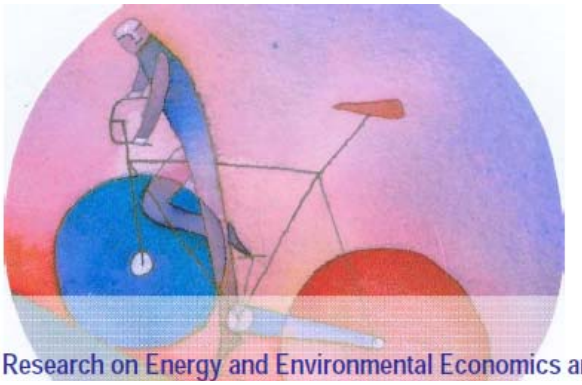


IEFE
Centre for Research on Energy and Environmental Economics and Policy

Research Report Series – ISSN 2036-1785

# Working Paper on Social, Economic, Cultural and Educational Barriers in Buildings and Transport within each Partner Country - National Report for Italy

*Edoardo Croci, Silvio Camaldo, Denis Grasso, Tania Molteni, Alessandro Palma*

Research Report n. 17
June 2015

Report developed within HERON project - "Forward-looking socio-economic research on Energy Efficiency in EU countries", which received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649690

***IEFE - The Center for Research on Energy and Environmental Economics and Policy at Bocconi University***
***via Guglielmo Röntgen 1, I-20136 Milan***
***tel. +39.02.5836.3820 – fax +39.02.5836.3890***
**www.iefe.unibocconi.it – iefe@unibocconi.it**

This report can be downloaded at: http://www.iefe.unibocconi.it

Edoardo Croci (IEFE – Bocconi) Steering Committee member

Silvio Camaldo (IEFE – Bocconi)

Denis Grasso (IEFE – Bocconi)

Tania Molteni (IEFE – Bocconi)

Alessandro Palma (IEFE – Bocconi)

**HERON (No: 649690): Deliverable D.2.1**

# D.2.1 WORKING PAPER ON SOCIAL, ECONOMIC, CULTURAL AND EDUCATIONAL BARRIERS IN BUILDINGS AND TRANSPORT WITHIN EACH PARTNER COUNTRY-NATIONAL REPORTS

DATE 29 JUNE 2015

**Partner: "*Università Commerciale Luigi Bocconi*"**

Italy

National Report

***Institution: Università Commerciale Luigi Bocconi***

***Steering Committee member (1): Edoardo Croci***

***Prepared by: Edoardo Croci, Silvio Camaldo, Denis Grasso, Tania Molteni, Alessandro Palma. Università Commerciale Luigi Bocconi - UB - IEFE.***

*(1) The Steering Committee member has the responsibility for ensuring the quality of the report.*

**HERON: Forward – looking socio-economic research on Energy Efficiency in EU countries**
*This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 649690. The content of this document reflects only the authors' views and the EASME is not responsible for any use that may be made of the information it contains.*

## Contents

## List of tables



## List of figures

# ACRONYMS

ACI: Automobile Club d'Italia.

AEEG: Italian Regulatory Authority for Electricity Gas and Water.

AMAT: Agenzia Mobilità Ambiente Territorio (Agency for Mobility Environment Territory).

ASSTRA: Associazione Trasporti (Transport Association).

CATI: Computer-assisted telephone interviewing.

CDP: Cassa Depositi Prestiti (Deposit and Loan Fund).

CENSIS: Centro Studi Investimenti Sociali.

CNR: Consiglio Nazionale delle Ricerche (National Research Council).

D.I.: Decreto Interministeriale (Inter-ministerial Decree).

D.L.: Decreto Legge (Law Decree).

Dlgs: Decreto Legislativo (Legislative Decree).

D.M.: Decreto Ministeriale (Ministerial Decree).

D.P.R.: Decreto del Presidente della Repubblica (Decree of the President of the Republic).

EE: Energy Efficiency.

ENEA: Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (Italian National Agency for New Technologies, Energy and Sustainable Economic Development)

EPBD: Energy Performance of Buildings Directive.

ESCO: Energy Service Company.

EU: European Union.

FIAB: Federazione Italiana Amici della Bicicletta (Italian Federation of Friends of the Bicycle).

GPP: Green Public Procurement.

GSE: Gestore dei Servizi Energetici (Energy Service Operator).

IEA: International Energy Agency.

ISFORT: Istituto Superiore di Formazione e Ricerca per i Trasporti (Institute for Education and Research on Transport).

ISTAT: Istituto Nazionale di Statistica (National Institute for Statistics).

ITS: Intelligent Transport System.

L.: National Law.

LEAP: Long range Energy Alternatives Planning System.

LED: Light-Emitting Diode.

LEED: Leadership in Energy & Environmental Design.

LPG: Liquified Petroleum Gas.

MATTM: Italian Ministry for the Environment and the Protection of Land and Sea.

MISE: Italian Ministry of Economic Development.

MIT: Italian Ministry of Infrastructures and Transport.

NEEAP: National Energy Efficiency Action Plan

NUTS: Nomenclature of Territorial Units for Statistics.

PIDEE: Piano integrato di diffusione dell'efficienza energetica (Integrated plan for the uptake of energy efficiency).

PNIRE: Piano Nazionale Infrastrutturale per la ricarica dei veicoli alimentati ad energia elettrica (National infrastructure plan to set up electric vehicle charging points).

PRT: Personal Rapid Transport

PUM: Piano Urbano della Mobilità (Urban mobility plan)

PUMS: Piano Urbano della Mobilità Sostenibile (Sustainable Urban Mobility Plan).

RSE: Ricerca sul Sistema Energetico (Research on the Energy System).

R&D: Research and Development.

SEAP: Sustainable Energy Action Plan.

SUMP: Sustainable Urban Mobility Plan.

TEP: tonnellata equivalente di petrolio (tonnes of equivalent oil).

TOE: tonnes of equivalent oil.

WP: Work Package.

WWF: World Wildlife Fund.

# EXECUTIVE SUMMARY

During the past decade, energy consumption in Italy remained stable at '90s' level, mainly because of the economic stagnation occurred in the recent years. The composition of energy consumption in 2013 shows that buildings and transport are two key sectors for Italy. In fact civil use represents 39% of energy consumption and transportation 30%. Regarding the efficiency trend, Italy assumes a relatively good rank in the European context. However, energy intensity increased both in the residential sector and non-residential sector and transportation showed modest efficiency gains, considering the 2000-2013 period.

After a brief overview of the main policy instruments in force in Italy to promote energy efficiency in the buildings and transport sectors and of the main potential energy efficiency technologies, the report maps through a literature review the main social, economic, cultural, educational and institutional barriers that currently characterize the Italian context, and that are limiting a further diffusion of energy efficiency in these two sectors. For buildings, both residential and commercial sub-sectors are analysed; for transport, both people and freight transport are considered. The barriers are qualitatively assessed based on the authors' evaluation. The report also puts the identified barriers in relation with policy instruments currently in force in Italy and highlights which policy instruments are contributing (or could possibly contribute) to overcome them.

Regarding the **building sector**, the analysis shows that efficiency performances in Italy can be considered relatively high with respect to other Member States. However, the achievement of further efficiency gains is strongly bounded to a variety of barriers affecting different actors involved and at different degrees. Main limitations in the building sector are:

- lack of a 'culture of saving' that limits, and sometimes neutralizes, the effect of policies aimed at boosting efficiency gains;
- old age of the existing building stocks and the great historical importance of such buildings which strongly limit the technical options for energy-efficiency renovations and retrofits;
- dyscrasia between the national/supra-national and local governance, Italy being characterized by a high regional fragmentation which produces insufficient policy coordination, uncertainty among actors involved as well as delays in policy implementation;
- lack of monitoring and controls which generate free-riding behaviours and other market failures;
- the issue of split incentives and principal-agent problem, which in Italy assumes relevant dimension given the high ownership fragmentation in the real-estate market (relevant presence of condominiums);
- economic stagnation, which limits the access to credit and the expenditure budget for energy efficiency investments, both for households and public administrations.

Besides these, behavioural and social issues (misperception of economic returns, different purchasing choice in presence of other people, limited trust in local and national public administration) and a lack of technical knowledge (both in households and in mediating subjects such as ESCo, building administrators etc.) further limit the adoption process of more efficient technologies.

The overview of barriers shows that further awareness raising and information provision to consumers, home-owners and building administrators are needed, to spread a culture of saving and to inform about benefits and opportunities of energy efficiency. Furthermore, economic instruments

or facilitating mechanisms to improve the access to available financial sources would be required. Also, action would be needed to address inefficiencies of bureaucracy and increase governance and policy coordination among the multiple administrative levels.

Regarding **transport**, the analysis shows that an inefficient use of energy is still present both in the people and freights transportation.

In relation to **public and private** transport sector, Italy is still a country where private mobility is prevalent, even if in some urban areas public transport services are well developed and contribute to reduce car use. The main barriers affecting the achievement of further efficiency gains in public and private transport sector are:

- Public transport supply in Italy is still limited in several Italian cities (with some remarkable exceptions), with significant problems in terms of quality and numbers of services. For many Italians, public transport is not reliable and attractive and for this reason they prefer not to use it;
- Soft mobility (bike and pedestrian) is less developed than in other European countries. This is strictly related both to cultural aspects and to the lack of adequate infrastructures in urban areas (bike and pedestrian pathways, etc.);
- Italy is one of the most motorised country in the world. Car is still a status symbol for a large part of population;
- In the last years, due to economic crisis and the national spending review process, several financial cuts were done to national funds dedicated to the regional and local public transport services. As local public transports are highly dependent from these resources (ordinary activities cover only a limited part of their annual budgets), these relevant cuts generate increasing difficulties in guaranteeing high public transport services levels;
- Innovative forms of private mobility (for example electric mobility, etc.) are not developed, as there is still a lack of adequate infrastructures (electric public recharge area in case of electric vehicles). Moreover it is important to highlight the importance given at national level to the promotion of biofuels and biomethane.

In relation to **freight** transport sector, the achievement of further efficiency gains is strongly bounded to a variety of barriers affecting mainly the logistic operators involved in national and urban freights delivery. Main limitations in the logistic sector are:

- Very competitive market, where it is difficult to set up forms of collaboration among the main logistic operators in order to reach more efficient solutions (sharing of vehicles and/or common usage of urban logistic platforms);
- Italy is affected by high delays in the main national and regional logistic infrastructures development and improvements (ports, inter-mobility nodes, etc.);
- Many competences in the urban transport regulation at urban level (access to city centres, etc.) are delegated to the municipal level without an adequate coordination at regional and national level. This aspect led to a high fragmentation of legislative frameworks that impede an efficient organization of logistic services and to create national business model usable in different cities;
- Italian logistic operators appear affected by significant problems in recruiting high-educated logistic manager and working forces. These education deficiencies limited their innovative capacity;

- All the previous barriers, together with a high bureaucracy level, create an economic framework where private investments (national and international) in the logistic sector are not perceived as attractive.

On one side, some barriers (promotion of green vehicles, bio fuels, ITS, coordination among different logistics operators) have been addressed by policy instruments in place. On the other side, other barriers, mainly related to the strengthening of people and freight transport infrastructures for more energy efficient and sustainable mobility received less attention in the Italian policies framework. Therefore investments to fill the gap of sustainable mobility infrastructures and services would be required, as well as information to consumers about the benefits and opportunities of sustainable mobility and to promote a more diffused culture of sustainable travel behaviours.

For the freight transport, beyond measures to address the infrastructural gap, also capacity building and coordination mechanisms for operators would be necessary, together with actions to address inefficiencies caused by bureaucracy.

# INTRODUCTION

This report provides the contents of the national report for Italy, which seeks to identify country-specific barriers to energy efficiency policy.

The national report is structured as follows:

1. Context

2. Mapping country-specific barriers in the building sector at local, regional and national scales

   - Social
   - Cultural
   - Economic
   - Educational
   - Institutional

3. Mapping country-specific barriers in the transport sector at local, regional and national scales

   - Social
   - Cultural
   - Economic
   - Educational
   - Institutional

4. Linking country-specific barriers to policy instruments

5. Key findings

The material collected through this report will be used to inform deliverable D.2.1 'Working paper on social, economic, cultural and educational barriers in building and transport'. The outcome of D.2.1 will be used in tasks WP3 and WP4. The main barriers identified for each country in WP2 will be considered in the development of the scenarios build in the LEAP software.

More specifically, WP2 will provide a qualitative assessment of the key barriers for each country (e.g. small impact, medium impact, big impact), as these will be presented in this report by each partner. This assessment will be based on the expert view of each partner. WP3 will then attempt to quantify the effect of these barriers in combination with the policy instruments that allow overcoming them. The research outcome of WP3 will be included in WP4.

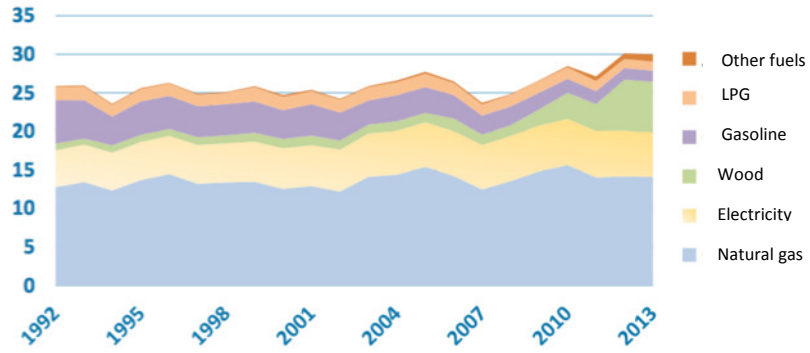
# 1. CONTEXT

During the past decade, the energy consumption in Italy remained stable at '90s' level. The reason can be mainly attributable to the economic stagnation occurred in the recent years, which is still gripping the EU. However, the energy mix changed toward a cleaner and more sustainable energy system. While in 1997 oil adsorbed more than 50% of total demand, recently oil and gas contribute less than 35% of the primary energy demand, as renewable energy sources have grew, in the same period, more than 27% with a current relative contribution of around 20% in the Italian energy mix (ENEA, 2015). Overall, all the traditional energy sources have shown decreasing trend in contributing to the final energy demand. However, when compared to other 28 EU countries, Italy is still affected by some specific limitations such as the intensive use of natural gas, large energy dependence and absence of nuclear production. However, such limitations are compensated by a lower per-capita energy demand with respect to other EU countries (2,63 toe/inhabitant) and a decreasing consumption trend. Sectoral analysis (1997-2013) shows that, with the exception of commercial and residential building (+31,9%), all the other sectors (transportation, industry, agriculture) have followed a negative trend, while from 2012 to 2013 the negative consumption trend affected the energy demand as a whole. The composition of energy consumption, in 2013, appears to be composed by civil use (39%), transportation (30%), industry (22%), agriculture (2%) and other uses (7%). Regarding the efficiency trend, Italy assumes a relatively good rank in the European context (-17,2% with respect to EU-28 mean, -14,2% with respect to the Euro Zone in the 2000-2013 period). In this respect, it is worth noting that from the introduction of White Certificates in 2005, energy intensity decreased by 7,9%. Manufacturing industry also showed decreasing energy intensity, with a reduction of 31,5%. On the other hand, energy intensity in the residential sector raised both in total energy mix (+25,1%) as well as specifically in electricity (+12.8%) considering the 2000-2013 period, although the presence of seasonal trend due to winter months. Increasing energy intensity also characterized non-residential sector (+50% in electricity, +32% in energy as a whole), which confirms its dominant role in the civil sector. Transportation showed modest efficiency gains, also because of the EU interventions to boosting environmental-friendly mobility. Overall, the ODEX index shows, in the case of Italy, a constant trend equals to 86,6% of total efficiency (100%). If decomposed over time, the annual ODEX rate was higher in the 2004-2009 period (1,5%) than the one registered over the entire period 1990-2013 (0,5%) (ENEA, 2015).

## 1.1 BUILDINGS SECTOR

According to the latest available data (ENEA, 2015), in the 2012-2013 period the residential consumption pattern appears to be stable (-0,4%). However, long run data (Figure 1) highlights a slight increase in energy consumption, with a relevant change in the energy mix occurred in recent years.

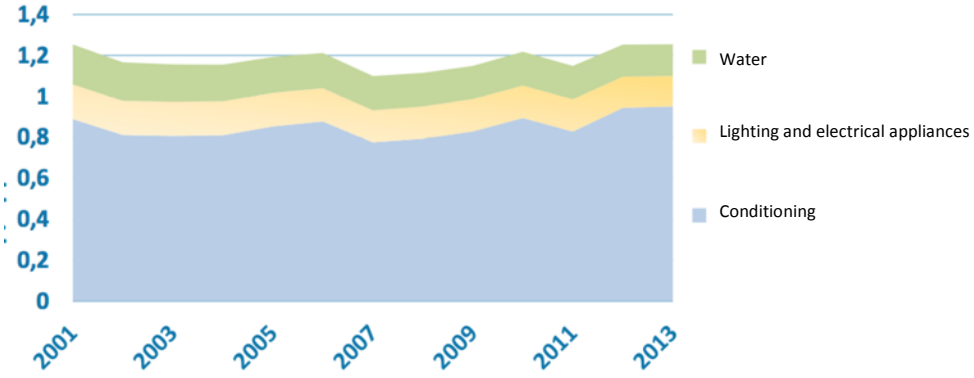
**Figure 1 - Energy consumption in building by fuel (Mtoe), 1992-2013**




Source: ENEA, 2015

In particular, wood consumption grew dramatically because of the biomass systems, which showed better economic performances compared to natural gas systems, particularly in mountain provinces. Renovations of principal and secondary dwellings have been catalysts for such a technology turnover. However, the non-decreasing trend of natural gas is due to the enlargement of the existent gas network, especially in southern Italy. Consumption for conditioning and heating adsorbs around 76% of total residential consumption, with a growing trend in the recent years. On the contrary, constant trends have been detected for cooking, water heating and lighting (Figure 2).

