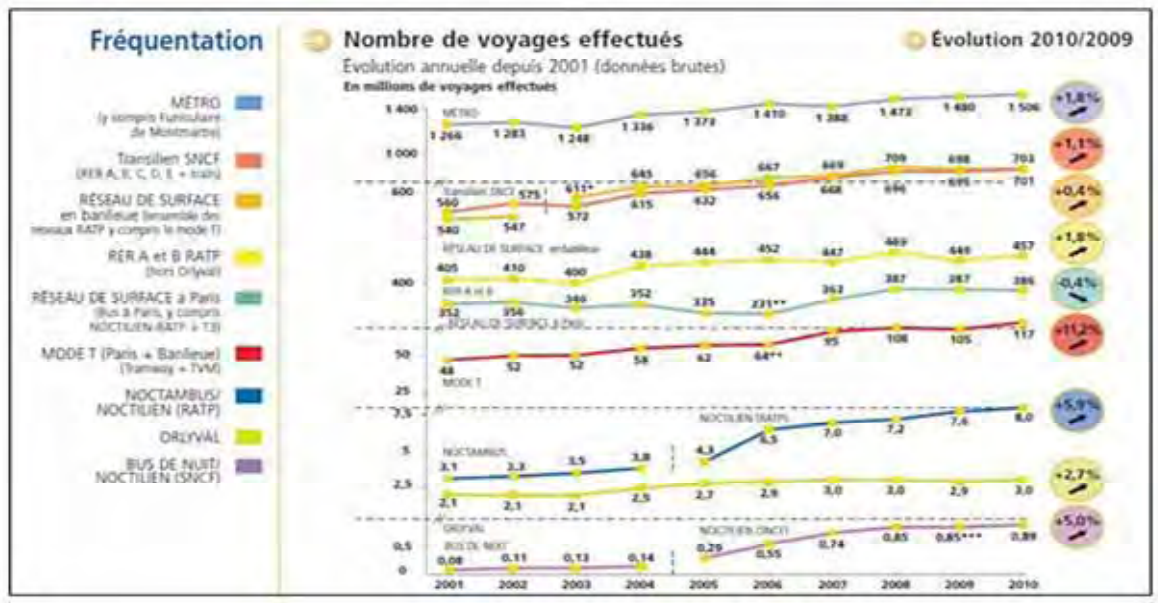

Fig. 10: In Paris between 2009-2010 there has been a general increase in the use of public transport modes, excepted the road transport.

Among the European cities that have integrated transport policies with environmental ones, assigning to the energy and environmental sustainability, in general, a key role, there is Paris which puts as its main objective of planning strategies the improvement of accessibility and quality of life. In 2006, after consultation of citizens and local communities, has been approved for the entire region of Ile-de-France the "Plan de la Protection de l 'Atmosphere" (PPA) aiming at respecting the limit values for air quality based on 16 measures. Nearly all of these measures affect urban mobility, identified as the sector that most of all is a difficult obstacle to the achievement of the objectives of air quality, for its obvious harmful impacts.

The development of PPA has been paralleled by the "Plan de Deplacement de Paris" (PDP, is the PUM approved in 2007) which has strengthened the addresses defined already in 2001 by the municipal administration to expand the offer of alternative moving modes to the car. The PDP has been integrated with the environmental plan for reducing greenhouse gas emissions (Plan de lotte contre le dereglement climatique) which constitutes the SEAP referred to the entire region of Paris, developed in 2007. A close-up fight oriented to climate change had already been drawn up in 2005 and was the continuation of all transport, urban and environmental policies, in order to ensure the consistency of the measures to realize. This continuity of planning tools also features the 2007 update, which aims at broadening and extending the measures contained in the PDP in order to:

- increase the transport demand met by public transport;
- reduce of 30% private motorized traffic and the values of CO_2 emissions within 2020 and of 75% by 2050, compared to 2004 (reference year of BEI);
- satisfy the 30% of energy needs through renewable energy sources.

In fact, these are the objectives relating to the city of Paris, because for the entire Ile-de-France region, plan aims at achieving goals far more ambitious than those of European strategy: not 20-20-20, but 25-25-25. The determination of the French Government to reduce air pollution and emissions of CO_2 and other toxic agents related to urban transport has led to a further update of SEAP in 2011 that aims mainly at electrical and even more at cycling mode. In order to revolutionize urban transport, it has been developed Autolib project that offers citizens an evolved system of car sharing with more than 6000 charge stations and approximately 3000 cars available work fully. The area that will be affected by the Autolib service includes Paris and over 46 municipalities of Ile-de-France, an area with a very high number of potential users, if we consider that the inhabitants of the Paris region are seven million, to which must be added the more than 27 million tourists who choose every year the *ville lumiere* as a tourist destination. Velib (an acronym of the French words bike and freedom) is the service bike sharing initiated by 2007 and provides citizens and tourists about 20,000 bicycles. The peculiarity of Velib lies in the fact that you can rent a bicycle, taking it from a station and back to another 24 hours per day, in order to use the service even at night, when the underground trains and buses are no longer in service[2].

Fig. 11: In Paris, about 58% population own a car, thanks to the efficient and intermodal public transport network and to the implementation of projects such as Velib.

[2] Paris metro train system and bus service is available until midnight.

5 MAJOR EXPERIENCES IN ITALIAN CITIES

European strategies aimed at reducing energy consumption, particularly for the urban transport sector, although they have been accepted in our Country with considerable delay, they are succeeding in reversing the trend of growing energy costs and emissions, according to reports from some national reports referred to below as the Annual Report on Energy Efficiency (AEER) produced annually by ENEA. According to the EC Directive 2006/32, Italy has drawn up its national Action Plan for Energy Efficiency (EEAP) in 2007, aimed at defining ex ante measures to achieve energy savings of 9% by the ninth year of application of the directive (2016), calculated on the average value of annual energy consumption of the five years preceding the implementation of the directive. In July 2011 Ministry of economic development (MiSE) presented the new EEAP draft «intending to promote consistently and continuous actions by initiatives already foreseen in EEAP 2007 and to submit proposals for medium-long term based on innovative and reliable setting» (EEAP 2011). In parallel, the national Action Plan for Renewable Energies (PAN), drafted by MiSE and by Environment Ministry provides additional guidance for energy efficiency, as essential to the achievement of the renewable energy targets and CO_2 reduction. The analysis on final energy consumption for each sector in the EEAP 2011 emphasizes that the question of final use of transport represents the 31.5% of the total and has grown since 1990 at an average rate of 1.5% per annum. A progressive increase in consumption occurred until 2007, followed only for the years 2008 and 2009 a reversal due to the economic crisis (Gargiulo, 2009). Of these total consumption, about 2/3 are due to passenger transport, the remaining part to freight, and both are dominated by the road transport.

From a point of view of energy efficiency, urban mobility segment remains even less efficient because of the low average fill rate of only 1.2 passengers per vehicle, and the low efficiency of cars and commercial vehicles and trucks which are the main mode of transport of goods. All has a negative impact on energy efficiency index of the entire transport sector, grown only 1.1% in the period 1990-2009.

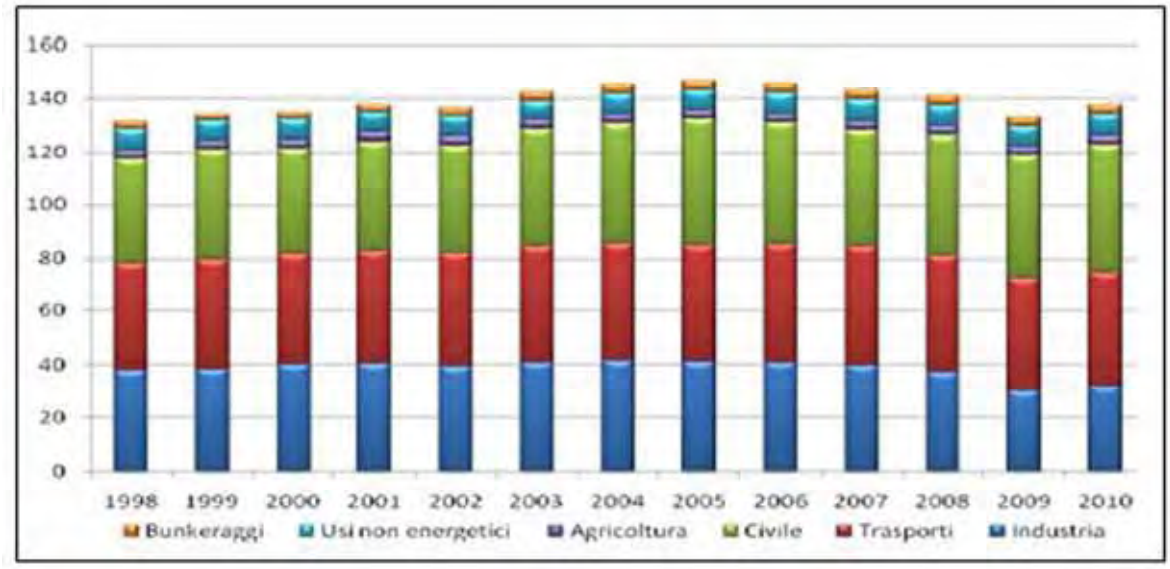

Fig. 12: In Italy in 2010 the final consumption of energy has been equal to 137,5 Mteps (Million of equivalent tons of oil), with a 3,6% increase compared to 2009. The final uses of energy are increased of the 8 ,7% in the period 2000-2005 and they are decreased of 9,2% during the years 2005 -2009. This reduction is due to the economic crisis and to the energetic efficiency incentives.

ENEA in its AEER evaluates the improving in efficiencies in different business areas (transport, manufacturing, residential) by suitable efficiency indexes that relate the energy consumption to produce goods and/or services with the quantity produced. In particular, the transport sector has shown an alternate trend compared to the other, showing more modest efficiencies.