**Figure 2 - Energy consumption in building by use (toe/dwelling) 2001-2013**



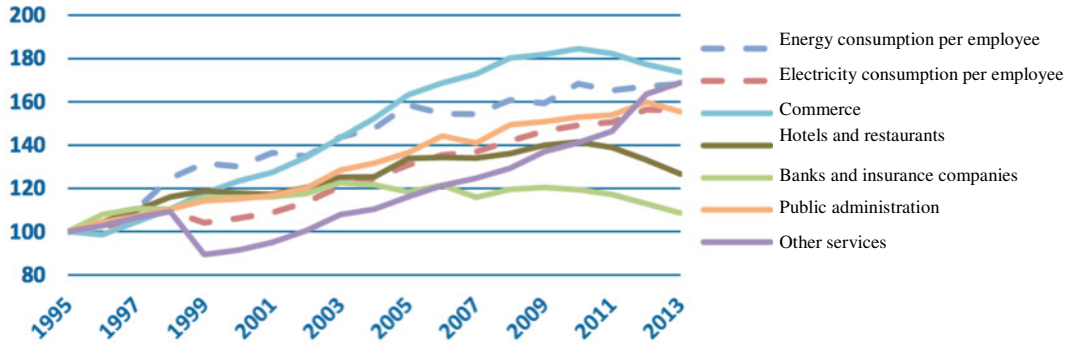

Source: ENEA, 2015.

Differing from the residential, the non-residential sector (commercial buildings, public administration) has shown an increasing trend in electricity consumption, with a limited slow down due to the economic crisis and a ratio consumption/employee almost doubled in the last twenty years (Figure 3).

Concerning the stock of buildings, Italy has shown a slightly increasing trend. In 2013, the number of total existing buildings is estimated to 14.515.795, with a growth of 13,1% with respect to 2001 (ISTAT, 2014a). Residential buildings account for 84,3% of total stock, of which 51,8% consists in single dwellings. The growth of residential buildings has been of 8,6% in the 2001-2011 period. The stock of non-residential buildings appears composed as follows: buildings devoted to manufacturing production (18,9%), commercial activities (16,2%), services (11,7%) and tourism (4%). At spatial level (Figure 4), the growth of buildings from 2001 to 2011 appears to be concentrated in central and

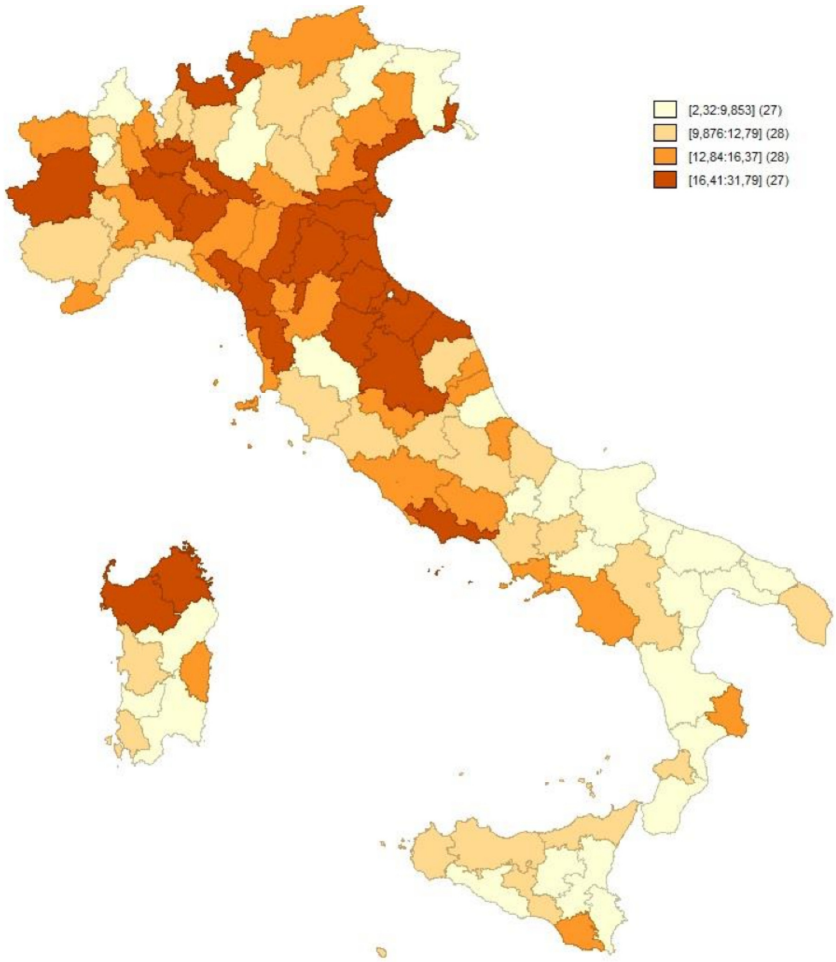
northern areas, while the southern region, characterized by lower residential energy consumption due to higher temperatures and moderate precipitation levels, shows very little variation.

**Figure 3 - Electricity consumption in non-residential buildings (index numb. 1995=100), 1995-2013**




Source: ENEA, 2015

**Figure 4 - Change of building stock 2001-2011, by province**

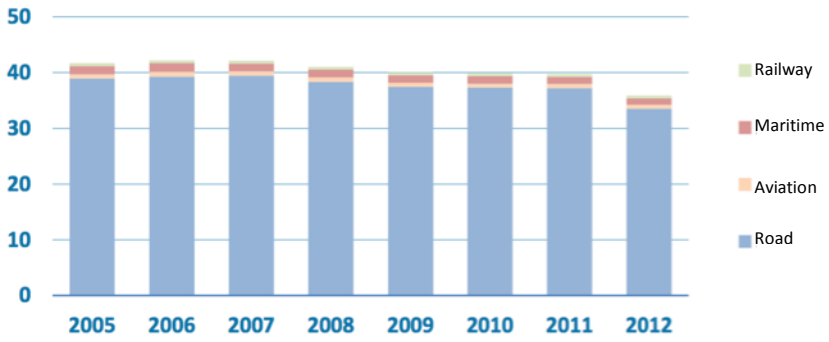



Source: ISTAT, 2014a.

## 1.2 TRANSPORT SECTOR

Energy consumption in the transport sector is characterized by a rather constant trend, with little variation in the most recent years, although maintaining a long-run constant share in the final energy consumption (30%). In 2012, the last available year, maritime and road transport showed the most relevant reduction (-11% and -10%, respectively), followed by aviation (-5%) and trains (-3%). However, road transport represents the lion's share of transport sector in Italy (Figure 5).

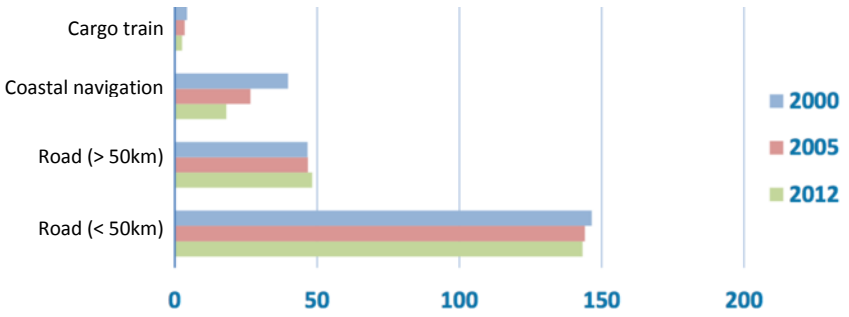
**Figure 5 - Final energy consumption in transport sector, by type (Mtoe) 2005-2012.**




Source: ENEA, 2015

The energy mix in the transport sector is dominated by fossil fuels (95%) and petroleum products, even though the share shows little negative and constant change. By looking at the longer-run trend (2000-2013), passenger and freight transportation sectors have shown efficiency gains. In particular, fleet turnover, increased load factor as well as intensification of daily trips, have concurred to positive efficiency performances. In the case of aviation, the reasons of such gains can be also due to the competition with the high-speed railway system, which has induced aviation companies to modify their tariff schemes and service supply. On the other hand, road transport has not shown the same efficiency trend, although the intensification of the government's intervention aimed at incentivizing the turnover of the existing vehicle stock with a more efficient one. This can be determined by the economic crisis, which has limited the expenditure capacity. Besides this, per-vehicle load factors remained constant over years. With respect to the freight transport system, efficiency gains derived from the increase of coastal navigation (*cabotaggio*), by the growth of load factors due to the higher competition in maritime transport sector as well as by higher fuel prices, which contributed to largely reduce energy consumption, in particular in the 2005-2012 period (Figure 6).

**Figure 6 - Energy consumption trend in transport sector, by type (goe/Tkm) 2005-2012**




Source: ENEA, 2015

## 1.3 OVERVIEW OF POLICY INSTRUMENTS AND MEASURES

Italy has developed a large set of policies and tools in order to promote and strengthen energy efficiency both in buildings and transport sectors.

In the **building sector**, the regulatory policy framework is compliant with the main EU directives on the theme (EPBD, EPBD recast and Energy Efficiency Directive). There have been some delays in the transposition of these directives into the Italian legislative framework, but to date the transposition has been completed. Also economic policy instruments are well developed, covering the needs of both public and private sectors buildings. One of the most significant economic instrument adopted for promoting energy efficiency is the White Certificates scheme, mainly targeting industrial and commercial buildings. Other important Italian economic policy instruments for promoting energy efficiency in buildings are the "Thermal Account" (targeting public authorities), tax deductions (targeting private buildings and families) and the "National Energy Fund for Energy Efficiency" to strengthen the investments in the sector. Several dissemination and awareness policy instruments have been launched during the years. In Italian buildings energy efficiency policy schemes, a very important role is played by regional and local authorities, as several competencies (such as energy certification of buildings, etc.) have been transferred by central authorities to regional and local authorities.

Several **actors** are involved in the formulation/delivery/evaluation of the buildings energy efficiency policy instruments. A crucial role is played by national ministries (Ministry of the Environment and Protection of Land and Sea, Ministry of Economy and Finance, Ministry of Economic Development and Ministry for Regional Affairs) supported by national technical organizations like ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development), CNR (National Research Council) and RSE (Research on the Energy System)[1]. Regional authorities also play important roles, since they hold the legislative powers and the administrative competences regarding the energy certification of buildings. Also municipalities can develop and implement several policy instruments, such as building regulations and local planning instruments, influencing energy efficiency of buildings in their territorial areas. Furthermore, municipalities develop voluntary local Sustainable Energy Action Plans (SEAPs) within the Covenant of Mayors initiative, which systematize several policies and measures regarding energy use in buildings at local level[2].

In order to involve all the different actors at national and regional level as well as private actors interested in energy efficiency, a national 'energy efficiency control room' was settled in 2014 by the Ministry of Economic Development.

Table A displays the most relevant policy instruments for energy efficiency in the building sector currently in force in Italy:

[1] Company financed by the Italian Electricity System Research Fund (Fondo per la Ricerca di Sistema) of the Italian Economic Development Ministry conducting research in the energy field.

[2] In Italy, up to now, more than 3.100 municipalities have signed the Covenant of Mayors and more than 2.500 have developed a Sustainable Energy Action Plan (data: Covenant of Mayors website, visited on 15 July 2015 http://www.eumayors.eu/index_en.html)

**Table A: Policy instruments for energy efficiency in the building sector in Italy**

| **Policy instruments for energy efficiency in the building sector in Italy** | |
|---|---|
| Regulatory policy instruments | · Energy performance in buildings. Transposition of EPBD and EPBD recast EU directives (Dlgs. 19 August 2005, n. 192, modified with Dlgs. 30 May 2008, n. 115; L. 3 August 2013, n. 90);<br>· Transposition of the Energy Efficiency Directive 2012/27/EU (Dlgs. 4 July 2014, n. 102);<br>· Rules for implementing the national energy plan in the field of rational use of energy, energy saving and development of renewable energy sources (L. 9 January 1991, n. 10);<br>· Regulation on Accreditation of Italian Energy Certifiers (D.P.R. 16 April 2013, n. 75);<br>· Green Public Procurement. Minimum Environmental Criteria for several appliances related to buildings, in particular public lighting and energy services for buildings (D.M. 25 February 2011, D.M. 25 July 2011, D.M. 7 March 2012);<br>· Energy labeling of households appliances (Dlgs. 28 June 2012, n. 104);<br>· Simplification/exemption of authorization procedures for some energy efficiency measures (municipal level);<br>· Regional Regulatory Schemes on energy efficiency in buildings (regional level);<br>· Municipal buildings regulations (municipal level). |
| Dissemination and awareness | · Pilot Projects on multi service smart metering (Deliberation 19 September 2013, 393/2013/R/gas of the AEEG);<br>· Transparent billing methods (Deliberation 18 November 2008 – ARG/com 164/08 of the AEEG);<br>· National Green Procurement Plan ("Piano d'Azione Nazionale per il GPP") (D.M. 11 April 2008, updated with D.M. 10 April 2013);<br>· ENEA website "Obiettivo efficienza energetica" (Target: energy efficiency) [3];<br>· Several dissemination/awareness campaigns on specific energy efficiency themes (all experiences are mapped in the NEEAP – National Energy Efficiency Action Plan 2014)[4]; |

[3] http://www.efficienzaenergetica.enea.it/
[4] http://www.efficienzaenergetica.enea.it/politiche-e-strategie-1/politiche-e-strategie-in-italia/paee/paee-2014.aspx

| | |
|---|---|
| | · Buildings energy efficiency voluntary certification schemes and environmental voluntary certification schemes (Casa Clima, Protocollo Itaca, LEED….);<br>· Sustainable Energy Action Plans (SEAPs) (municipal level). |
| Economic policy instruments | · Thermal Account (D.M. 28 December 2012)[5];<br>· Tax deductions (introduced with L. 27 December 2006, n. 296, namely the Budget Law 2007 – "Legge finanziaria 2007", and renewed several times with modifications);<br>· White Certificates (or Energy Efficiency Certificates) scheme and Obligation for national energy distributors (D.M. 20 July 2004);<br>· Kyoto Fund (introduced with L. 27 December 2006, n. 296, namely the Budget Law 2007 – "Legge finanziaria 2007", and implemented through following acts);<br>· National Fund for Energy Efficiency ("Fondo Nazionale per l'Efficienza Energetica") (Dlgs. 4 July 2014, n. 102);<br>· Measures for the energy efficiency in schools ("Misure per l'efficientamento energetico degli edifici scolastici") (D.I. 14 April 2015, n. 66);<br>· Fund for home purchase and/or renovation ("Plafond Casa")(Cassa Depositi e Prestiti) (D.L. 31 August 2013, n. 102, converted into L. 28 October 2013, n. 124). |
| Capacity building | · Integrated plan for the uptake of energy efficiency ("Piano integrato di diffusione dell'efficienza energetica", PIDEE)(Dlgs. 4 July 2014, n. 102);<br>· General conference on Energy Efficiency ("Stati Generali Efficienza Energetica"[6] (ENEA);<br>· ENEA training platform and e-learning courses for experts on energy efficiency in buildings[7]. |
| Policy instruments for the promotion of energy services | · Definition of ESCOs and set-up of a voluntary national certification scheme for certified ESCOs (Dlgs. 30 May 2008, n. 115). |

[5] Incentive mechanism for small projects designed to increase energy efficiency and generate thermal energy from renewable sources.

[6] http://www.statigeneraliefficienzaenergetica.it/

[7] http://www.formazione.enea.it/

| | |
|---|---|
| Research and Development and BAT promotion | · National Electric System Research (ENEA, CNR and RSE carry out R&D activities on urgent and strategic issues which have results for the benefit of the national electric system users as a whole);<br>· National "Smart Cities and Communities and Social Innovation" funds (2012 and 2013) (Director Decree 5 July 2012, N.391/Ric);<br>· National prize for energy efficiency measures (GSE's "Premio Efficienza Energetica");<br>· ENEA reports on energy efficiency best available technologies. |

In the **transport sector**, several planning instruments have been launched in order to strengthen and coordinate the policy schemes, both in people and freights transports. Many regulatory and financial policy instruments are in place in order to discourage more polluting behaviors and vehicles. A national policy focus is dedicated to the promotion of electric mobility and biofuels. On the contrary, less attention is given to the promotion of maritime transports. As in the case of buildings, many competences have been transferred by central public authorities to regional and local levels. Hence, regional and local levels play a fundamental role in the promotion of a more sustainable and efficient transports system.