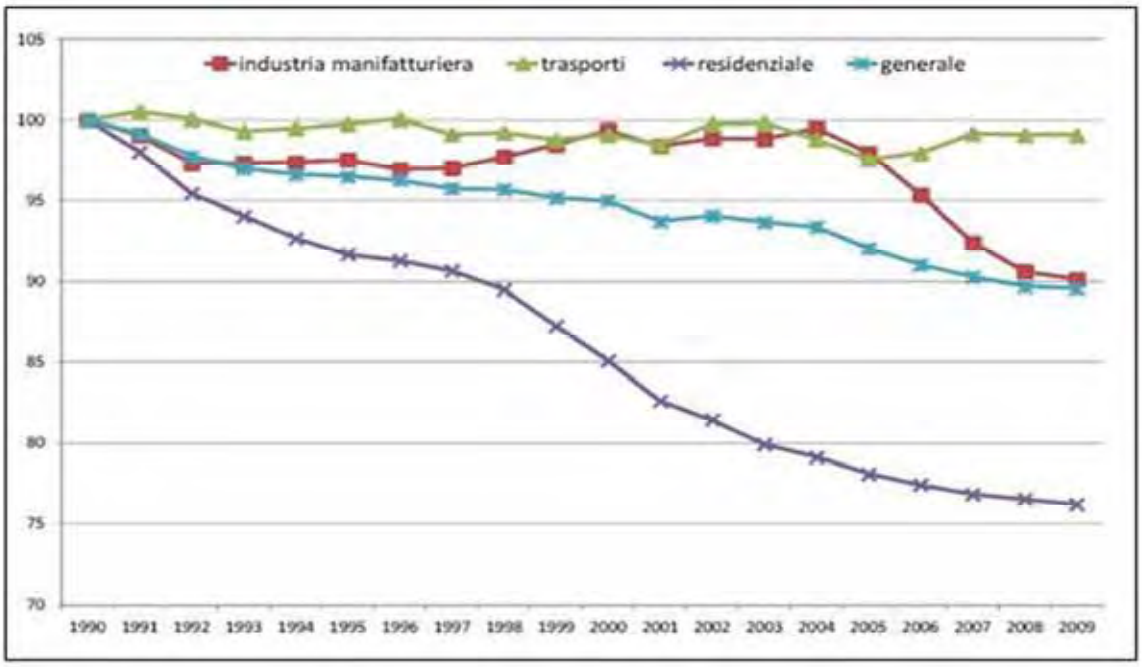

Fig. 13: Energetic efficiency index which ENEA refers to is the ODEX index (it has been developed within the ODYSSEE project-Energy Efficency Indicators in Europe).This index has measured the energy efficiency variation since 1990, year when the value is set equal to 100.

In addition to efficiency in the AEER is also assesses the energy intensity, calculated by comparing the final consumption of the sector to GDP (Gross Domestic Product), which shows in 2008 and 2009, negative growth rates of consumption for all transport modes. This reduction was determined by an ever greater use of fuel produced by alternative energy sources (LPG, biodiesel, biofuels) and greater sensitivity of consumers towards energy-environmental factors, and inexpensively. By then, a confrontation between Italy and some European countries more attentive to energy issues it emerges a general decreasing trend of mobility energy intensity, largely due to road transport and in particular to technological improvements in the car sector.

In the period 1999-2009 Italy has reduced its energy intensity in the transport sector less than half compared to other European countries and shows a modest increase in the use of public rail transport. This result indicates the need for more effective modal transfer policies, in order to contribute not only to energy saving, but also to the reduction of polluting emissions into the atmosphere. The recent economic crisis that has swept limited in transport: a decrease of 5% compared to the maximum value recorded in 2007, compared to a decline of 12% for all other sectors in 2009. The contribution of transport to the climate and energy emergency is therefore indisputable, and it is a matter that must surely be addressed if we consider the high environmental costs resulting. Hence the importance of initiatives such as the Covenant of Mayors, within the wider Europe strategy 20-20-20, which is also confirmed in the EEAP.

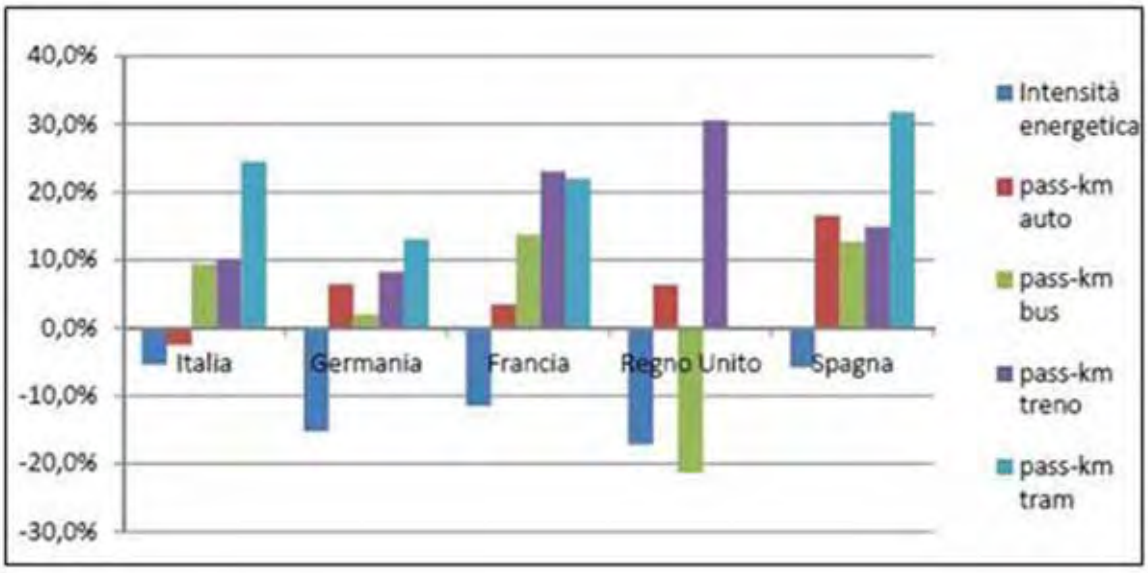

Fig 14: Energetic intensity variation of transport sector and of passenger traffic variation in the decade 1999-2009 related to the available data of the project ODYSSEE.