Several relevant actors are involved in the formulation/delivery/evaluation of the transport energy efficiency policy instruments. A central role in transport policy instruments at national level is played by the Ministry of Transport and by the National Transport Authority settled in 2013. At local level a fundamental role is devoted to municipalities and their mobility and traffic plans.

Table B displays the most relevant policy instruments for energy efficiency in the transport sector currently in force in Italy:

**Table B: Policy instruments for energy efficiency in the transport sector in Italy**

| **Policy instruments for energy efficiency in the transport sector in Italy** | |
|---|---|
| Planning Instruments | · Italy's National Plan for Logistics 2011/2020 (Piano Nazionale della Logistica 2011-2020) (Ministry of Transport note prot. 567/CGA 30 may 2012);<br>· National Strategic Plan for Ports and Logistic (Piano Strategico Nazionale della Portualità e della Logistica) (Ministry of Transport 2015);<br>· National infrastructure plan to set up electric vehicle charging points (Piano Nazionale Infrastrutturale per la ricarica dei veicoli alimentati ad energia elettrica, PNIRE) (L. 7 August 2012, n.134);<br>· National Action Plan for Intelligent Transport System (Piano di Azione Nazionale sui Sistemi Intelligenti di Trasporto) (D.L. 12 February 2014, n.44);<br>· Promotion of use of biomethane in transports. (Dlgs. 3 March 2011, n.28, Article 8);<br>· Five years bus fleet renewal plan (Piano quinquennale per il rinnovo del parco mezzi del trasporto passeggeri su gomma) (L. 27 December 2014, n.147);<br>· Contract for the development of the national rail infrastructures (Contratto di Programma 2012-2016. Parte Investimenti) (Report to Italian Senate 3 February 2015 n.21);<br>· Sustainable Urban Mobility Plans, SUMP (Piani Urbani per la Mobilità Sostenibile);<br>· National Green Procurement Plan (Piano d'Azione Nazionale per il GPP) (D.M. 11 April 2008, updated with D.M. 10 April 2013);<br>· Sustainable Energy Action Plan, SEAPs (Piani d'Azione per l'Energia Sostenibile). |
| Regulatory instruments | · Vehicle Certification. Vehicle $CO_2$ emissions standards (several national laws compliant with European policies on theme);<br>· Renewable energy in transport sector. (Dlgs. 3 March 2011, n.28);<br>· Urban Traffic Plans (Piano Urbano del Traffico) (Dlgs. 30 April 1992, n.285);<br>· Obligation for national fuel producers to input into consumption 1% of biofuels of total traditional fuel. (L.11 March 2006, n. 81);<br>· National quality standards for biofuels (AEEG Resolution 160/2012/R/GAS);<br>· Minimum Environmental Criteria for the acquisition of vehicles for road transport (Criteri Minimi Ambientali per l'acquisizione dei veicoli adibiti al trasporto su strada) (D.M |

| | |
|---|---|
| | 8 May 2012);<br>· Limits to polluting vehicles (Regional legislations). |
| Economic instruments | · Government subsidies for the purchase of low-emission vehicles (L. 9 April 2009, N.5 and L. 26 June 2012, N.134);<br>· Incentives for the promotion of biofuels in transport sector (Dlgs. 3 March 2011, N.28);<br>· Ad-hoc fund of Ministry of Infrastructure and Transport on PNIRE implementation 2013-2015 (L. 7 August 2012, n.134);<br>· Ministry call in favour of the Regions to fund a network of electric vehicle charging points (L. 7 August 2012, n.134);<br>· National electric car sharing project in cities (co-financed by the Ministry of Environment);<br>· National funds for the development of underground railways (Defined in annual Italian Budget Laws);<br>· Funds related to the "Five years bus fleet renewal plan" (L 27 December 2014, N.147);<br>· Structural fund on thematic area "sustainable movement of people and goods" (EU 2014-2020 Structural Funds);<br>· Road tax (tax exemption for electric vehicles and discount on car assurance) and regional schemes for tax exemption for GPL and methane vehicles. (Regional legislations);<br>· National funds for local public transports (indirect effects for example in fleets renewal, etc.). (Defined in annual Italian Budget Laws);<br>· Funding for energy efficiency, renewable energy and bike-sharing (L. 24 December, n.244). |
| Information and awareness instruments | · Guide to fuel saving and decreasing $CO_2$ emission by cars (Guida sul risparmio di carburanti e sulle emissioni di anidride carbonica delle autovetture) (Published by MATTM, MIT and MISE);<br>· National Logistics Platform UIRNET[8] (Sistema Nazionale della Logistica Integrata e Intermodalità) (D.M 20 June 2005, n.18T);<br>· Events and initiatives within the European Sustainable Mobility Week;<br>· National observatory on local public transports policies (Osservatorio nazionale sulle politiche per il trasporto pubblico locale) (L. 24 December 2007, N.244). |
| Policy instruments for Research and Development | · Design and implementation of a Green Wheel bicycle (Initiative of Ministry of Environment);<br>· National "Smart Cities and Communities and Social Innovation" funds 2012 and 2013 (Director Decree 5 July 2012, n.391/Ric); |

[8] https://www.uirnet.it/uirnet/

| | |
|---|---|
| | · National technological maritime platform (Piattaforma Tecnologica Nazionale Marittima) (Dlgs. 21 November 2005, n.284). |

A more detailed description and analysis of the most relevant policy instruments for Italy can be found in Deliverable 1.1. "Landscape of energy efficiency policy packages in a Multi-Level government system – National Report for Italy" and Deliverable 1.2. "Status-quo analysis of energy efficiency policies in 8 EU countries – National Report for Italy" of the HERON project.

## 1.4 OVERVIEW OF TECHNOLOGIES FOR ACHIEVING ENERGY EFFICIENCY IN THE PARTNER COUNTRY

In order to provide an overview that allows a quick comparison of the different existing solutions, the mapping of the key technologies for achieving energy efficiency in the *buildings sector* in Italy has been made by associating to each technology the annual potential energy savings (in TWh), as estimated by Energy Strategy Group (2013). In particular, the main technologies here considered are:

- *For space heating and air conditioning: heat pump (53,3 TWh* per year*)*[9]*, opaque building surfaces (63,4 TWh* per year*)*[10]*, fixtures with high efficiency (12,4 TWh* per year*)*[11]*, solar cooling (0,76 TWh* per year*), solar thermal (11,4 TWh* per year*)*[12]*;*
- *For energy production and energy saving: small wind turbines (3,9 TWh* per year*) and photovoltaic*[13] *(17,0 TWh* per year*);*
- *For water heating: building automation (16,1 TWh* per year*)*[14]*, condensing boilers (34,7 TWh* per year*)*[15] *and biomass boilers (38,6 TWh* per year*);*
- *For cooking, washing machines, laundry dryers and dishwashers: induction cooking (1 TWh* per year*) and efficient and pre heated appliances (3,7 TWh* per year*);*
- *For lighting: efficient lighting systems (17 TWh* per year*)*[16]*.*

[9] The heat pumps are now in about 2% of the stock of production equipment installed in Italian buildings. There are indeed 400,000 installations of heat pumps compression and 150.000 installations of absorption heat pumps (source: Energy Strategy Group, 2013).

[10] Currently in Italy about 50%-70% of buildings has levels of thermal insulation roofing, walls and ground higher than 1.5W/m$^2$K (source: Energy Strategy Group, 2013).

[11] Currently in Italy about 40% -60% of buildings has levels of thermal insulation closures windows more than 3W/m$^2$K.

[12] It is estimated that currently Italy has a total installed 2.5-3 GW of solar thermal for the production of domestic hot water and heat for heating (source: Energy Strategy Group, 2013).

[13] The current situation of the photovoltaic market in Italy is characterized by the presence of more than 526.463 plants scattered throughout the country, with a capacity corresponding to 17.080.255 kW (source: Energy Strategy Group, 2013).

[14] Currently in Italy the Energy Management Systems record low uptake; thanks to the integration of wi-fi technologies, the Building Automation System counts about 150.000-250.000 applications (source: Energy Strategy Group, 2013).

[15] It is estimated that in mid-2013, about 20%-30% of total heating units in use (19 million units, including central heating systems) were condensing boilers (source: Energy Strategy Group, 2013).

[16] To date in Italy, the lighting equipment in use is composed by about 15-18% gas lamps, LED lamps for 9-13% and for the remaining part fluorescent lamps (source: Energy Strategy Group, 2013).

As regards the *transports sector*, the main fuel-efficient technologies, as identified by numerous sources (such as ENEL, 2013; ENEA, 2015; Marciani et al., 2014) are:

- For *road transport*: low emission vehicles (natural gas, hybrids, hydrogen and electric), innovative vehicles based on automation[17], tire pressure monitoring[18], awareness of "eco-driving"[19] and mobility management actions[20];
- For *rail transport*: power magnetic induction and recovering energy from braking;
- For *navigation*: hull antifouling systems, replacement of propeller and rudder, engine auto tuning, optimizers of hydro-dynamic flow, information system for the optimization of consumption, Air Cavity System and Waste Heat Recovery System;
- For *aviation*: high efficiency motors and aircraft with long life cycle.

More details on the technologies for achieving energy efficiency and their degree of diffusion in Italy can be found in Deliverable 1.4. “Technological trends in the building and transport sector – Italy”.

# 2. MAPPING COUNTRY-SPECIFIC BARRIERS TO IMPLEMENTATION OF ENERGY EFFICIENCY IN BUILDINGS AND TRANSPORT SECTORS

Within the following chapter, the main social, economic, cultural, educational and institutional barriers that currently characterize the Italian context, and that are limiting a further diffusion of energy efficiency in the buildings and transport sectors, are mapped through a literature review. For buildings, both residential and commercial sub-sectors are analysed; for transport, both people and freight transport are considered. The literature review analyses official documents and reports as well as scientific literature. Afterwards, the impact of barriers is qualitatively assessed based on the authors’ evaluation.

## 2.1 MAPPING BARRIERS IN THE BUILDING SECTOR

***Social, cultural and educational barriers*** **-** As recognized by specific studies (Galarraga *et al*., 2011; Panzone, 2013), behavioural adjustments, consumption practices, and quality perceptions on consumer choices can represent relevant issues in reducing energy efficiency gaps. In this respect, Italy does not constitute an exception. According to ENEL (2013) and ENEA (2015), behavioural and cultural barriers represent in Italy major limitations to spurring the adoption of energy efficiency technologies. Broadly speaking, behavioural and cultural barriers reduce the awareness of individuals on energy savings deriving from efficiency gains, thus limiting the diffusion of a ‘culture of saving’

[17] Cyber car, personal rapid transport (PRT), high-tech bus, high-tech lorry and dual-mode vehicles.

[18] It is estimated that proper tire pressure can cut fuel consumption by up to 5% (source: Managenergy: Energy efficient transport. 2008).

[19] Eco-driving (changing gears as soon as possible, maintaining a steady speed, frequently checking the tire pressure and decelerating smoothly) allows to save on average 5-10% of fuel, in addition to ensuring an economic saving, reducing the likelihood of accidents, noise pollution and emissions (source: Ecodriven. 2008).

[20] For example: encouraging the use of bicycles and public transport; company buses, teleworking, company kindergarten and grocery shopping online, car-pooling, car-sharing, bike-sharing, etc.

both at individual and community level. Such a culture constitutes the precondition for successful public interventions and attractive private investments in energy efficiency, since without a shared and dynamic efficiency culture, the interest and the associated value of more efficient goods is limited and misperceived. As a consequence, economic returns associated to previous investments on energy efficiency are difficult to be achieved given the existence of market limitations and inefficiencies (lack of information, few market agents). In this respect, the issue of behavioural spillovers deriving from best practices of virtuous individuals or communities assumes crucial importance. Without considering such multiplicative additional effects, the impacts of policies aimed at promoting a social awareness of efficiency benefits would be underestimated, both at individual as well as at country level, where international policy spillovers have been found to play a large role in inducing national regulation (see Costantini *et al*., 2015).

Data on environmental attitudes in Italy show that, despite the environmental awareness is increasing over time, the level of interest towards environmental issues and proactive action appears to be moderate, although not far from the European average. According to a survey conducted by the national statistical office (ISTAT 2014b, based on 2012 data), only 45% of the Italian population is interested in environmental issues, with an 8% increase from a previous analysis conducted in 1998 (37,4%). The level of interest varies according to geographical localisation of respondents (more interested citizens in the Northern regions in comparison with Southern regions). It slightly differs according to gender, with more interest from males (46,7% for males, 43,2% for females) and it significantly varies according to age. The share of interested people is higher in adult-age ranges (45-54 years and 55-64 years, namely 51% and 53%), and the lowest among the very young and very old people (14-24 years and over 75 years, namely 38% and 27%). Also the level of education plays a role. In fact the level of interest increases with an increase of the level of education.

Regarding the means used by the population to be informed about the environment, Italians tend to inform themselves mainly through TV/radios (85%), newspapers (53,8%) and less frequently through specialized magazines or books (11,5%), whereas more active forms of participation (like attending conferencing, participating in environmental associations) are not widely diffused. The typology of used information means varies significantly only according to the level of education; more educated people tend to rely less on TV/radio and more on newspapers/specialized magazines, as well as are more engaged in an active participation. Interestingly, the use of all environmental information means decreased over time between 1998 and 2012. Despite the fact that mass media are the most frequently used information means, they are not positively evaluated by respondents. In fact, more than half of respondents declares a low satisfaction for information provided by mass media regarding the environment.

Climate change is considered a relevant environmental problem. ISTAT's survey (2014b) ranked climate change third in terms of share of Italian population that has identified it as urgent problem (46,6% of respondents), after air pollution (52,1%), and waste production and disposal (46,7%). Notably, the share of people that considers climate change an urgent problem has increased by 11% in comparison with 1998. This environmental issue has attracted increasing attention by citizens in this time frame. Climate change and availability of energy emerge as serious problems also within another survey, conducted at EU-level by Eurobarometer (European Commission, 2011b). Both issues rank third in terms of share of Italian citizens that have identified them as most serious problem

faced by the world (identified both by 42% of respondents), after the economic situation (53%), and international terrorisms (44%). Italians also quite agree that fighting climate change and improving energy efficiency can result in positive economic effects, boosting EU economy and jobs (77% agree, 12% disagree, 11% don't know) in line with EU-27 average data (European Commission, 2011b). As far as environmentally-friendly and climate protection behaviours are concerned, Italians' behaviours seem to be in line with those of the European average, as revealed by the Eurobarometer survey (European Commission, 2011b). When asked about personal action to face climate change, 45% of Italian respondents state that they carried out actions to fight climate change in the last 6 months, whereas 45% did not carry out actions and 10% didn't know. When asked about which actions specifically they had carried out, actions linked to energy efficiency behaviours both in the buildings and transport sector were named significantly less frequently than the other typologies of actions, consistently with EU-27 data[21]. The most frequently cited climate-protection actions were related to waste reducing and recycling (55%), reducing the use of disposable items (41%) and buying local/seasonal food (35%). Regarding the attitudes in purchasing specific equipment using energy, Italians seem to assign a relevant importance to energy consumption in choosing new equipment to be purchased. When asked about how much attention they pay to buying a new light bulb, refrigerator or car, relevant percentages of respondents declared that they pay "a lot of attention" to their energy uses, with higher shares than EU-25 average data (European Commission, 2006). Finally, regarding attitudes towards specific energy policies, and in particular when asked about which priority public authorities should pursue to support people in reducing their energy consumption, the development of tax incentives to promote an efficient use of energy emerged as the most important (45% of respondents), followed by the provision of more information on the efficient use of energy (33%), and adopting higher efficiency standards for energy consuming equipment (27%) (European Commission, 2006). These results slightly differ from the overall EU-25 result, where most importance was attributed to the provision of information (43%), followed by tax incentives (40%). In a more recent survey (European Commission, 2011b), Italians seem also to agree with the idea of designing taxation schemes more on the energy use, in line with average EU-27 responses. In fact 73% of respondents agrees with such (24% totally agree, 49% tends to agree), whereas only 17% disagrees (13% tends to disagree, 4% totally disagrees), with a relatively high percentage of respondents that cannot express an opinion (10% does not know) (European Commission, 2011b). To summarize, the level of interest of the Italian population for the environment is rather weak, and they prefer passive forms of information rather than active and participative ones. Some regional and age differences can be detected, in particular youngest generations seem to be the least responsive in paying attention to the environment preservation. However, climate change is perceived as a serious problem and stimulates forms of personal initiatives, even though pro-energy efficient behaviours are not diffusely implemented to this aim. Nonetheless, Italians attribute a high relevance to energy uses when they purchase new equipment. The reasons of such results deserve a

[21] Energy efficient behaviours investigated and answers given by Italian citizens were (listed by relevance): choosing a more energy efficient household appliance when buying a new one (29%), using regularly environmentally-friendly alternatives to private cars (e.g. walking, biking, taking public transport or car-sharing) (21%), better home insulation (12%), having assigned importance to a low fuel consumption in the purchase of a new car (10%), avoiding short-haul flights whenever possible (5%), purchase of a low-energy home (4%) (European Commission, 2011b).

specific focus and should be further investigated in order to understand whether they are determined by other co-benefits of energy-efficiency (e.g. monetary savings, positive social recognition). Regarding the attitude towards specific policies, there seem to be a diffused agreement with the idea of taxation schemes based on the amount of energy used. A survey conducted within the project Promotion3e[22], in collaboration with 8 EU countries including Italy, provides further interesting information on the environmental attitudes, habits and choices of private consumers in purchasing home appliances. Although the projects relies on the analysis of a limited sample based on several municipalities belonging to the Province of Teramo, the results constitute one of the few case study in Italy on environmental attitudes. In the survey report, the most important choice factors of more efficient goods are reported. Although the cost always assumes the greatest importance in driving consumer choices, power consumption, energy-efficiency performance and power rating also constitute relevant factors (fourth, seventh and eighth position). In particular, when only environmental-specific factors are ranked, energy efficiency performances and energy labelling class reveal as factors of primary importance. The report also signals gender and age differences in environmental attitudes. Namely, female customers are reported to have more consideration for water and energy consumption in their choices of electrical appliances than male customers do. In addition, female customers report significantly more positive general attitude towards the environment than male customers and show greater confidence in sales support. With respect to age, customers younger than 30 years old pay relatively less attention to factors such as energy consumption. On the contrary, older women seem to be more prone to the consideration of environmental aspects, especially for energy efficiency classes. As a final consideration, it is worth noting that the attitude for choosing environmental-friendly and more efficient appliances (also being persuaded by technicians and sales advisors) is stronger when other people accompany buyers. Thus, the presence of friends and relatives seems to assume a positive role to the promotion of ecological buying. A specific issue regards those barriers affecting condominiums. It is worth considering that in Italy more than 75% of buildings date back to periods in which no norms or regulation related to energy performance was in force (ENEA, 2015). In light of this, a strong intervention aimed at renovating the stock of existing buildings is required. Nevertheless, a set of specific factors negatively affect the success of government plans to promote energy efficiency in residential buildings. More specifically, a study conducted by Politecnico di Milano and University of Insubria (WWF, 2007) detects cultural, technical and economic barriers. With respect to educational and technical barriers, WWF (2007) highlights the lack of technical expertise of building administrators, these being not able to identify and propose the correct set of interventions and investments in order to achieve energy efficiency gains. Moreover, the ownership fragmentation existing in condominium also affects the decision process. When a plurality of individuals with heterogeneous preferences are involved in decision process (e.g., to invest in energy efficiency technologies), this can result in initiative failures due to a lack of managerial capacity and coordination ability by the building administrator.

[22] The Promotion3e project aimed to reduce the energy consumption of households' electric equipment and products by implementing actions to encourage the take-up of energy efficient appliances as well as measures that increase quality and efficiency of information available to consumers. The project involves 8 EU countries, namely Portugal, Spain, UK (North Ireland), France, Greece, Italy, Germany and Poland and it has been developed in the 2008-2011 period.

**Table 1 Main social, cultural and educational barriers in the building sector**

| Type of barrier (Social, cultural, educational) | Title of barrier | Description of barrier |
|---|---|---|
| Social, cultural, educational (several factors interacting) | Gender and age differences | · Less consideration for water/energy consumption by male customers in electrical appliances choices.<br>· Less positive general attitude towards the environment by male customers.<br>· Less consideration of environmental aspects and energy efficiency classes by younger customers (< 30 yrs). |
| Social | Group as push factor to energy efficiency investments | Being alone when taking decisions on energy efficiency investment (appliances in particular) negatively affects the importance of saving issues and consumption performance. Being within a group (friends, relatives etc) seem to induce to environmental-friendly behaviour. |
| Social, cultural, educational (several factors interacting) | Lack of a "culture of saving" | This constitutes a precondition for successful public interventions and attractive private investments in energy efficiency. |
| Social, cultural | Fragmentation of home ownership (due to relevant presence of condominiums) | When a plurality of individuals with heterogeneous preferences are involved in decision process (e.g., to invest in energy efficiency technologies), this can result in initiative failures due to a lack of managerial capacity and coordination ability by the building administrator. |
| Educational | Lack of technical expertise of building administrators | Building administrators are often not able to identify and propose the correct set of interventions and investments in order to achieve energy efficiency gains. |

***Economic barriers*** - An Italian-specific economic barrier, affecting the building sector both at industrial and residential level, is constituted by the lack of incentive to invest in EE in consequence of the little incidence that energy costs assumes in most of the companies and families, although this aspect is particularly important in the case of electricity. Italy shows higher energy prices with respect to other EU countries (IEA, 2015), with an industrial pattern characterized by few energy-intensive companies whose energy bill covers more than 10% of the production cost (ENEL, 2013). The remaining companies show moderate energy consumptions and this mitigates the incentive to invest in energy efficiency technologies given by the well-known price-induced effect (Binswanger, 1974, among all). On the contrary, at household level this barrier is disappearing since the share of

households with energy bill higher than 10% of their income is increasing over time, a phenomenon known as 'fuel poverty' (Thomson and Snell, 2013). The issue of split incentives and principal-agent problem assumes crucial importance in the building sector. On one hand, owners could invest in energy efficiency with limited economic returns (excluding the extra cost to which the building is sold). On the other hand, those individuals that actually pay the bill and live in the building has limited incentive to invest in energy efficiency as do not own any properties and can only temporary occupy the building. In addition, difficulties in accessing credit caused by the economic stagnation also limits energy efficiency investments and affect both building administrators and ESCo companies.

**Table 2 Main economic barriers in the building sector**

| Title of barrier | Description of barrier |
|---|---|
| Little incidence of energy costs on companies/families | Little incidence of energy costs on companies/families means a lack of incentives to invest in EE. Higher energy prices could restore optimal level of EE investments although this could lead to 'fuel poverty' phenomena in poorer households. |
| Split incentives and principal-agent problem | On one hand, owners could invest in energy efficiency with limited economic returns (excluding the extra cost to which the building is sold). On the other hand, those individuals that actually pay the bill and live in the building have limited incentive to invest in energy efficiency as do not own any properties and can only temporary occupy the building. |
| Difficulty to access credit caused by the economic stagnation | Difficulties in accessing credit caused by the economic stagnation also limits energy efficiency investments, affecting both building administrators and ESCo companies. |

***Institutional, technical and technological barriers*** – In Italy the institutional and normative settings often constitute significant limitations to the promotion and diffusion of energy efficiency technologies, undermining the success of government regulation. Such a barriers are manifold and include: (i) lack of normative schemes; (ii) dyscrasia between national, supra-national and local norms which implies redundancy legislation, delays in adopting policy schemes, uncertainty as well as coordination failures due to the numerous Italian municipalities which often set different requirements; (iii) lack of transparency and long waiting times for authorizations to be faced by adopters and subjects involved (ENEL, 2013). In addition, the building sector is affected by the existence of a disconnection between the policy regulation and the effective implementation of policies in the real context. Apart from the numerous Italian regional fragmentation which induces to difficult policy coordination, this is also due to a lack of mediating subjects such as installers and technicians which seem not to have any particular incentive to operate in this sector, apart from that indirect given by the policy-induced market demand stimulus. Given the lack of incentives for providers, these latter seem not to provide consumers with sufficient technical information for adopting energy efficiency solutions (ENEL, 2013). A further institutional barrier lies on the lack of control to the initiatives actually undertaken by the building administrators, although the Italian legislation envisages specific control and penalty schemes. Technical limitations also constitute

relevant obstacles to energy efficiency gains. Also in this case, the Italian case shows specific features. According to ENEA (2015), more than 60% of Italian residential dwellings are older than 45 years and more than 25% show annual consumption between 160 and 220 kWh/m$^2$. Non-residential buildings are also characterized, on average, by an old age and low efficiency performances. The massive presence of low-efficient buildings represents a technical limitation difficult to be addressed in order to achieve energy efficiency targets, also considering the moderate propensity to demolish old buildings given the historical importance that these assume in the Italian urban setting.

**Table 3 Main institutional barriers in the building sector**

| Title of barrier | Description of barrier |
|---|---|
| Lack of normative schemes. | Lack of norms and regulations due to delays in adopting and implementing EU Directives. |
| Dyscrasia between national, supra-national and local norms and lack of policy coordination. | The regional fragmentation (at NUTS-3 level Italy counts 197 provinces and 8047 municipalities) affects the policy coordination across different administrative levels. It implies redundancy legislation, uncertainty as well as coordination failures due to the numerous Italian municipalities, which often set different requirements and adoption procedures. |
| Low-quality bureaucracy level. | The low level of Italian bureaucracy produces lack of transparency and long waiting times for authorizations to be faced by adopters and subjects involved. |
| Lack of mediating subjects such as installers and technicians. | These subjects seem not to have incentives to operate in the EE sector and they do not provide consumers with technical information for adopting energy efficiency solutions. This produces a disconnection between the in-force policies and the effective implementation in the real context. |
| Lack of control for non-compliant building administrators and enforcement schemes. | Lack of control for non-compliant building administrators. |

**Table 4 Main technical and technological barriers in the building sector**

| Title of barrier | Description of barrier |
|---|---|
| Technical limitation (old age and low EE performance of the existing stock) | In Italy more than 75% of buildings dates back to periods in which no norms or regulation related to energy performance were in force. |

Table 5 summarizes the barriers to energy efficiency in the building sector identified within literature, subdividing them according to their impact (high, medium, low). Given the lack of quantitative comparative assessments on the barriers in literature, the following impact assessment derives from a qualitative expert evaluation based on the authors' knowledge. For this national report (included as Annex), the identified barriers were assessed according to their impact, from 'High' to 'Low', taking into consideration the criteria mentioned in the main report "Working paper on social, economic, cultural and educational barriers in buildings and transport".

**Table 5 Assessment of barriers in the building sector**

| Impact of Barriers | Barriers |
|---|---|
| High | Old age and low EE performance of the existing stock of buildings |
| | Lack of a "culture of saving". |
| | Dyscrasia between national, supra-national and local norms (lack of policy coordination). |
| | Lack of control for non-compliant building administrators. |
| | Lack of normative schemes. |
| Medium | Fragmentation of home ownership (due to relevant presence of condominiums). |
| | Lack of technical expertise of building administrators. |
| | Low-quality bureaucracy level. |
| | Difficulty to access credit due to economic stagnation. |
| | Lack of mediating subjects such as installers and technicians. |
| | Split incentives and principal-agent problem. |
| Low | Group as push factor to energy efficiency investments. |
| | Little incidence of energy costs on companies/families. |
| | Gender and age differences in adopting EE technologies. |

## 2.2 MAPPING BARRIERS IN THE TRANSPORT SECTOR

In the transport sector, Italy shows an infrastructural deficit which has to be recovered in order to boost a sustainable mobility. Relevant limitations lie to the amount of lines for mass rapid transport in large cities and exchange parking. In the public transportation system, a large replacement of old vehicles is required since the technology turnover is often insufficient to guarantee a quality service. The South of Italy has a significantly lower public transport offer, both quantitatively (in terms of car-km) and qualitative (mean age rolling stock, punctuality, technologies), than the rest of the country. It also offers an average standard of service well below average levels in Europe (Gentile, 2009).

With respect to the freight transport, it is worth signalling a lack of logistics in the ports and their connection to the power supply, especially in the south of the country (Messina et al., 2011).

Besides these structural deficits, the economic stagnation has exacerbated the lack of funds to be devolved to the transport system, although such investments, at different regional level, have been recognized to be able to boost the economy, with generation of new labour force. The automotive sector, particularly in the urban context, shows most of the inefficiency. This is due to the low car load factor (only 1.2 passenger/car) which produces large traffic congestion and urban disamenities (Marciani et al., 2014). For instance, statistics show that cars are used for 75% of private transportation within the urban areas and such a share is projected to increase over time (Marciani et al., 2014). The inefficiency also affects the freights transportation, which in the urban context shows the highest consumption rate per ton/km (Zunder and Ibanez, 2004).

Besides these infrastructural and structural factors, it is possible to identify a series of social, cultural and educational factors, as well as economic and institutional ones, which can hamper the use of more energy efficient transport modes in the personal travel and freight transportation in Italy.

The following paragraphs will present and briefly discuss these barriers to energy efficiency in the transport sector in Italy, differentiating them between transportation of people and of goods.

**Transportation of people**

**Social, cultural and educational barriers**

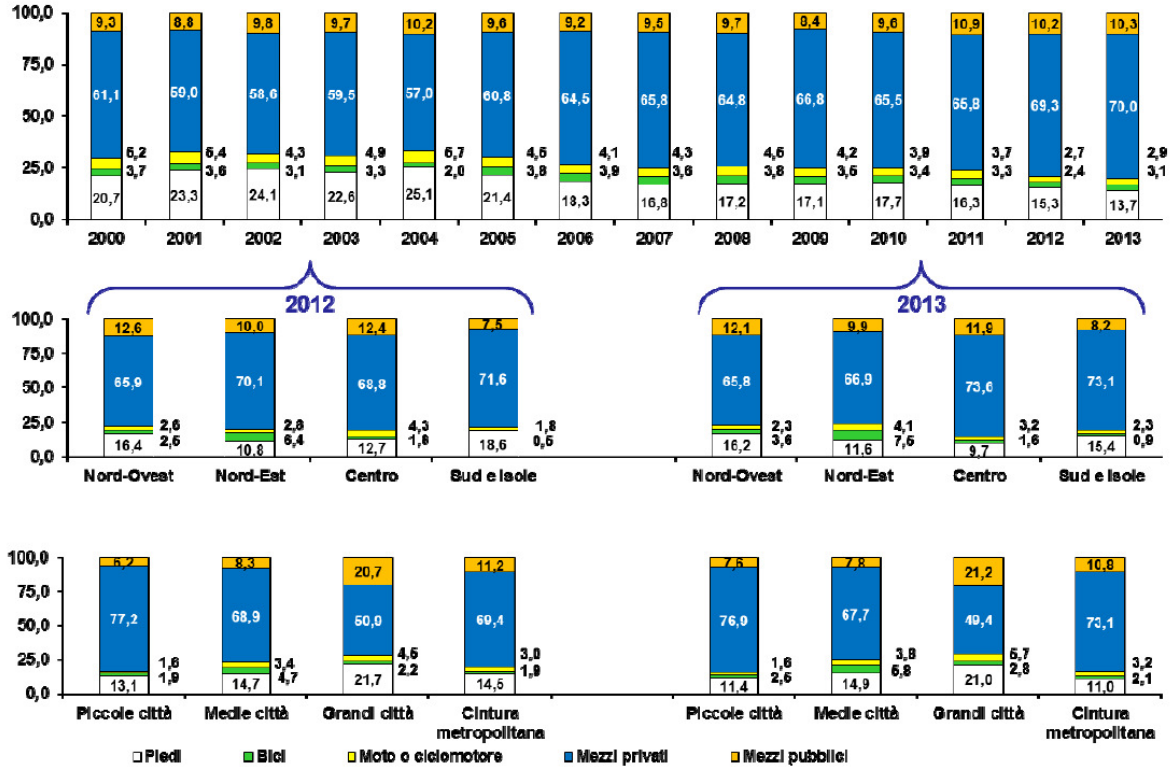
As shown by the data on the type of means of transport used by the different social categories (table below), the primacy of the car in Italy is very strong. Working-age men represent the main users of cars. Data seem to show a preference for walking by women and people who do not work (young people under 20 and people over 65 years). However, walking is marginal compared to the other modes. Overall, sustainable transport modes, such as public transport, walking and biking, have a relative low weight on the people mobility.

| MODES OF TRANSPORT IN ITALY | | | | | |
|---|---|---|---|---|---|
| | **Man** | **Woman** | **Young (<20 years)** | **Old (>65 years)** | **Worker (35-44 years)** |
| **Car** | 72,1 | 65,1 | 38,5 | 54,7 | 73,0 |
| **Public transport** | 2,6 | 4,2 | 5,8 | 3,2 | 3 |
| **Walking** | 9,5 | 14,4 | 21,5 | 27,2 | 10,1 |
| **Bicycle** | 3,6 | 4,5 | 7,7 | 1,7 | 3,2 |

*Source: ISTAT, 2012*

The table described above refers to Italian average data. Differences can be noted on the choice of transport modes at regional and local scales. In fact cars are more used in Southern regions in comparison with Northern regions and in rural areas with respect to urban areas (see table below by Isfort, 2014). This can be explained by the lack of public transport infrastructures and low quality transport services already explained above.

**Figure 7 - Trips by modal share**




Source: Isfort, 2014

No relevant differences at regional and local scales can be noted as far as preferences of mobility associated with sex and age are considered (Isfort, 2014).

The following paragraphs describe the main social, cultural and education factors that influence the use of each personal transport mode and lead to a preference of lower-energy efficient travel choices over more sustainable ones.