This agreement pushes cities «to take a commitment to reduce emissions, as well as national Governments, which must necessarily work together to reach the ambitious targets set for 2020» (EEAP 2011). 800 Italian cities have ratified the Pact including three main cities of the region Campania: Naples, Salerno and Benevento. Sustainable energy action plans (SEAP) presented by the municipal councils must contain measures to achieve the objective of reducing CO2 emissions.

The starting point for the drafting is the emission inventory (Baseline Emission Inventory-BEI) which constitutes a snapshot of municipal energy situation with reference to the year since then the reduction of carbon dioxide emissions shall be assessed. Among the many Italian cities that have signed the Covenant there is Genoa, which has defined a system of integrated policies in the medium to long term, making the SEAP interact with recent Urban Mobility Plan (PUM approved in January 2010) and Communal Plan (adopted in December PUC 2011).

In particular, the Document of he Objectives of PUC (2010) describes the project of a solid sustainable planning that reconciles the objectives of growth of the town ("Genoa City world, accessible and attractive") with the protection of territory, landscape and ecosystem. Genoa has the lowest inhabitant per vehicle ratio among the biggest Italian cities (one vehicle out of two inhabitants) and approximately 43% of trips by public transport, one of the highest rates of use of the collective transport of Italian cities. From the data reported in the BEI, for which the base year is 2005, has been shown that energy consumption of private and commercial transport is markedly higher than the public one.

The measures identified in the Genoa SEAP are aimed at the reduction of energy demand and polluting emissions reduction in the short (3-5 years) and long term (2020). In particular, actions referring the transport sector reflect the commitment that the municipal administration has long dedicated to the problems of this sector (granting the right to travel for all, improving the quality of public transport, reducing polluting emissions), proving to be in line with the most recent regional regulatory framework, based on the sustainable development of the energy system and mobility. Intervention strategies outlined in this regard focus on containment of traffic and on the improvement of energy and environmental efficiency. For the chief city of Liguria encouraging bikeability and car sharing means to pursue the objectives of sustainable

mobility and energy saving: on the one hand, individual motorized movement will be reduced and on the other hand, will be reduced the energy demand for transport of 55%.

Categories	Fleets	Energy consumption [MWh/2005]	Total per categories [MWh/2005]	CO2 emissions [t/2005]	Total per categories [t/2005]	TOTAL TRANSPORTS [t/2005]
Municipal Fleet	Cars	4452	37293	1129	9830,8	495533,4
	Two wheelers	1580		393,3		
	AMIU (Waste collection)	31261		8308,5		
Public transport	Buses (diesel, oil and hybrid)	96902	111271,9	25856,8	33234,6	
	Electric systems	14223		7338,6		
	Car sharing	146,9		39,2		
Private and commercial	Cars & Commercial vehicles	1380184	1704728	364462	452468	
	Two wheelers	324544		88006		

Fig. 15: In 2005 in Genoa, the major energetic consumption of transport sector is due to commercial and private vehicles

Intervention measures for energy efficiency are helped by those concerning the regulation of urban trips in order to discourage recourse to the car use by residents and cityusers.

This will determine less dependence on cars, an increasing use of public transport and of soft mobility, a decrease of energy consumption and polluting emissions. In this vein have road pricing policies and the creations of the Isole Ambientali have been strategic. In fact, acting synergically on restricting the use of private cars and the promotion of alternative transport modes allows to create a system of sustainable urban mobility. An evaluation conducted in SEAP shows that the new road pricing regime called Blue Areas, in force since 2005 and intended to expand in accordance with PUM, is allowing to reduce congestion in central urban areas and to secure a more rational accessibility to citizenship, thanks to more careful organization of parking areas.

The results expected from the implementation of all the measures referred to the transport sector are expressed in terms of reducing CO2 emissions (about 22.8%) and not also in terms of reducing energy consumption, contrarily to what stated in the initial part of the plan.

Rome has acceded to the Covenant of Mayors in 2010, pledging, in particular:

- to implement a series of measures aimed at energy efficiency, focusing heavily on the production of energy from renewable sources;
- to intervene on the planning and organization of transport system with strategic decisions concerning urban development;
- to inform and involve the citizens and other local stakeholders for a more intelligent use of energy;
- to prepare and implement pilot projects that can serve as examples of excellence (Benchmarks of Excellence-BoE) for the development of sustainable energy in urban contexts;

The issues considered in the Roman SEAP are integrated with other plans already adopted (such as the plan for sustainable mobility and the action plan for the achievement of the objectives of the Kyoto Protocol, both approved in 2009) or in the process of drafting, acting synergically with transport system, territorial planning, construction, and the use of alternative energy sources.