First of all, it should be noted that Italy, after Luxembourg, is the second European country for motorization rate, with 621 cars per 1.000 inhabitants, considerably above the European average of 487 cars (ISTAT, 2012). This produces relevant disamenities and Italy is the fourth country - considering European countries, Canada and the United States - for the level of traffic congestion (INRIX, 2013).

The reasons for the preference of private over public transportation are numerous. The choice of public transport closely depends on its accessibility and availability (Handy and Niemeier, 1997; Kwan, 1998; Occelli 1999, quoted by Borlini and Memo, 2009). Public transport does not guarantee the same flexibility and rapidity as private cars. Also, it seems not to provide the same freedom, prestige and safety as private cars or bikes (Curtins and Perkins, 2006).

In Italy, such preference for private cars over public transport can be explained by the low satisfaction of Italians for public transport service. A survey promoted by the EU Commission shows that Italians are less satisfied of public transportation than citizens of other European countries (EU Commission, 2011a). According to this study, the reasons of low satisfaction for the public transport

can be detected in: (i) lack of stations and stops (identified as relevant by 80% of survey respondents), low comfort of vehicles (78%), low frequency of vehicle passages (76%), insufficient timetables (63%), lack of service reliability (62%), safety concerns (44%) and high costs (42%) (EU Commission, 2011a). A further survey, conducted by Aci-Censis (2011) based on 3.992 interviews elaborated using the CATI method, provides further information on the main barriers to public transport's use; more precisely, these are: (i) absence of direct connections (30,4%), low stop frequency and long stop distance from home (respectively 25,2% and 23%), low trip comfort (21%), low economic advantage (11%).

Among those factors, safety is identified as one of the main barrier to public transportation use also by the Isfort (2012), which indicates that, according to a relevant share of Italians, public transportation is affected by safety concerns. In detail, subway trips are considered as the most dangerous, while trains and walking are perceived as relatively more safe.

Furthermore, in Italy, citizens and policy makers do not acknowledge the environmental and social benefits of a greater use of public transport (in terms of energy savings, health and quality of life) (Cassa Depositi e Prestiti, 2013).

As far as biking is concerned, Italy is characterized by a scarce usage of bicycles with respect to other Member States such as The Netherlands (FIAB, 2012). Such a gap seems to be attributed to lack of street maintenance, safety concerns (theft of bicycles in particular) and unfavourable weather conditions. The same barriers, associated with lack of adequate space and opportunity to cover short distances, concern walking (Legambiente and ACI, 2010).

Along with the "traditional" transport modes described above, other forms of sustainable mobility are spreading in Italy, such as car sharing and car-pooling. Among these, car-pooling appears not to be diffused (Zoccarato G., 2013), even though in the last year it is increasing (CarPooling, 2013). It was not possible to identify specific barriers to the diffusion of these alternative transport modes, because of lack of specific studies and data.

A cultural phenomenon that generates energy inefficiencies in the transport sector in Italy is definitely the chaotic parking. A relevant share (54,4%) of respondents interviewed by Isfort (2007) declares to face systematically double parked cars during their trips.

Within this national context, exceptions and specific situations at local level can be identified, such as in the Milan city area. In the last years, Milan has seen a significantly diffusion of bike sharing and car sharing systems, with high numbers of users and a relevant impact on transport choices. The city has also increased its metro lines supply and suburban railways, which have also contributed to modal changes. Furthermore, the city has implemented a road pricing scheme (previously a pollution charge, "Ecopass", then transformed into a congestion charge, "Area C"), which has enabled a relevant reduction of congestion in the city centre. The overall combined effect of these sustainable mobility policies and measures has generated an increase of public transport modal share and a decrease of motorization rates, as shown by the data included in the Sustainable Urban Mobility Plan recently adopted by the City of Milan (Comune di Milano, AMAT, 2015).

Social, cultural and educational barriers in the public and private transport sector above described can be summarized as follows (Table 6).

**Table 6 Main social, cultural and educational barriers in the public and private transport sector**

| Type of barrier (Social, cultural, educational) | Title of barrier | Description of barrier |
|---|---|---|
| Social | Car ownership (private transport) | Italy is the second European country for motorization rate (ISTAT, 2012) and is the fourth country for the level of traffic congestion (INRIX, 2013) |
| Social, cultural | Low satisfaction for the public transport (includes several elements, such as the perception of public transport as unsafe and as less flexible/rapid than private means) | According to a survey promoted by the EU Commission, Italians are less satisfied of public transportation than citizens of other European countries (EU Commission, 2011a). Private transport is often privileged since public transport does not guarantee the same rapidity (Handy e Niemeier, 1997; Kwan, 1998; Occelli 1999) and seems not to provide the same freedom, prestige and safety as private cars or bikes (Curtins and Perkins, 2006) |
| Social, cultural, educational | Low acknowledgement of environmental/social benefits of public transport use | Citizens and policy makers do not acknowledge the environmental and social benefits of a greater use of public transport in Italy (in terms of energy savings, health and quality of life) (Cassa Depositi e Prestiti, 2013). |
| Social, cultural | Bike perceived as dangerous and not compatible with some weather conditions (private transport) | Italy is characterized by a scarce usage of bicycles with respect to other Member States such as The Netherlands (FIAB, 2012). Such a gap seems to be attributed to lack of street maintenance, safety concerns (theft of bicycles in particular) and unfavourable weather conditions. |
| Cultural, educational | Insufficient safety, lack of adequate space for walking (private transport) | In Italy there is little walking mobility because of insufficient safety, lack of adequate space and opportunity to cover short distances (Legambiente and ACI, 2010) |
| Cultural, educational | Chaotic parking (private transport) | A cultural phenomenon that generates energy inefficiencies in the transport sector in Italy is definitely the chaotic parking (Isfort, 2007) |

**Economic barriers**

A relevant economic barrier to energy efficiency in the Italian public transport is related to the high dependency of management authorities on national and regional funds. Own earnings cover only a limited part of general public transport costs (Cassa Depositi e Prestiti, 2013).

Furthermore, the responsibility for public transport is divided into different levels: municipal, regional and national. As a consequence there are many different tariff structures, scattered information and missing integration of schedules for the user (Cassa Depositi e Prestiti, 2013).

Also, the tariff of the travels is currently lower than the average EU. This implies less coverage of the costs necessary to make the system more efficient (Messina et al., 2011). To this, it must be added that the rate of ticket evasion is higher in Italian transport companies than in the major foreign transport companies: such a rate is estimated at least 6% in about 43% of Italian companies, whereas 27% of them are able to maintain this rate under 2% (ASSTRA, 2007).

A further factor to be considered is that the companies operating in the field of public transport heavily depend on government grants: in 2013, more than half of revenues came from public compensation, while the remainder is covered for 30% by revenues from traffic and for 17% by revenue complementary services (advertising and rentals) and parking. Companies, therefore, are obliged to update the ticket tariff only after receiving the indications of grantors, which are based on considerations of distributive equity rather than on economic and industrial considerations. In Italy ticket tariffs are low, poorly differentiated across regions and population groups, and not enough related to the costs and objectives of the transport companies (Cassa Depositi e Prestiti, 2013).

A further economic barrier to energy efficiency in transport regarding public transportation concerns investments in low-density areas. Investments needed to realize high-capacity transport systems in low-density residential areas with a high urban sprawl are characterized by a low economic viability. Therefore, investments in these areas are not pursued, generating a lack of public transport service provision. Urban sprawl produces also an effect in terms of trips increase by private cars in the urban areas, producing higher environmental pressure. Travisi *et al*. (2010) estimated that in Italian municipalities urban sprawl has generated a 37% increase of car trips.

Finally, a relevant economic barrier related to energy efficiency in public and private transport concerns electric vehicles. This is mainly related to the high cost of batteries. Although the recent technological developments, which enable batteries with better performances than in the past, the cost of batteries is not affordable yet (for a 150 km-range battery, the cost is estimated around Euro 9000). Such low battery performances limit the electric vehicles to cities and urban areas and contribute to the diffusion of hybrid vehicles.

**Table 7 Main economic barriers in the public and private transport sector**

| Title of barrier | Description of barrier |
|---|---|
| Critical economic condition of several public transport management authorities (public transport) | High dependency of Italian public transport management authorities on national and regional funds (Cassa Depositi e Prestiti, 2013) |
| Fragmentation of public transport operators (public transport) | Responsibility for public transport is divided into different levels: municipal, regional and national (Cassa Depositi e Prestiti, 2013) |
| High evasion rate of public transport tickets (public transport) | The rate of ticket evasion is higher in Italian transport companies than in the major foreign transport companies (ASSTRA, 2007) |
| Spending review conducted by central government on public transport services (public transport) | Companies operating in the field of public transport service are obliged to update the ticket tariff only after receiving the indications of grantors, which are based on considerations of distributive equity rather than on economic and industrial considerations (Cassa Depositi e Prestiti, 2013) |

| | |
|---|---|
| Low economic viability of the investment necessary for the realization of high-capacity transport in low-density residential areas (public transport) | Investments needed to realize high-capacity transport systems in low-density residential areas with a high urban sprawl are characterized by a low economic viability. Therefore, investments in these areas are not pursued, generating a lack of public transport service provision. |
| Urban sprawl (private transport) | Urban sprawl in Italy has resulted in an increase of car trips (up to 37%) in urban areas in Italian municipalities (Travisi et al., 2010) |
| High cost of batteries for electric vehicles (public/private transport) | The cost of batteries with better performances is not affordable yet, for a 150 km-range battery, the cost is estimated around Euro 9000 (Marciani et al., 2014) |

**Institutional/organizational barriers**

Following the economic crisis of recent years, the public funds allocated to the management of the transport sector have plummeted. This resulted in a very serious and intolerable situation in terms of reduced services, social unrest, tariff increases, reduction of employment in the sector, traffic congestion and pollution (Cassa Depositi e Prestiti, 2013).

The lack of funds has also prevented the renewal of the vehicles stock, resulting in a reduction of the quality of service and a negative impact on the operating costs of the transport companies, whose maintenance costs have increased dramatically (ACI, Fondazione Caracciolo, 2013).

Key institutional barriers for promoting a more efficient mobility of people are the lack of a national strategy for bike and pedestrian mobility and the delay of establishment of an Italian Transport Authority, which was established only in September 2013.

Delays in the definition of the strategic national plan have also affected the completion of the regional planning frameworks (regional transport plans), whose completion took longer than desirable, particularly for the southern regions (Il Sole 24 Ore, 2012).

More institutional barriers are represented by a scarce attention in the public transport concession of qualitative standards of services and myopia for long-term vision regarding the future of transport infrastructures. Particularly, it should be noted that in the concessions contracts of public transport services, few attention is given to quality standards of public transport providers, because only economic aspects are considered. The Italian transport strategy "tends to leave an emergency approach to prevail" (Cassa Depositi e Prestiti, 2013).

**Table 8 Main institutional/organizational barriers in the public and private transport sector**

| Title of barrier | Description of barrier |
|---|---|
| Reduction of national public investments in the public transport sector | Following the economic crisis, the public funds allocated to the management of the transport sector have plummeted. This resulted in a very serious and intolerable situation in terms of reduced services, social unrest, tariff increases, reduction of employment in |

| | |
|---|---|
| | the sector, traffic congestion and pollution (Cassa Depositi e Prestiti, 2013). |
| Lack of a national strategy for bike and pedestrian mobility | There have been several proposals in the national parliament to set a national plan for bike and pedestrian mobility and infrastructure. To date no plan was accepted. |
| Lack of an Italian Transport Authority for a long time | There has been a delay in the establishment of an Italian Transport Authority (established only in 2013). |
| Delays in the definition of the strategic national plan | Delays in the definition of the strategic national plan have affected the completion of the regional planning frameworks (regional transport plans) (Il Sole 24 Ore, 2012). |
| Scarce attention in the public transport concession of qualitative standards of services | In the concessions contracts of public transport services few attention is given to quality standards of public transport offers. Only economic aspects are considered. |
| Lack of a long term vision regarding the future of transport infrastructures | According to the CDP, the Italian transport strategy "tends to leave an emergency approach to prevail" (Cassa Depositi e Prestiti, 2013) |

**Infrastructural/technical/technological barriers**

The main Italian technological barrier within the public transport is represented by the old fleets. In Italy, road vehicles for public transport have, on average, a longer life with respect to other European countries: 11.6 years on average compared to 7 in Europe (ACI, Fondazione Caracciolo, 2013). As a consequence, a lack of transport infrastructure must be added, which is particularly evident for the underground lines. The main Italian cities, in fact, have a lower number of subway lines in comparison with the other European member states with similar size (Eurispes, 2015).

A further infrastructural gap which constitutes a barrier to the diffusion of electric vehicles is due to the lack of recharge stations, these latter being at a low implementation stage also because of problems of electric loads and interconnections (Marciani, 2011).

Bio-methane vehicles are scarcely diffused in Italy because of the limited fuel production. Moreover, as in the case of methane, fuel stations are poorly diffused and far from urban centres (Messina et al., 2011).

**Table 9 Main infrastructural/technical barriers in the public and private transport sector**

| Title of barrier | Description of barrier |
|---|---|
| Old Italian public transport fleets<br>(public transport) | In Italy public transport fleets have, on average, a longer life with respect to other European countries: 11.6 years on average, compared to 7 in Europe (ACI, Fondazione Caracciolo, 2013) |
| Few underground lines in Italian cities<br>(public transport) | The main Italian cities have a lower number of subway lines in comparison with the other European members states with similar size (Eurispes, 2015). |
| Lack of recharge stations for electric vehicles (public and private transport) | A further barrier to the diffusion of electric vehicles is due to the lack of recharge stations, these latter being at a low implementation stage also because of problems of electric loads and |

| | |
|---|---|
| | interconnections (Marciani et al., 2014) |
| Technical limitations of electric vehicles (public and private transport) | Although the recent technological developments, electric vehicles still show large limitations to be fully employed in the road transport sector (Marciani et al., 2014) |
| Scarce diffusion of Bio-methane in Italy (private transport) | Bio-methane vehicles are scarcely diffused in Italy because of the limited fuel production. Moreover, as in the case of methane, fuel stations are poorly diffused and far from urban centres (Messina et al., 2011) |

Table 10 summarizes the barriers to energy efficiency in the people transport sector identified within literature, subdividing them according to their impact (high, medium, low). Given the lack of quantitative comparative assessments on the barriers in literature, the following impact assessment derives from a qualitative expert evaluation based on the authors' knowledge. For this national report (included as Annex), the identified barriers were assessed according to their impact, from 'High' to 'Low', taking into consideration the criteria mentioned in the main report "Working paper on social, economic, cultural and educational barriers in buildings and transport".

**Table 10 Assessment of barriers in the people transport sector**

| Impact of Barriers | Barriers |
|---|---|
| **High** | Low satisfaction for the public transport |
| | Critical economic condition of several public transport management authorities |
| | Low economic viability of the investment necessary for the realization of high-capacity transport in low-density residential areas |
| | Spending review conducted by central government on public transport services |
| | Urban Sprawl |
| | Reduction of national public investments in the public transport sector |
| | Old Italian public transport fleets |
| | Lack of a national strategy for bike and pedestrian mobility |
| **Medium** | Fragmentation of public transport operators |
| | Lack of an Italian Transport Authority for a long time |
| | Chaotic parking |
| | Delays in the definition of the strategic national plan |
| | High cost of batteries for electric vehicles |
| | High evasion rate of public transport tickets |
| | Scarce attention in the public transport concession of qualitative standards of services |
| | Scarce diffusion of Bio-methane in Italy |
| | Few underground lines in Italian cities |
| | Lack of recharge stations for electric vehicles |
| | Lack of a long term vision regarding the future of transport infrastructures |
| **Low** | Bike perceived as dangerous and not compatible with some weather conditions |
| | Car ownership |
| | Low acknowledgement of environmental/social benefits of public transport use |
| | Insufficient safety, lack of adequate space for walking |
| | Technical limitations of electric vehicles |
| | Scarce diffusion of Bio-methane in Italy |

**Transportation of goods/freight transport**

In Italy, freight transport is responsible for a high share of urban pollutant emissions. In fact even if the logistic sector represents only 8-15% of total urban vehicles flows, it produces 20-30% of the total urban emissions (MDS Transmodal and DG Transport, 2012).

According to CE Delft data (2011), Italy is one of the countries where the logistic sector generates more negative externalities. This high impact of the logistic sector on Italian pollutants emissions is strongly related to the low efficiency of the sector (ISFORT, 2013).

The following paragraphs describe the main social, cultural, educational, economic, institutional and technical barriers to energy efficiency in the logistic transport.

**Social, cultural and educational barriers**

In Italy, last-mile freight transportation is characterized by a strong competition among market players, especially on prices and timing of deliveries, related mainly to the needs to protect their own quota of market in a very high competitive market. This makes it difficult to implement solutions that could increase energy-efficiency (such as consolidation of loads and the use of shared logistics platforms).

A further element which limits efficiency is the irregular parking. High levels of irregularity in parking logistic vehicles are documented in Italian urban areas. More than 60% of logistic operators declare to avoid the use of regular parking areas for the last mile delivery activities (Transport Ministry, 2011). This plays a crucial role in the high congestion levels affecting several Italian cities. The low control levels conducted by municipal police does not contribute to mitigate such a negative context.