Starting from the analysis of the information contained in the BEI (reference year 2003) have been identified as priority areas of action (tertiary and residential mobility, as they represent the most responsible sectors for the polluting emissions) and initiatives to be undertaken shortly (next 3-5 years) and long-term (vision to 2020), to meet the CO2 reduction targets.

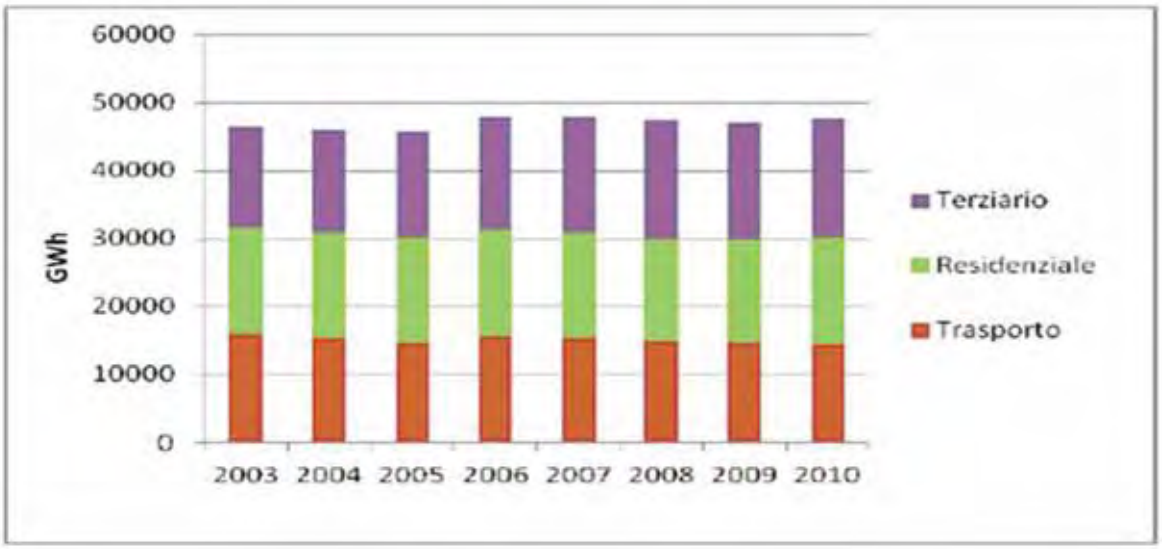

Fig. 16: Total energy consumption during the years 2003-2010 in Rome.

The most important element concerns the primacy that Rome holds compared to other European capitals, because urban trips made by cars is represented by 67%.

This alarming factor can be regarded as the outcome of two phenomena: an urban sprawl, an inadequate provision of public transport in the densely populated suburbs. Preferring cars to public transport causes, then, a strong congestion of radial arteries and ring roads surrounding the town and a considerable carbon dioxide emission (about 3.59 million tons/year).

Città	Londra	Parigi	Roma
Popolazione	7 557 000	2 153 600	2 718 770
Superficie comunale (kmq)	1.570	105.4	1.285
Lunghezza rete stradale (km)	14 926	1 644	5000*
Autovetture	2 497 000	673 600	1.897 672
Veicoli merci	21 000	117 700	182 397
Motocicli	116 000	102 000	379 000
Ciclomotori			156 000
Altri veicoli	376 000	-	44 294
Numero veicoli a motore	3 010 000	893 300	2 660 202
Tasso di motorizzazione (veic. x 1000 ab.)	**398**	**415**	**978**
Tasso di autovetture (auto x 100 ab.)	33	31	69

**interno al GRA*

Fig.17: In Rome the high motorization rate, compared to London and Paris, is confirmed by the data reported by the Urban Plan for sustainable mobility (SUMP 2007).

The SEAP identifies interventions aimed at reducing emissions of the transport sector on the basis of the lines of address Urban plan for sustainable mobility (PUMS 2009), by integrating them with urban planning, infrastructural and at to discouraging the use of private cars, particularly rush hours. In particular, the totality of operations for public transport is intended to modify the modal choice, to point users as much as possible towards a transport low environmental impact and innovative services.

To discourage the car use in urban central area, already identified as LEZ (Low Emission Zones), vehicular traffic interdiction measures even more restrictive are envisaged allowing transit only for vehicles powered by non-traditional fuels and establishing Privileged Zones or pedestrian traffic. This action of banning transit

in the centre will be implemented together with other measures which are viable alternatives to residents or for authorized users. Among the services provided there is the use of an electric vehicle to share with other users (electric car sharing), an initiative involving the absence from circulation of 5-6 private cars per each shared car and that, therefore, represents a positive impact on vehicular congestion problems that characterize Rome, as well as on the reduction of fuel consumption and emissions. Car sharing service has been activated already in 2005, in some areas of the historic center, and in 2008 was approved the development plan for the expansion of Rome Car Sharing service that included increasing the areas served and the number of cars, and awareness of potential users. To help encourage citizens to buy and use of electric cars, the SEAP provides for the development of a systematic action aiming at the diffusion on territory of charging infrastructure in public places.

The SEAP of Rome, finally, also contains measures regarding the diffusion of alternative fuels such as hydrogen, producing only water vapor. The municipal administration will use bus fuel-cells fed pure hydrogen and achieve, in the long term, two hydrogen production and distribution.