A lack of high-level managerial competencies can also be identified. A survey conducted by ISFORT among the main Italian logistic operators reveals that the lack of an adequate educational level of Italian managers is considered the first problem in the logistic sector in Italy.

Several Italian economic operators organize by themselves their freights supply (“Conto Proprio”) (namely 45% of total freights moved in a year in Italy) (Confindustria Vicenza, 2008). Since private travel is less efficient than trips organized by specialized logistic operators (Marciani et al., 2014), this barrier has a detrimental effect on urban congestion and pollution levels.

Italian logistic operators (Marciani et al., 2014) are characterized by high level of outsourcing of last mile delivery activities to very little and often low qualified last mile delivery companies (“Padroncini”). These outsourcers are less efficient compared to big logistics operators, due to their very little corporate dimensions and lack of adequate financial resources to invest in more efficient delivery services.

A relevant cultural aspect regarding consumer preferences regards the e-commerce, which in Italy is rapidly growing (Casaleggio associati, 2014). As e-commerce foresees short delivery time, for logistic operators it is more difficult to organize in a more efficient way their delivery plans (for example using a single vehicle to deliver all goods addressed to the same urban area).

Another aspect is the high importance attributed by logistics operators to showing their logo in the last mile delivery and to control the quality of delivery (brand identity). Such a strong "brand identity" of the main logistic operators limits all the experiences in sharing vehicles in the last mile delivery (vehicles characterized also for this reason by very low load factors). Moreover, this creates an incentive for the growing of "door-to-door" and "business-to-consumers" services.

A last cultural barrier is the role of lobbies. Italian small logistic operators have a very important political weight. Often they act as a barrier to develop new national and regional policies.

Social, cultural and educational barriers in the freight transport sector can be summarized as follows (table below).

**Table 11 Main social, cultural and educational barriers in the freight transport sector**

| Type of barrier (Social, cultural, educational) | Title of barrier | Description of barrier |
|---|---|---|
| Cross-cutting | Low cooperation between logistic operators | Low cooperation between different market players[23] limit the adoption of more sustainable measures (Marciani et al., 2014) (for example sharing of last mile vehicles, use of the same urban logistic platforms, etc.). |
| Cultural, educational | Low probability to be sanctioned for irregular parking | High level of irregularity in parking logistic vehicles are documented in Italian urban areas. In fact in urban areas, more than 60% of logistic operators declare to avoid the use of regular parking areas for the last mile delivery activities (Transport Ministry, 2011). This plays a crucial role in the high congestion levels affecting several Italian cities. This high level of irregularities is strictly related to the low control levels conducted by municipal police. |
| Educational | Lack of high level managerial competencies | A survey conducted by ISFORT among the main Italian logistic operators reveals that the lack of an adequate educational level of Italian managers is considered the first problem in the logistic sector in Italy. |
| Cultural | Several economic operators organize by itself their freights supply (Conto Proprio) | A high quota of Italian economic operators (45% of total freights moved in a year in Italy) (Confindustria Vicenza, 2008), organizes by themselves their freights supply. As private travel is less efficient than trips organized by specialized logistic operators (Marciani et al., 2014), this barrier has a detrimental effect on urban congestion and |

[23] Evidences collected by IEFE-Bocconi University during the research regional project OPTILOG (http://www.optilog.it/it/)

| | | |
|---|---|---|
| | | pollution levels. |
| Cross-cutting | High outsourcing level of main logistic operators | Italian logistic operators (Marciani et al., 2014) are characterized by high level of outsourcing of last mile delivery activities to very little and often low qualified last mile delivery companies (Padroncini). These outsourcers are less efficient compared to big logistics operators due to their very little corporate dimensions and lack of adequate financial resources to invest in more efficient delivery services. |
| Cross-cutting | E-commerce rapid growth | In Italy e-commerce is rapidly growing (Casaleggio associati, 2014). As e-commerce foresees short delivery time, for logistic operators it is more difficult to organize in a more efficient way their delivery plans. |
| Cultural | High importance for logistics operators to show their logo in the last mile delivery and control the quality of delivery (brand identity) | The strong "brand identity" of the main logistic operators limits all the experiences in sharing vehicles in the last mile delivery (vehicles characterized also for this reason by very low load factors)[24]. Moreover this creates an incentive for the growing of "door-to-door" and "business-to-consumers" services. |
| Cultural | Strong lobbies block political reforms | Italian small logistic operators have a very important political weight. Often they act as a barrier to develop new national and regional policies. |

**Economic/institutional barriers**

Local traffic regulation in Italy is highly fragmented. Each Italian municipality has its own traffic regulation, which often differs from those adopted in other cities within the same region or even province. This fragmentation limits the possibility of logistic operators to organize in a more efficient way their delivery plans and/or to export efficient organization models from one city to another.

Few external/international investments are carried out in the Italian logistic sector. As documented by ISFORT, Italy receives less external/international investments in the logistic sector compared to other European countries.

[24] Evidences collected by IEFE-Bocconi University during the research regional project OPTILOG (http://www.optilog.it/it/)

The logistic sector is characterized by higher levels of bureaucracy, compared to other European countries (ISFORT, 2013). This affects many aspects of the logistic sector, from the vehicles quality requirements to the organization of the delivery services.

Regulatory aspects limit the growth of green logistic solutions. Both at national and regional levels, norms limiting the growing of green logistic solutions exist. For instance, there are limits on the dimension of cargo bikes usable in the last mile deliveries, or there are limits in trains maximum length impeding to optimize single train trip (ISFORT, 2013). Also the Italian normative on road and traffic management (Codice della Strada) generates several limitations in the definition of innovative services and business models.

Further limitations derive from a relevant lack of infrastructures for intermodal logistics (especially in urban areas). This regards in particular:

• Train to lorries;

• Ship to train/lorries.

These limits are related both to scarce public and private investments for the development of these infrastructures and to the lack of an adequate political will.

Finally, there is a lack of adequate economic resources for local public administrations (ISFORT, 2013). This aspect has a detrimental effect on several activities of local public administrations in the logistic sectors, like:

• Scarce road check activities conducted my municipal police forces and low level of violations sanctioning;

• Reduction in the investments on urban logistic infrastructures.

Main economic and institutional barriers in the freight transport sector can be summarized as follows (table below).

**Table 12 Main economic/institutional barriers in the freight transport sector**

| Title of barrier | Description of barrier |
|---|---|
| High fragmentation of local traffic regulation | Each Italian municipality has its own traffic regulation, often very different one to another[25]. This fragmentation limits the possibility of logistic operators to organize in a more efficient way their delivery plans and/or to export efficient organization models from one city to another. |
| Few external/international investments in Italian logistic sector | As documented by ISFORT, Italy receives less external/international investments in the logistic sector compared to other European countries. |

[25] See for example the case of Lombardy Region and its investigation report on the different municipal traffic regulation in more than 80 cities (Merci in Città. Regole vigenti nei principali comuni Lombardi). (http://www.agendadigitale.regione.lombardia.it/shared/ccurl/14/313/MERCI%20citt%C3%A0_aggiornamento%20novembre2013.pdf)

| | |
|---|---|
| High bureaucracy in the logistic sector (both national and regional level) | The logistic sector in Italy is affected by a higher level of bureaucracy compared to other European countries (ISFORT, 2013). This high level of bureaucracy affects many aspects of the logistic sector, from the vehicles quality requirements to the organization of the delivery services. |
| Regulatory aspects limit the growing of green logistic solutions (both national and regional level) | Both at national and regional levels, norms limiting the growing of green logistic solutions exist. For example there are limits on the dimension of cargo bikes usable in the last mile deliveries, or there are limits in trains maximum length impeding to optimize single train trip (ISFORT, 2013). Also the Italian normative on road and traffic management (Codice della Strada) generates several problems in the definition of innovative services and business models[26]. |
| Lack of infrastructures for intermodal logistics (especially in urban areas) | Italy is affected by a strong lack of adequate infrastructures (ISFORT, 2013) (especially in urban areas) for the organization of intermodal logistics services both in:<br>• Train to lorries;<br>• Ship to train/lorries.<br><br>These limits are related both to scarce public and private investments for the development of these infrastructures and to the lack of an adequate political will. |
| Lack of adequate economic resources for local public administrations | Local administrations are increasingly affected by a shrinking of their budget (ISFORT, 2013). This aspect has a detrimental effect on several activities of local public administrations in the logistic sectors, like:<br>• Scarce road check activities conducted my municipal police forces and low level of violations sanctioning;<br>• Reduction in the investments on urban logistic infrastructures. |

**Technical and technological barriers**

The national logistic infrastructures gap is a relevant technical barrier. As evidenced in many official national documents, Italy is affected by a significant delay in the logistic infrastructural development. The most significant infrastructural weakness directly affecting the logistic sector is related to a poor ports infrastructures development. In fact, in a country like Italy surrounded by the sea, more than 90% of freights delivery are conducted by lorries (Transport Ministry, 2011).

In particular, Italian southern regions have weaknesses in freights infrastructures development, compared to the northern regions. Such a delay, both in quantitative and qualitative terms, affects

[26] Evidences collected by IEFE-Bocconi University during the research regional project OPTILOG (http://www.optilog.it/it/)

the development of transport infrastructures and reduces the opportunities to organize more efficient freights transport services.

Finally, there are technical limitations in electric freights vehicles technology. Electric vehicles do not guarantee the required performances standards for national freights delivery. Electric vehicles are more attractive at urban scale, particularly where restricted traffic areas are in place. For instance, a last-generation small-size commercial vehicle has only 100 km of autonomy with a full recharge cycle of 5 hours, which are not always sufficient to guarantee a standard workflow. Besides this, the battery weight (around 1 ton) reduces the maximum payload. Main technical and technological barriers in the freight transport sector can be summarized as follows (table below).

**Table 13 Main technical and technological barriers in the freight transport sector**

| Title of barrier | Description of barrier |
|---|---|
| National logistic infrastructures gap | As evidenced in many official national documents, Italy is affected by a significant delay in the logistic infrastructural development[27]. The most significant infrastructural weakness directly affecting the logistic sector is related to a poor ports infrastructures development (ISFORT, 2013). In fact, in a country like Italy surrounded by sea, more than 90% of freights delivery are conducted by lorries (Transport Ministry, 2011). |
| Italian southern regions weaknesses in freights infrastructures development | Italian southern regions are characterized by bigger weaknesses in logistic infrastructures equipment compared to the northern part of Italy (ISFORT, 2013). Such a delay, both in quantitative and qualitative terms, reduces the opportunities to organize more efficient freights transport services. |
| Technical limitations in electric freights vehicles technology | Electric vehicles do not guarantee the required performances standards for national freights delivery. Electric vehicles are more attractive at urban scale, particularly where restricted traffic areas are in place. |

Table 14 summarizes the barriers to energy efficiency in the goods transport sector identified within literature, subdividing them according to their impact (high, medium, low). Given the lack of quantitative comparative assessments on the barriers in literature, the following impact assessment derives from a qualitative expert evaluation based on the authors' knowledge. For this national report (included as Annex), the identified barriers were assessed according to their impact, from 'High' to 'Low', taking into consideration the criteria mentioned in the main report "Working paper on social, economic, cultural and educational barriers in buildings and transport".

[27] http://www.repubblica.it/economia/2013/06/09/news/italia_il_ritardo_delle_infrastrutture_ci_costato_24_miliardi_di_pil-60727307/

**Table 14 Assessment of barriers in the goods/freight transport**

| Impact of Barriers | Barriers |
|---|---|
| High | Low cooperation between logistic operators |
| | Low probability to be sanctioned for irregular parking |
| | Several economic operators organize by itself their freights supply (Conto Proprio) |
| | High outsourcing level of main logistic operators |
| | Old logistics vehicles |
| | Italian southern regions weaknesses in freights infrastructures development |
| | National logistic infrastructures gap |
| Medium | High importance for logistics operators to show their logo in the last mile delivery and control the quality of delivery (brand identity) |
| | Lack of infrastructures for intermodal logistics (especially in urban areas) |
| | E-commerce rapid growth |
| | Regulatory aspects limits the growing of green logistic solutions (both national and regional level) |
| | High bureaucracy in the logistic sector (both national and regional level) |
| | High fragmentation of local traffic regulation |
| | Few external/international investments in Italian logistic sector |
| | Lack of adequate economic resources for local public administrations |
| Low | Technical limitations in electric freights vehicles technology |
| | Lack of high level managerial competencies |
| | Strong lobbies block political reforms |

# 3. BARRIERS AND POLICY INSTRUMENTS

The following chapter puts the barriers mapped through literature in relation with policy instruments currently in force in Italy and highlights which policy instruments are contributing (or could possibly contribute) to overcome them.

## 3.1 BUILDING SECTOR

Looking at the building sector, it seems that the mix of policy instruments implemented in Italy addresses several existing barriers to energy efficiency.

**Social, cultural and educational barriers** are mainly tackled through **awareness raising campaigns.** These are conducted by the national energy agency ENEA, as well as, at regional and local levels, by regional and local energy agencies which are active in their respective territories. Furthermore, it is worth mentioning the numerous campaigns promoted by private and civil society actors, such as environmental and professional associations, aimed at raising awareness. These often focus on a specific target group, such as young population or children, and envisage different targets and tools according to **gender/age differences**.

Also the issue **fragmentation of home ownership** is being addressed by specific awareness raising campaigns, which aim to inform people living in condominiums about the possibilities and benefits to jointly renovate their homes. Furthermore, the growing ESCOs market in Italy (Energy Strategy Group, 2015), focussing more on big energy efficiency projects, could contribute to overcome this relevant Italian barrier in order to boost energy efficiency renovation of Italian residential sector. However, the reliance on ESCOs for interventions on private houses/condominiums is not yet widespread in Italy (Energy Strategy Group, 2015).

Regarding **economic barriers,** the Italian government launched different economic policy instruments aimed at reducing the impact of economic barriers on buildings energy efficiency improvement. In particular, a set of three main economic policy instruments were launched targeted to specific building owners, and namely tax deduction mechanism targeted to families, Thermal Account targeted to national and regional/local public authorities and White Certificate mechanism to industrial and commercial buildings. Several **awareness raising campaigns** are in place in order to inform consumers about energy savings possibilities connected with energy renovation and the purchase of more energy efficient appliances, as well as a more virtuous use of appliances. As shown above, **fuel poverty** concerns are increasing in Italy since energy costs are assuming a relevant weight in some parts of population. **Transparent billing** is another policy instrument which can serve to this purpose and is being used as a tool to increase consumers' awareness (AEEG, 2010), as well as to enhance their knowledge on the **weight of energy costs**.
Since the economic crisis has tightened the possibility to **access credit** from bank and financial institutions, which can be among the enabling conditions of an energy renovation decision by families, policies such as the **establishment of dedicated funds** (Kyoto fund until 2014 and since 2015 the National Energy Efficiency Fund) have been put in place to facilitate the access to financial resources for energy renovation interventions. Also **tax deductions** for energy renovations and purchase of energy efficient appliances are in line with this direction, although they target only specific parts of population.
Moreover, the definition of **quality rules for ESCOs** and of **an official list** of ESCOs could contribute to tackle the barrier of access to credit (Energy Strategy Group, 2015), since ESCOs assume the financial risks and therefore could be used by private owners as means to finance their interventions by a third-party financing. However, the reliance on ESCOs for interventions on private houses/condominiums is not yet widespread in Italy (Energy Strategy Group, 2015).

As far as **institutional barriers** are concerned, the complex administrative structure and the government articulation in diverse administrative sub-national levels in Italy (Regions, Provinces - now abolished and substituted in specific cases by "Metropolitan Cities", and Municipalities) generates **policy coordination** problems (De Paoli, 2014) and **dyscrasia between norms** at diverse levels (Cresme Ricerche, Legambiente, 2013). At this purpose, the government has established a **coordination structure** named "Energy efficiency control room" (Cabina di Regia efficienza energetica). Other barriers linked to heavy bureaucracy and inefficiency of the public administration (Energy Strategy Group, 2014) are currently being addressed by **regulations and reforms of the public administration**, not specifically focused on energy efficiency.
Finally, among the **organizational barriers**, the **lack of mediating subjects** such as installers and technicians has been highlighted. Also this aspect is being addressed through dedicated **awareness raising campaigns**, as well as through specific **training platform and e-learning courses** for experts on energy efficiency in buildings set up by ENEA – national energy efficiency.

The overview of barriers and policy instruments in force shows that further awareness raising and information provision to consumers, home-owners and building administrators are needed, to spread a culture of saving and to inform about benefits and opportunities of energy efficiency.

Furthermore, economic instruments or facilitating mechanisms to improve the access to available financial sources would be required. Also, action would be needed to address inefficiencies of bureaucracy and increase governance and policy coordination among the multiple administrative levels.