With the SEAP (approved in July 2011) the municipality of Modena aims at defining the optimal mix of actions and instruments capable of ensuring «the development of a sustainable and efficient energy system that gives priority to energy saving and renewable energy, as instruments for the reduction of the consumption of fossil fuels and CO2 emissions and for greater environmental protection» (SEAP 2011).

The action of the municipal administration on issues related to the reduction of greenhouse gas emissions has improved especially in recent years, through a series of local policies aimed, on one hand, at making more efficient the systems of production and consumption of energy and, on the other, to reduce consumption at both public and private levels. The starting point for the achievement of all these objectives is the integration of the main municipal planning tools relating to land use, transport and energy and energy variable, or, more precisely, of the availability of energy. The overall energy consumption, reported in 2009, the year of reference for the construction of the BEI, shows that in Modena the most incident sector is transport (1624 MWh), where the 98% of fuel consumption is due to the use of private or commercial vehicles, and only 2% is attributable to public transport.

The actions of SEAP in Modena for urban mobility are intended to:-Improve the intermodal transport of persons and local public transport.

- reduce transport and urban transit vehicles.
- implement the bikeability.
- increase efficiency in transport technologies.

Of these, the first three goals had already been recognized as a priority for action in the PUM (approved in 2006), aimed at strengthening the network and public transport, especially for surrounding areas. The energy component is invoked in all the measures relating to four areas of action, providing the value of energy saved (in MWh) through their realization. This helps understand more easily the actual benefits arising from implementing the SEAP, who should not be assessed only in terms of ton of carbon dioxide saved, but also and above all in terms of consumption of energy from fossil fuels avoided.

Mobility options identified by the Modenese Adminsitration tend to provide users with the widest possible number of valuable and flexible alternative to the car.

Intermodality, then, is pursued by acting simultaneously on several fronts: the enhancement of local public transport, the strengthening of the use of increasing bicycle, the bike sharing service "C'entro in bici", active since 2003, creating a station for interregional and regional rail transport integrated with public road transport, taxi and parking lots for cars and bycicles.

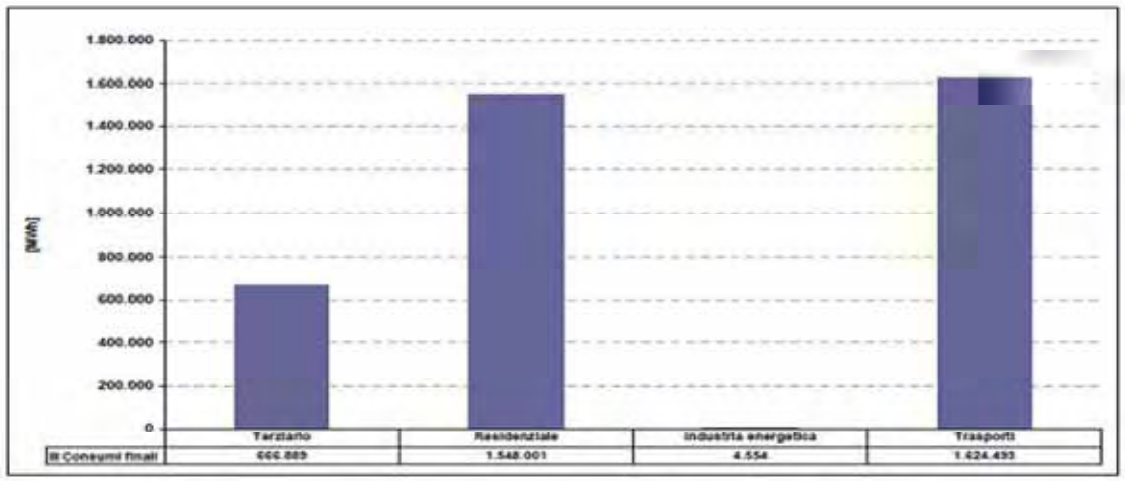

Fig. 18: The graph shows the energy consumption in 2009 in Modena.

Besides in Modena, Bari SEAP is the latest (May 2011) among the Italian cases and it is also the plan that from the "title" (SEAP-developing low carbon economy) reaffirms its intention not only to reduce CO2 emissions (a reduction of 35% compared with 2002, by 2020), but, mainly decarbonising the urban economy by increasing the use of renewable energy sources developing sustainable transport and promoting energy efficiency. These objectives can be achieved through «a systemic approach to planning, through coordinated actions with citizens first, and with the numerous public and private institutions» (SEAP 2011). Transversality and cooperation among urban planning tools and the close interdependence between land use, energy and urban mobility had already been favoured with Municipal Energy Environmental Plan (EEP 2006), by which the municipal administration has embarked on the path of implementation of the energy and environmental sustainability that is bringing to fruition with SEAP. The vision of a low carbon Bari has been defined on a grid of integrated interventions in order to increase the benefits from their synergistic implementation, and divided into vertical, and transverse sectors. Interventions both in education of behaviors and in energy planning can be considered as primary sectors since the success of the plan strongly on them. Changing patterns of use and consumption of energy, reoriented towards low-carbon lifestyles, and the development of a plan aimed at a rational use of soil and other natural resources, the upgrading of existing urban structure and a sustainable government of territory are elements saving energy policy shall depend on. The initiatives planned for the area of urban mobility, whose emissions in 2002 (reference year of BEI) are associated to the 96% to private transport, aim at counter balancing imbalances in the private transport, through the development of sustainable mobility systems alternative to cars, especially the bike. The future "on two wheels", in fact, is not only referred to the city of Bari, but to the entire region which will be the leader of the Italian regions involved in the project CY.RO.N.MED (Cycle Route Network of the Mediterranean). This project focuses on the definition of cycling network backbones of the Mediterranean area, through which it will be possible to enhance and develop sustainable transport modes. In order to facilitate soft mobility the SEAP shall promote the extension of the pedestrian area inside the LEZ active since 2008 in the historic part of the city. Other measures intended to reduce emissions of carbon dioxide are:

- identification of Areas 30, that are areas where the speed limit is of 30 km/h;
- Upgrading of rail transport and construction of three new railway lines, including the connection with the airport;
- renewal of the municipal vehicle fleet with low emission vehicles.

6 TOWARDS AN INTEGRATED APPROACH BETWEEN URBAN AND TRANSPORT SYSTEMS TO ENERGY EFFICIENCY

The population growth living in urban areas reaches 50% of the total, causing congestion, traffic, polluting air, noise and energy consumption, also due to the high density of urban activities. The combination of environmental effects clearly measurable and the energy price crisis produced by the explosion of global demand, reveals strongly the urgency to afford the problem in a multi-sectoral and systemic perspective. The weight of energy production from renewable sources out of the total production in Europe but especially in Italy, continues to be very low, and doesn't respect emission reduction targets. Furthermore the cost of the Kilovattora produced with the cheapest renewable sources available today (windpower) is even more triple than the one produced with traditional methods, such as from a coal-powered plant. This heavy gap doesn't allow the immediate solution to the problem but highlights how major benefits can be reached quickly with the lowest investment costs and how they are related to saving energy. It is essentially to rethink the development model, and, in particular, settlement and urban development, identifying the ways by which to reduce energy consumption maintaining sustainable economic growth rates and untying the link between economic growth and increasing energy consumption. Currently, in Italy, energy policy refers to the real estate already existing or just built are mainly focused on improving the efficiency of buildings but they reveal little effective because of the complexity of energy problem.

Fig.19: In order to reduce both carbon emissions and energy consume, a lot of cities are realizing interventions at building size, such as wind turbines on the roofs of the buildings

The choices that Italy and Europe are facing are clear though difficult: energy supply, reduce costs and energy consumption, reduction of polluting emissions are all long-term challenges that are taking increasingly serious aspects not be postponed. Italy responded to the growing attention from EU on these

issues, implementing policies aimed at improving both the efficiency and energy saving, but the absence of a clear strategic and integrated vision has generated a dispersion of resources in reaching the 20-20-20objectives, or more generally, in reducing the sustainability in energy sectors.
The measures to reduce emissions and to increase renewable energy are effective "only in theory", rather than in reality. For example, our country according to the EC Directive 77/2011 has to reach the goal 22% of renewable energy production by 2010, but, in recent years, the effective percentage of renewable sources for electrical uses has remained largely steady on the level of 16%. In addition, the transport sector is second only to the civil one for total energy consumption and 95% of the energy used comes from oil source. In fact, in spite of the policy of promotion intended to sell green vehicles diesel and gasoline vehicles are still used. The goal of greater efficiency in transport sector doesn't depend only on technological innovation, but also on an effective reorganization of urban trips discouraging private cars.
In this regard, ENEA in 2009 estimated that the doubling the current demand of alternative modes to private road transport, determines a total saving of approximately 2.7 Mtoe proving so that modal shift policies are as effective as those promoting energy efficiency through technological innovation. In our country we can therefore detect a gap between commitments at taken international level and the implementation of concrete actions aimed at reducing national energy consumption.

Transport sector	Alternative modes to road transport	Transport demand 2009	Current share [pax-km or ton-km]	Delta consumption unit 2009	Transport demand 2020	Delta consumption 2020	Saving energy 2020
		M pax-km or ton-km	%	Gep/ pax-km or/ton-km	M pax-km or ton-km	Gep/ pax-km or/ton-km	Mtep
City users	Pedestrian > 5 min	9434	n.d.	65,4	18867	52,3	0,5
	Public urban transport	18867	8,1	42,4	37734	33,9	0,6
Commuting	Regional rail network	26095	5,1	18,9	52190	15,1	0,4
	Regional buses	17208	4	29	34416	23,2	0,4
Long distance passengers	Long distance rail transport	22501	5,2	37,4	45002	33,6	0,8

Fig.20: The table provides For each alternative mode to private road transport the current demand (referred to 2009), energy savings per unit of traffic mode. The last columns are related to an hypothesis of modal transfer and energy saving 2020, referred to the suggested.