**Table 15 Barriers and policy instruments in the building sector**

| Types of barriers | Country-specific barriers | Scale | Barriers addressed in current policy instruments |
|---|---|---|---|
| **Social Cultural Educational** | Gender and age differences | *Probably differentiated at local/regional/national scale, should be further investigated by studies/surveys.* | Several dissemination/awareness campaigns on specific energy efficiency themes |
| | Group as push factor to energy efficiency investments | *Probably differentiated at local/regional/national scale, should be further investigated by studies/surveys.* | Several dissemination/awareness campaigns on specific energy efficiency themes |
| | Lack of a "culture of saving" | *Probably differentiated at local/regional/national scale, should be further investigated by studies/surveys.* | Several dissemination/awareness campaigns on specific energy efficiency themes |
| | Fragmentation of home ownership (due to relevant presence of condominiums) | *National/regional/local* | Several dissemination/awareness campaigns on specific energy efficiency themes,<br><br>Definition of ESCOs and set-up of a voluntary national certification scheme for certified ESCOs (Dlgs. 30 May 2008, n. 115). |
| | Lack of technical expertise of building administrators | *National/regional/local* | Several dissemination/awareness campaigns on specific energy efficiency themes. |
| **Economic** | Little incidence of energy costs on companies/families | *Probably differentiated at local/regional/national scale, should be further investigated by studies/surveys.* | Several dissemination/awareness campaigns on specific energy efficiency themes,<br><br>Transparent billing methods (Deliberation 18 November 2008 – ARG/com 164/08 of the |

| | | | |
|---|---|---|---|
| | | | AEEG). |
| | Split incentives and principal-agent problem | *National* | Definition of ESCOs and set-up of a voluntary national certification scheme for certified ESCOs (Dlgs. 30 May 2008, n. 115). |
| | Lowering in purchasing power due to economic crisis | *National* | Tax deductions (introduced with L. 27 December 2006, n. 296, namely the Budget Law 2007 – "Legge finanziaria 2007", and renewed several times with modifications) |
| | Difficulty to access credit caused by the economic stagnation | *National* | Kyoto fund (introduced with L. 27 December 2006, n. 296, namely the Budget Law 2007 – "Legge finanziaria 2007", and implemented through following acts) and National Fund for Energy Efficiency ("Fondo Nazionale per l'Efficienza Energetica") (Dlgs. 4 July 2014, n. 102);<br><br>Tax deductions (introduced with L. 27 December 2006, n. 296, namely the Budget Law 2007 – "Legge finanziaria 2007", and renewed several times with modifications),<br><br>Definition of ESCOs and set-up of a voluntary national certification scheme for certified ESCOs (Dlgs. 30 May 2008, n. 115). |
| **Institutional** | Lack of normative schemes | *National* | / |

| | | | |
|---|---|---|---|
| | Dyscrasia between national, supra-national and local norms and lack of policy coordination | *National* | Energy efficiency control room" (Cabina di Regia efficienza energetica) |
| | Low-quality bureaucracy level | *National* | Simplification/exemption of authorization procedures for some energy efficiency measures,<br><br>Reforms to increase efficiency in the public administration. |
| | Lack of mediating subjects such as installers and technicians | *National* | ENEA training platform and e-learning courses for experts on energy efficiency in buildings. |
| | Lack of control for non-compliant building administrators and enforcement schemes | *National* | / |
| **Technical/ technological** | Technical limitations (old age and low EE performance of the existing stock) | *National* | Issue addressed in several policies. |

## 3.2 TRANSPORT SECTOR

**Barriers and policy instruments**

Looking at the set of energy efficiency policy instruments defined in Italy for people and freights transport, it appears that some barriers (promotion of green vehicles, bio fuels, ITS, coordination among different logistics operators) have been addressed by policy instruments in place. On the contrary, other barriers, mainly related to the strengthening of people and freight transport infrastructures, received less attention in the Italian policies framework.

Therefore investments to fill the gap of sustainable mobility infrastructures and services would be required, as well as information to consumers about the benefits and opportunities of sustainable mobility and to promote a more diffused culture of sustainable travel behaviours.

For the freight transport, beyond measures to address the infrastructural gap, also capacity building and coordination mechanisms for operators would be necessary, together with actions to address inefficiencies caused by bureaucracy.

People transport sector

**Social, cultural and educational barriers** are mainly tackled through awareness raising campaigns. These are conducted by the Ministry of the Environment, as well as, at regional and local levels, by regional and local public authorities which operate in their respective territories. Furthermore, campaigns are also promoted by private (e.g. the managing authority of national railway network and the local managing authorities of local public transport services) and civil society actors (e.g. environmental associations, professional associations, consumer associations, etc.) in order to promote a wider use of public transports especially in urban areas.

**Economic barriers**

Italian policy instruments show a clear intention of the central government (supported by regional and local public authorities) to overcome the main technical and economic barriers threatening the large diffusion of less polluting vehicles and more sustainable fuels. In order to overcome the main economic barriers slowing down the renewal of Italian car fleets, the Italian government set a variety of **subsidies** supporting the purchasing of liquefied petroleum gas (LPG), methane and electric vehicles. Instead, technical barriers to a nation-wide dissemination of green-vehicles (linked mainly to poor refuel/recharge infrastructures) were tackled by the Italian government both by a **national plan for the promotion of the methane infrastructures** in Italian urban areas and by a **plan** supported by **funds** dedicated to set up a wider national **network of electric vehicles charging points**.

**Institutional/organizational barriers**

In relation to the scarce diffusion of Bio-methane, the Italian Government (in accordance with the EU directive) set an obligation for national fuels sellers to use a quota of biofuels and incentives to the producers of biomethane.

Freight transport sector

**Educational barriers** in the freights transport sector are not currently addressed by Italian policy instruments, since specific awareness campaigns have not been launched.

**Economic barriers** in the freights transport sector are mainly tackled by Italy's "National Plan for logistics 2011/2020". This plan, beyond involving all the main national logistic operators in a participatory process, defined a series of measures aimed to improve the level of cooperation among the different operators. In order to give concrete tools to improve cooperation, the national government gave rise to a national logistics platform (called UIRNET) which enabled the sharing of information and data among logistic operators.

Also some measures launched by municipalities (e.g. the institution of urban low emission zones or restricted access areas to more pollutants vehicles) had a relevant impact on the renewal of the logistic fleets.

**Technical and technological barriers** in the freight transports, related mainly to scarce diffusion of green vehicles in the logistic sector, have been tackled, as for the private mobility, by a plan to set up a national network of electric vehicles charging points.

**Table 16 Barriers and policy instruments in the transport sector**

## Transportation of people

| Types of barriers | Country-specific barriers | Scale | Barriers addressed in current policy instruments |
|---|---|---|---|
| **Social Cultural Educational** | Car ownership (private transport) | *National* | Government subsidies for the purchase of low-emission vehicles (L. 9 April 2009, N.5 and L. 26 June 2012, N.134);<br><br>National electric car sharing project in cities (co-financed by the Ministry of Environment);<br><br>Road tax (tax exemption for electric vehicles and discount on car assurance) and regional schemes for tax exemption for LPG and methane vehicles;<br><br>Awareness campaigns and Events and initiatives within the European Sustainable Mobility Week;<br><br>National programmes and funds aimed to improve public transport services. |
| | Low satisfaction for the public transport | *National* | Five years bus fleet renewal plan (Piano quinquennale per il rinnovo del parco mezzi del trasporto passeggeri su gomma) (L. 27 December 2014, n.147);<br><br>Contract for the development of the national rail infrastructures (Contratto di Programma 2012-2016. Parte Investimenti) (Report to Italian Senate 3 February 2015 n.21);<br><br>Sustainable Urban Mobility Plans, SUMP (Piani Urbani per la Mobilità Sostenibile);<br><br>Sustainable Energy Action Plans (SEAPs);<br><br>National funds for the development of underground railways (Defined in annual Italian Budget Laws);<br><br>Funds related to the "Five years bus fleet renewal plan" (L. 27 December 2014, n.147);<br><br>Structural fund on thematic area "sustainable movement of people and goods" (EU 2014-2020 Structural Funds); |

| | | | |
|---|---|---|---|
| | | | National funds for local public transports (indirect effects for example in fleets renewal, etc.). (Defined in annual Italian Budget Laws); |
| | Low acknowledgement of environmental/social benefits of public transport use (private transport) | *National* | National Green Procurement Plan (Piano d'Azione Nazionale per il GPP) (D.M. 11 April 2008, updated with D.M. 10 April 2013) (public administrations);<br><br>Sustainable Urban Mobility Plans, SUMP (Piani Urbani per la Mobilità Sostenibile);<br><br>Sustainable Energy Action Plans (SEAPs);<br><br>Awareness campaigns and Events and initiatives within the European Sustainable Mobility Week. |
| | Bike perceived as dangerous and not compatible with some weather conditions (private transport) | *National* | Sustainable Urban Mobility Plans, SUMP (Piani Urbani per la Mobilità Sostenibile);<br><br>Sustainable Energy Action Plans (SEAPs);<br><br>Funding for energy efficiency, renewable energy and bike-sharing (L. 24 December, N.244);<br><br>Awareness campaigns and Events and initiatives within the European Sustainable Mobility Week. |
| | Insufficient safety, lack of adequate space for walking (private transport) | *Local* | Sustainable Urban Mobility Plans, SUMP (Piani Urbani per la Mobilità Sostenibile);<br><br>Sustainable Energy Action Plans (SEAPs);<br><br>Urban Traffic Plans (Piano Urbano del Traffico) (Dlgs. 30 April 1992, n.285);<br><br>Awareness campaigns and Events and initiatives within the European Sustainable Mobility Week. |
| | Chaotic parking (private transport) | *Local* | Sustainable Urban Mobility Plans, SUMP (Piani Urbani per la Mobilità Sostenibile);<br><br>Urban Traffic Plans (Piano Urbano del Traffico) (Dlgs. 30 April 1992, n.285). |
| **Economic** | Critical economic | *National/ Local* | Five years bus fleet renewal plan (Piano |

| | | | |
|---|---|---|---|
| | condition of several public transport management authorities (public transport) | | quinquennale per il rinnovo del parco mezzi del trasporto passeggeri su gomma) (L 27 December 2014, N.147);<br><br>Contract for the development of the national rail infrastructures (Contratto di Programma 2012-2016. Parte Investimenti) (Report to Italian Senate 3 February 2015 n.21);<br><br>National funds for the development of underground railways (Defined in annual Italian Budget Laws);<br><br>Funds related to the "Five years bus fleet renewal plan" (L 27 December 2014, N.147);<br><br>Structural fund on thematic area "sustainable movement of people and goods" (EU 2014-2020 Structural Funds);<br><br>National funds for local public transports (indirect effects for example in fleets renewal, etc.). (Defined in annual Italian Budget Laws). |
| | Fragmentation of public transport operators (public transport) | *National/ Local* | / |
| | High evasion rate of public transport tickets (public transport) | *Local* | / |
| | Spending review conducted by central government on public transport services (public transport) | *National/Regional* | Several European and national funds for promotion of sustainable urban transport measures |
| | Low economic viability of the investment necessary for the realization of high-capacity transport in low-density residential areas (public transport) | *National* | Five years bus fleet renewal plan (Piano quinquennale per il rinnovo del parco mezzi del trasporto passeggeri su gomma) (L 27 December 2014, N.147);<br><br>Contract for the development of the national rail infrastructures (Contratto di Programma 2012-2016. Parte Investimenti) (Report to Italian Senate 3 February 2015 n.21);<br><br>National funds for the development of underground railways (Defined in annual Italian Budget Laws);<br><br>Funds related to the "Five years bus fleet renewal plan" (L 27 December 2014, N.147); |

| | | | |
|---|---|---|---|
| | | | Structural fund on thematic area "sustainable movement of people and goods" (EU 2014-2020 Structural Funds);<br><br>National funds for local public transports (indirect effects for example in fleets renewal, etc.). (Defined in annual Italian Budget Laws). |
| | Urban Sprawl | *National* | / |
| | High cost of batteries for electric vehicles (public/private transport) | *National* | National funds for local public transports, Government subsidies for the purchase of low-emission vehicles (L. 9 April 2009, N.5 and L. 26 June 2012, N.134). |
| **Institutional** | Reduction of national public investments in the public transport sector | *National/ Regional* | Several European and national funds for promotion of sustainable urban transport measures |
| | Lack of a national strategy for bike and pedestrian mobility | *National* | / |
| | Lack of an Italian Transport Authority for a long time (public transport) | *National* | Since September 2013 National Transport Authority is fully operative |
| | Delays in the definition of the strategic national plan | *Regional* | / |
| | Scarce attention in the public transport concession of qualitative standards of services | *National* | / |
| | Lack of a long term vision regarding the future of transport infrastructures | *National* | Italy's National Plan for Logistics 2011/2020 (Piano Nazionale della Logistica 2011-2020) (Ministry of Transport note prot. 567/CGA 30 May 2012). |
| **Infrastructural and technical** | Old Italian public transport fleets (public transport) | *Local* | Five years bus fleet renewal plan (Piano quinquennale per il rinnovo del parco mezzi del trasporto passeggeri su gomma) (L 27 December 2014, N.147);<br><br>National funds for local public transports (indirect effects for example in fleets renewal, etc.). (Defined in annual Italian Budget Laws). |
| | Few underground line in Italian cities (public transport) | *Local* | National funds for the development of underground railways (Defined in annual Italian Budget Laws). |

| | | | |
|---|---|---|---|
| | Lack of recharge stations for electric vehicles (private transport) | *National* | National infrastructure plan to set up electric vehicle charging points (Piano Nazionale Infrastrutturale per la ricarica dei veicoli alimentati ad energia elettrica, PNIRE) (L. 7 August 2012, n.134);<br><br>Ad-hoc fund of Ministry of Infrastructure and Transport on PNIRE implementation 2013-2015 (L. 7 August 2012, n.134); |
| | Technical limitations of electric vehicles (private transport) | *National* | National infrastructure plan to set up electric vehicle charging points (Piano Nazionale Infrastrutturale per la ricarica dei veicoli alimentati ad energia elettrica, PNIRE) (L. 7 August 2012, n.134);<br><br>Government subsidies for the purchase of low-emission vehicles (L. 9 April 2009, N.5 and L. 26 June 2012, N.134). |
| | Scarce diffusion of Bio-methane in Italy (private transport) | *National* | Incentives for the promotion of biofuels in transport sector, Promotion of use of biomethane in transports (Dlgs. 3 March 2011, N.28). |

**Transportation of goods/freight transport**

| Types of barriers | Country-specific barriers | Scale | Barriers addressed in current policy instruments |
|---|---|---|---|
| **Social Cultural Educational** | Low cooperation between logistic operators | *National* | Italy's National Plan for Logistics 2011/2020 (Piano Nazionale della Logistica 2011-2020) (Ministry of Transport note prot. 567/CGA 30 May 2012);<br><br>National Logistics Platform UIRNET (Sistema Nazionale della Logistica Integrata e Intermodalità) (D.M 20 June 2005, N.18T). |
| | Low probability to be sanctioned for irregular parking | *Local* | / |
| | Lack of high level managerial competencies | *National* | National Action Plan for Intelligent Transport System (Piano di Azione Nazionale sui Sistemi Intelligenti di Trasporto) (D.L. 12 February 2014, n.44). |
| | Several economic operators | *Local* | Italy's National Plan for Logistics |

| | | | |
|---|---|---|---|
| | organize by itself their freights supply (Conto Proprio) | | 2011/2020 (Piano Nazionale della Logistica 2011-2020) (Ministry of Transport note prot. 567/CGA 30 May 2012);<br><br>Municipal limits to city center access |
| | High outsourcing level of main logistic operators | *National* | Italy's National Plan for Logistics 2011/2020 (Piano Nazionale della Logistica 2011-2020) (Ministry of Transport note prot. 567/CGA 30 May 2012). |
| | E-commerce rapid growth | *National* | / |
| | Brand identity | *National* | / |
| | Strong lobbies block political reforms | *National* | / |
| **Economic and Institutional** | High fragmentation of local traffic regulation | *Local* | / |
| | Few external/international investments in Italian logistic sector | *National* | Italy's National Plan for Logistics 2011/2020 (Piano Nazionale della Logistica 2011-2020) (Ministry of Transport note prot. 567/CGA 30 May 2012). |
| | High bureaucracy in the logistic sector (both national and regional level) | *National/local* | / |
| | Regulatory aspects limits the growing of green logistic solutions (both national and regional level) | *National/ Regional/local* | / |
| | Lack of infrastructures for intermodal logistics (especially in urban areas) | *National/ Regional/local* | / |
| | Lack of adequate economic resources for local public administrations | *Regional/Local* | National "Smart Cities and Communities and Social Innovation" funds 2012 and 2013 (Director Decree 5 July 2012, N.391/Ric). |
| **Technical and technological** | National logistic infrastructures gap | National | Italy's National Plan for Logistics 2011/2020 (Piano Nazionale della Logistica 2011-2020) (Ministry of Transport note prot. 567/CGA 30 May 2012).<br><br>National Action Plan for Intelligent Transport System (Piano di Azione Nazionale sui Sistemi Intelligenti di Trasporto) (D.L. 12 February 2014, n.44).<br><br>Contract for the development of the national rail infrastructures |

| | | | |
|---|---|---|---|
| | | | (Contratto di Programma 2012-2016. Parte Investimenti) (Report to Italian Senate 3 February 2015 n.21). |
| | Italian southern regions weaknesses in freights infrastructures development | National | Italy's National Plan for Logistics 2011/2020 (Piano Nazionale della Logistica 2011-2020) (Ministry of Transport note prot. 567/CGA 30 May 2012). |
| | Technical limitations in electric freights vehicles technology | National | National infrastructure plan to set up electric vehicle charging points (Piano Nazionale Infrastrutturale per la ricarica dei veicoli alimentati ad energia elettrica, PNIRE) (L. 7 August 2012, n.134). |

# 4. KEY FINDINGS

**Buildings:**

Efficiency performances in the Italian building sector can be considered relatively high with respect to other Member States. However, the achievement of further efficiency gains is strongly bounded to a variety of barriers affecting different actors involved and at different degrees. Main limitations in the building sector are:

- lack of a 'culture of saving' that limits, and sometimes neutralizes, the effect of policies aimed at boosting efficiency gains;
- old age of the existing building stocks and the great historical importance of such buildings which strongly limit the technical options for energy-efficiency renovations and retrofits;
- dyscrasia between the national/supra-national and local governance, Italy being characterized by a high regional fragmentation which produces insufficient policy coordination, uncertainty among actors involved as well as delays in policy implementation;
- lack of monitoring and controls which generate free-riding behaviours and other market failures;
- the issue of split incentives and principal-agent problem, which in Italy assumes relevant dimension given the high ownership fragmentation in the real-estate market (relevant presence of condominiums);
- economic stagnation, which limits the access to credit and the expenditure budget for energy efficiency investments, both for households and public administrations.

Besides these, behavioural and social issues (misperception of economic returns, different purchasing choice in presence of other people, limited trust in local and national public administration) and a lack of technical knowledge (both in households and in mediating subjects such as ESCo, building administrators etc.) further limit the adoption process of more efficient technologies.

The overview of barriers and policy instruments in force shows that further awareness raising and information provision to consumers, home-owners and building administrators are needed, to spread a culture of saving and to inform about benefits and opportunities of energy efficiency. Furthermore, economic instruments or facilitating mechanisms to improve the access to available financial sources would be required. Also, action would be needed to address inefficiencies of

bureaucracy and increase governance and policy coordination among the multiple administrative levels.

**Transport**

The transport sector in Italy is responsible of a high environmental pressure, since an inefficient use of energy is still present both in the people and freights transportation.

In relation to public and private transport sector, Italy is still a country where private mobility is prevalent, even if in some urban areas public transport services are well developed and contribute to reduce car use. The main barriers affecting the achievement of further efficiency gains in public and private transport sector are:

- Public transport supply in Italy is still limited in several Italian cities (with some remarkable exceptions), with significant problems in terms of quality and numbers of services. For many Italians, public transport is not reliable and attractive and for this reason they prefer not to use it;
- Soft mobility (bike and pedestrian) is less developed than in other European countries. This is strictly related both to cultural aspects and to the lack of adequate infrastructures in urban areas (bike and pedestrian pathways, etc.);
- Italy is one of the most motorised country in the world. Car is still a status symbol for a large part of population;
- In the last years, due to economic crisis and the national spending review process, several financial cuts were done to national funds dedicated to the regional and local public transport services. As local public transports are highly dependent from these resources (ordinary activities cover only a limited part of their annual budgets), these relevant cuts generate increasing difficulties in guaranteeing high public transport services levels;
- Innovative forms of private mobility (for example electric mobility, etc.) are not developed, as there is still a lack of adequate infrastructures (electric public recharge area in case of electric vehicles). Moreover it is important to highlight the importance given at national level to the promotion of biofuels and biomethane.

In relation to freights transport sector, the achievement of further efficiency gains is strongly bounded to a variety of barriers affecting mainly the logistic operators involved in national and urban freights delivery. Main limitations in the logistic sector are:

- Very competitive market, where it is difficult to set up forms of collaboration among the main logistic operators in order to reach more efficient solutions (sharing of vehicles and/or common usage of urban logistic platforms);
- Italy is affected by high delays in the main national and regional logistic infrastructures development and improvements (ports, inter-mobility nodes, etc.);
- Many competences in the urban transport regulation at urban level (access to city centres, etc.) are delegated to the municipal level without an adequate coordination at regional and national level. This aspect led to a high fragmentation of legislative frameworks that impede an efficient organization of logistic services and to create national business model usable in different cities;
- Italian logistic operators appear affected by significant problems in recruiting high-educated logistic manager and working forces. These education deficiencies limited their innovative capacity;

- All the previous barriers, together with a high bureaucracy level, create an economic framework where private investments (national and international) in the logistic sector are not perceived as attractive.

On one side, some barriers (promotion of green vehicles, bio fuels, ITS, coordination among different logistics operators) have been addressed by policy instruments in place. On the other side, other barriers, mainly related to the strengthening of people and freight transport infrastructures for more energy efficient and sustainable mobility received less attention in the Italian policies framework. Therefore investments aimed at filling the gap of sustainable mobility infrastructures and services would be required, as well as information to consumers about the benefits and opportunities of sustainable mobility in order to promote a more diffused culture of sustainable travel behaviours.

For the freight transport, beyond the measures to address the infrastructural gap, also capacity building and coordination mechanisms for operators would be necessary, together with actions to address inefficiencies caused by bureaucracy.

# REFERENCES

ASSTRA (2007). L'evasione tariffaria nel trasporto pubblico locale. Available at: http://www.asstra.it/conoscenza/pubblicazione/levasione-tariffaria-nel-trasporto-pubblico-locale-asstra-hermes.html

ACI-CENSIS. (2011). XIX rapporto – Il triennio che sta cambiando il modo di muoversi. Available at: http://www.aci.it/fileadmin/documenti/studi_e_ricerche/monografie_ricerche/RAPPORTI_ACI_CENSIS/ACI-CENSIS_2011.pdf

ACI, Fondazione Caracciolo (2013). Muoversi meglio in città per muovere l'Italia. Analisi e proposte per un progetto di mobilità urbana. Available at: http://www.aci.it/fileadmin/documenti/notizie/Eventi/Studio_ACI_Fondazione_Caracciolo_su_mobilita_urbana.pdf

AEEG (2010). Annual report to the European Commission on Regulatory activities and the state of services in the electricity and gas sectors. Available at: http://www.autorita.energia.it/allegati/relaz_ann/10/annualreport10en.pdf

Binswanger H. (1974). A microeconomic approach to innovation. Economic Journal, Vol. 84(336) pp. 940-958.

Borlini B. and Memo F. (2009). Ripensare l'accessibilità urbana. Available at: http://www.riminiventure.it/binary/rimini_venture_new/documenti/Paper2_Borlini_Memo_49811.1264409762.pdf

CarPooling (2013), Carpooling: Italia al terzo posto della classifica europea. Sbarca anche da noi la sharing economy. Press release available at: http://www.carpooling.it/press_releases/view/232

Casaleggio associati (2014). E-commerce in Italia 2014. Available at: http://www.primaonline.it/wp-content/uploads/2014/05/Casalegio_Focus-E-commerce-2014-Web.pdf

Cassa Depositi e Prestiti. (2013). I problemi del trasporto pubblico locale. Article available at: http://www.circolorefricerche.it/it/le-analisi/2013/11/i-problemi-del-trasporto-pubblico-locale/

CE Delft (2011), Handbook on estimation of external costs in the transport sector. Available at: http://ec.europa.eu/transport/themes/sustainable/doc/2008_costs_handbook.pdf

Comune di Milano, AMAT, (2015). Piano Urbano della Mobilità Sostenibile. Documento di Piano. Available at: https://drive.google.com/folderview?id=0B1yqkoznVqZXcm45RzR5MHFrX2s&usp=sharing

Confindustria Vicenza, 2008. Trasporto merci in conto proprio e dichiarazione delle cose trasportate. Available at: http://www.confindustria.vicenza.it/pdf/guida_168.pdf

Costantini V., Crespi F., Palma A. (2015). Characterizing the policy mix and its impact on eco-innovation in energy-efficient technologies. SEEDS Working Papers 11/2015, SEEDS, Sustainability Environmental Economics and Dynamics Studies. Available at: https://ideas.repec.org/p/srt/wpaper/1115.html

Creazza A., Curi S., Dallari F. (2014). City logistics: panoramica delle best practice nazionali e internazionali. Liuc Papers - Pubblicazione periodica dell'Università Carlo Cattaneo – LIUC. Available at: http://www.liuc.it/ricerca/clog/cm/upload/271.pdf

Curi S. (2002). Il trasporto urbano di merci, analisi delle esperienze city logistics in Europa. in Giuffrida F. (2002). Ingresso e movimentazione delle merci nelle grandi aree urbane. Available at: http://www.filt.lombardia.it/images/sns/S2.pdf

Curtins C., Perkins T. (2006). Travel Behaviour: A review of recent literature. Impacts of transit led development in a new rail corridor. Working paper no 3. Available at: http://urbanet.curtin.edu.au/local/pdf/ARC_TOD_Working_Paper_3.pdf

De Paoli L. (2014), Efficienza energetica: governance, strumenti e mercato, Ediplan editrice.

ENEA (2015). Rapporto Annuale Efficienza Energetica 2015 (RAEE). Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile. Roma (Italy). Available at: http://www.enea.it/it/produzione-scientifica/pdf-volumi/raee-2015.pdf

Enel Foundation (2013), Stato e prospettive dell'efficienza energetica in Italia - I Rapporto. Available at: http://www.enel.com/it-IT/doc/enel_foundation/events/report_stato_e_prospettive_efficienza_energetica.pdf

Energy Strategy Group (2013), Energy Efficiency Report 2013. L'efficienza energetica in Italia: soluzioni tecnologiche ed opportunità di business nell'industria, i servizi e la pubblica amministrazione .

Energy Strategy Group (2014), Energy Efficiency Report 2014. Energy intelligence, gestione del rischio e modelli di finanziamento per i progetti di efficienza energetica.

Energy Strategy Group (2015), Energy Efficiency Report 2015. I modelli di business degli operatori dei servizi energetici in Italia ed in Europa.

European Commission (2006), Attitudes towards Energy, Special Eurobarometer 247 / Wave 64.2 - TNS Opinion & Social. Available at: http://ec.europa.eu/public_opinion/archives/ebs/ebs_247_en.pdf

European Commission (2011a), Future of Transport. Analytical Report, Flash Eurobarometer 312. Available at: http://ec.europa.eu/public_opinion/flash/fl_312_en.pdf

European Commission (2011b), Climate change, Special Eurobarometer 372 / Wave EB75.4 – TNS opinion & social. Available at: http://ec.europa.eu/public_opinion/archives/ebs/ebs_372_en.pdf

Eurispes. (2014). Libro bianco sulla mobilità e i trasporti in Italia. http://www.eurispes.eu/content/libro-bianco-sulla-mobilit%C3%A0-e-i-trasporti-italia

Eurispes. (2015). Rapporto Italia 2015 – 27esima edizione. Available at: http://eurispes.eu/content/sintesi-rapporto-italia-2015

FIAB. (2012). Raccontaci come usi la bici - Indagine nazionale FIAB 2011. Available at: http://fiab-onlus.it/download/Report_Indagine_FIAB_Raccontaci.pdf

Galarraga I., González-Eguino M., Markandya A. (2011). Willingness to pay and price elasticities of demand for energy-efficient appliances: combining the hedonic approach and demand systems. Energy Econ. Vol. 33 (1), pp. 66–S74.

Gentile D., (2009). Un mezzogiorno da connettere. Agenzia Campana per la Mobilità Sostenibile. Available at: http://www.acam-campania.it/wp-content/uploads/2013/05/Un-Mezzogiorno-da-connettere.pdf

Giuffrida F. (2002). Ingresso e movimentazione delle merci nelle grandi aree urbane. Supplemento a "Il lavoro nei trasporti" Mensile della FILT Nazionale. Editrice EDITRASPORTI. Available at: http://www.filt.lombardia.it/images/sns/S2.pdf

International Energy Agency (IEA) (2015). Energy Prices and Taxes Statistics. Paris. Available at: http://www.iea.org/statistics/

INRIX (2013). National Traffic Scorecard Annual Report. Available at: http://inrix.com/scorecard/key-findings-it/

Isfort (2007). La cattiva abitudine della sosta in doppia fila. Available at: http://www.isfort.it/sito/statistiche/Fermate_audimob/Testi_fermate/F01_Parcheggi_2007.pdf

Isfort (2012). Osservatorio sui comportamenti di mobilità degli italiani. AUDIMOB.

Isfort (2013). Gli scenari del trasporto merci e della logistica nell'opinione degli operatori: i risultati di un'indagine diretta. Available at:
http://www.isfortprogetti.it/Doc_osslog/2013/isfort_dt_28_11_2013.pdf

Isfort (2014). La domanda di mobilità degli italiani. Rapporto congiunturale di fine anno. Dati campionari 2014. "AUDIMOB" Osservatorio sui comportamenti di mobilità degli italiani. Available at:
http://www.isfort.it/sito/statistiche/Congiunturali/Annuali/RA_2014.pdf

ISTAT (2011). Statistiche focus: Trasporti urbani. Anno 2009. Available at:
http://www3.istat.it/salastampa/comunicati/non_calendario/20110406_00/testointegrale20110406.pdf

ISTAT (2012). Censimento generale della popolazione e delle abitazioni, Sezione Servizi, Trasporto aereo, ferroviario, marittimo, su strada. Data accessibile at: http://dati-censimentopopolazione.istat.it/

ISTAT (2014a). Edifici e Abitazioni, 15° censimento della Popolazione e delle Abitazioni 2011. Nota Mensile (11 agosto 2014). Available at:
http://www.istat.it/it/files/2014/08/Nota-edifici-e-abitazioni_rev.pdf?title=Edifici+e+abitazioni+-+11%2Fago%2F2014+-+Testo+integrale.pdf

ISTAT (2014b), Popolazione e ambiente: comportamenti, valutazioni ed opinioni. Available at:
http://www.istat.it/it/files/2014/04/Report_famiglia_ambiente-istat.pdf?title=Popolazione+e+ambiente+-+04%2Fapr%2F2014+-+Testo+integrale.pdf

Jaffe A.B., Newell R.G., Stavins R. N. (2005). A tale of two market failures: Technology and environmental policy. Ecological Economics, Vol. 54(2-3), pp. 164-174.

Legambiente and ACI. (2010). La città ai nostri piedi. 1980/2010 30 anni di isole pedonali. Analisi statistica e proposte di ACI e LEGAMBIENTE. Available at:
http://www.ecodallecitta.it/docs/news/EDC_dnws1199.pdf

Marciani M. (2011). Innovazione tecnologica per lo sviluppo competitivo e sostenibile del sistema logistico. Genova. Available at:
http://shippingtech.it/download%20convegni%202011/city%20logistics/MassimoMarciani.pdf

Marciani M. et al. (2014). Nuovi modelli di governance dalla distribuzione urbana alla smart logistics. Giordano editore, Napoli.

MDS Transmodal and DG Transport (2012). Study on urban freight transport. Available at:
http://ec.europa.eu/transport/themes/urban/studies/doc/2012-04-urban-freight-transport.pdf

Messina G., Valentini M.P., Pede G. (2011). L'efficienza energetica dei trasporti. ENEA. Available at: http://www.enea.it/it/comunicare-la-ricerca/documenti/quaderni-energia/trasporti.pdf

Cresme Ricerche, Legambiente (2013), Innovazione energetica in edilizia. Rapporto ONRE 2013. Available at: http://www.legambiente.it/sites/default/files/docs/sito_onre_2013_min.pdf

Panzone L. A. (2013). Saving money vs investing money: Do energy ratings influence consumer demand for energy efficient goods? Energy Economics, Vol. 38, pp. 51-63.

Thomson H., Snell C. (2013). Quantifying the prevalence of fuel poverty across the European Union. Energy Policy, Vol. 52, pp. 563–572.

Transport Ministry. (2010). Piano Nazionale della Logistica 2011-2020 (National Logistic Plan 2011-2020). Available at: http://www.mit.gov.it/mit/mop_all.php?p_id=12956

Travisi, C.M., Camagni, R., Nijkamp, P. (2010). Impacts of urban sprawl and commuting: a modelling study for Italy, Journal of Transport Geography, 18(3), 2010, 382-392.

WWF (2007). Le barriere all'efficienza energetica nei condomini italiani. Analisi e proposte d'intervento. In collaboration with Politecnico di Milano and Insubria University. Available at: http://awsassets.wwfit.panda.org/downloads/dossierbarriere_wwf_def.pdf

Zoccarato G. (2013), Dynamic CarPooling to promote sustainable mobility. Master Degree Thesis – Università degli Studi di Padova. Available at: http://tesi.cab.unipd.it/43144/1/Tesi_laurea_magistrale_Zoccarato_Giovanni.pdf

Zunder T. H., Ibanez J. N. (2004). Urban Freight Logistics in the European Union. Available at: http://www.istiee.org/te/papers/N28/09%20(pg.%2077-84)%20zunder.pdf