Through the analysis of urban planning tools and of mobility governance as well as the ones referred to the energy issue, results a strong awareness of the need to adopt strategies geared toward the reduction of polluting emissions to the implementation of natural mechanisms of uptake (mitigation) and new strategies aimed at contrasting the possible adverse effects of climate change. On the other hand, it's evident also that a national unified reference framework causes heavy restrictions on the implementation of concrete actions. For example, there is much diversity and generalization about addresses on sustainable mobility oriented to mitigate the effects due to climate change. On the contrary the measures referred to energy efficiency of buildings, are supported by laws and latest national public finance interventions.
The process of resolving energy issues has been slowed down by international choices such as the Conference of the Parties COP17 of Durban in 2011 that allows to develop solutions for the reduction of

greenhouse gas emissions starting in 2020. Therefore an energy policy environmentally sustainable, characterized by an integration between energy, mobility and urban system, should be quickly adopted. Henceforth initiatives such as the Covenant of Mayors might provide a valuable contribution, as SEAP (Sustainable Energy Action Plan) is based on interrelationship between these areas. However, the development of a synergy between programs, planning tools, and mobility governance still requires a great deal of cooperation and human and economic resources. The definition of SEAP is only on voluntary basis, which is an element of weakness for the success of European low-carbon policies. Considered the positive results that SEAP have been reaching it should be advisable to get compulsory these initiatives to get the sustainable energy objectives. Anyway the implementation of the SEAP has some points in common with various cities, though each city show its own characteristics and therefore needs specific solutions for transport problems they suffer. In all the European cases proposed has developed an integrated planning process, focusing on shared decisions among the various stakeholders and particularly with the community. An open participation is the fundamental element to achieve prearranged objectives as energy sustainability begins mainly with a radical lifestyle change. Italy too is making progress in the definition of integrated policies; however, the integration between urban and transport plans compared with the European cases analyzed often remains a theoretical aspect. Energy saving should therefore be regarded as a consequence of the reduction of polluting emissions and not as a goal.

All the examples referred to Italy have considered SEAP as an important opportunity in order to identify the best solutions for their own problems about energy efficiency and urban transport. Infact these elements represent both a challenge and an opportunity to rethink the future of cities, to transform and improve life conditions. Therefore, the elements to be brought into question should be: the path to be followed, the role of the subjects involved or to involve and the tools to use.

	London	Amsterdam	Paris	Genoa	Rome	Modena	Bari
COUNCIL DELIBERATION	2010	2010	2007	2010	2011	2011	2011
2020 CO2 REDUCTION	38%	40%	25%	23%	20%	21%	35%
MAJOR TRANSPORT MEASURES	Increasing the use of public transport; Increasing pedestrian and bike modes; Use of hydrogen buses; Promoting sustainable fuels; Car e bike sharing (electric too); expansion of the network of charge points for electric vehicles; Promoting electric vehicles.	Promoting hydrogen buses; Promoting electric vehicles; Promoting hydrogen vehicles; Increasing pedestrian and bike modes; Car and bike sharing electric too).	Increasing pedestrian and bike modes; Promoting hybrid vehicles Car and bike sharing (electric too); Renewal municipal vehicles.	Parking policies; Increasing pedestrian and bike modes; municipal green vehicles; Car and bike sharing; Green buses.	Increasing pedestrian and bike modes; Promoting sustainable fuels; Establishment ZTL for traditional vehicles; Electric car sharing; Bike sharing; municipal green vehicles; Promoting network of charge points for electric vehicles.	Increasing the use of public transport; Parking policies; Park and ride stations; Car pooling; Car and bike sharing (electric too); Promoting electric vehicles.	Car and bike sharing (electric too); Park end ride stations; Increasing pedestrian and bike modes; Promoting electric vehicles; Expansion of rail network.
INTEGRATION WITH OTHER PLANNING TOOLS	Cycling Revolution London; The plug-in vehicle Infrastruture Strategy; Hydrogen Action Plan; Mayor's Transport Stategy	Amsterdam Climate Program; Amsterdam Smart City	Plan de la Protection de l'Atmosphere	PUM; PUC	PUMS	PUC; PEC; PUT	PEC

Fig.21:Summary table for European and Italian analyzed cases

The above considerations allow immediately perceive that such things require a different and broader strategy to solve the problem. The extreme slowness and the fragmentation of the Italian law system witness the inadequacy of acts to build renewable energy plants and give evidence to the absence of a mature industrial market of green energy.

Italy is the European country with the best investment opportunities in the renewable energy but at the same time it is the Nation where is more difficult to achieve projects. The guidelines (D Lgs 387 2003) to approve the realization of renewable energy plants from are a plain example of this situation. The core of the problem of change climatic emissions is mainly represented in medium and large cities, where temperature is higher at least two degrees compared to less densely urbanized territory. Henceforth Europe has pointed out as seventh thematic strategy the urban environment, where it is necessary to integrate environmental policy with other actions.

A great deal of studies and research on energy and environmental has showed the lack of a systemic approach. The traditional division between city and countryside has determined a higher soil consumption causing the inevitable growth of road transport demand and worsening the territorial, environmental and energy unsustainability.

Fig.22: The experimental two-seat electric vehicle in New York

The research lines that afford the energy consumption reduction have been developing their field action only recently within the Relevant National Interest Research Programs (PRIN) and National Operational Programs (PON). The integration among territorial transformations, planning mobility and environmental sustainability opens interesting perspectives for the definition of new intervention strategies that tie together, into a new model of governance of the territory, different aspects such as: the reorganization of urban system, rail transport, social housing, urban regeneration and the implementation of energy policies and climate adaptation.

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