ANNUAL REPORT | ENERGY EFFICIENCY

2017
executive summary

ANALYSIS AND RESULTS
of energy efficiency policies in Italy

NATIONAL AGENCY
FOR ENERGY EFFICIENCY
ENEA

NATIONAL AGENCY
FOR ENERGY EFFICIENCY

ENEA

ANALYSIS AND RESULTS
of energy efficiency policies
in Italy

ENERGY EFFICIENCY
ANNUAL REPORT 2017
2016 DATA

executive summary

July 2017

The full Report was edited by the Italian National Energy Efficiency Agency of ENEA, based on data and information available as of June 1st 2017.

For further information, please contact:

Unità Tecnica Efficienza Energetica
Centro Ricerche ENEA Casaccia
Via Anguillarese, 301
00123 S. Maria di Galeria - Roma
e-mail: efficienzaenergetica@enea.it

A copy of the full Report can be downloaded at www.efficienzaenergetica.enea.it.

ENERGY EFFICIENCY ANNUAL REPORT 2017
Executive summary

2017 ENEA
Italian National Agency for New Technologies, Energy and Sustainable Economic Development

Published by ENEA - Promotion and Communication Office

Printed at the ENEA Technographic Laboratory - ENEA Frascati Research Centre

Foreword

I would like to open this sixth edition of the Annual Energy Efficiency Report by remembering Art Rosenfeld, an American scientist passed away at the beginning of this year and considered the Californian father of energy efficiency: he spent a large part of his long life working in the research field and inspiring a whole generation of scientists to work on energy efficiency, in both building and industrial sectors, convincing policymakers and sectoral agents to adopt measures and technologies for energy saving.

It is no coincidence that the term "Rosenfeld effect" is associated to his influence on the Californian energy policy, where per capita energy consumption has remained at the same level over the last forty years, whereas it has increased by 50% relative to the seventies in the US.

The Californian experience shows that the sole feasible road, to reach important results in this sector, is constant collaboration among the research community, technological innovation and public policies.

A clear example in our Country is the building sector, which has received most of attention in regulatory terms in the last few years. Not least, the important innovations of the so-called condominium Ecobonus included in the Legislative Decree no. 50/2017, aimed at incentivising the interventions on the envelope, necessary for deep renovation and upgrade of the building stock towards nearly zero energy buildings (NZEB).

The Italian companies in this sector managed to adequately meet the new innovation needs, starting from the envelope cohibentation technologies up to plant design. Besides being a clear example of the innovation potential of our industrial system, mainly constituted by small and medium enterprises, this also demonstrates how an advanced regulatory framework could create a virtuous circle that, starting from research results, fosters innovation to positively impact economy and the environment.

Are we at California's levels? Not yet, unfortunately. But our Country, as a whole, shows a good level of energy efficiency, especially in the industrial and transport sectors, as mentioned in the National Energy Strategy, currently on public consultation.

The year 2016 was very demanding for all of us but, at the same time, extremely productive. Personally, I cannot conceal ENEA's increasing commitment, both favouring cooperation agreements with the major research, innovation and institutional actors, and improving our traditional support to policymakers to adopt specific regulatory and incentivising tools.

The results are absolutely encouraging and recognised at EU level as sectoral best practices. I will mention just a few of them and recommend to read the rest of this report, which is the outcome of the work of our researchers involved in a constant measuring and monitoring activity:

- more than 15,000 energy audits performed in more than 7,000 enterprises, a success achieved also thanks to their growing awareness that investing in efficiency implies significant economic benefits;
- more than 360,000 requests for 65% fiscal deduction for energy upgrade of existing building stock, corresponding to more than 3.3 billion euros of activated investments and to slightly more than 95 ktoe/year of energy saving;
- 5.5 million White Certificates issued by GSE, with an increase of 10% relative to 2015, corresponding to 1.9 Mtoe/year of primary energy saving (in 2015 energy saving was 1.7);
- an increase by 300% of requests for the Thermal Account mechanism from local PA, especially for integrated interventions able to exploit the synergies with other financing possibilities, provided by structural funds at regional level;
- 50 million contacts reached through the first phase of the Three-Year Training and Information Program (art. 13, Legislative Decree no. 102/2014).

Figures show that we are moving in the right direction and, especially, that the effectiveness of the tools in force has not been impaired by the economic crisis. This is encouraging also relative to the possibility to achieve the new challenging targets proposed for 2030 by the new climate and energy package of the European Union.

Before concluding, I would like to express my sincere acknowledgements to all ENEA colleagues and to the external authors who, year after year, offer they collaboration to elaborate this valuable piece of work that, punctually, we deliver to our Country.

Everyone could use it as a mirror to reflect his own results and mistakes to be corrected, but also as a window on a horizon that does not seem so distant, after all.

Let’s all keep the good work going!

Federico Testa

NATIONAL AGENCY
FOR ENERGY EFFICIENCY

ENEA

Table of Contents

Introduction: The international and national contexts

The international context has been characterised, in recent years, by increasing economic activity and energy prices at lower levels than in previous years: despite economic recovery, a reduction in CO_2 emissions at the global level was highlighted by the International Energy Agency data for the 2014-2016 period, suggesting possible decoupling between GDP and energy consumption. This emission trajectory is due to energy efficiency for two thirds and to the changes in the composition of energy supply for one third. The global energy intensity in the years 2014-2015 decreased by 1.7% per year and in 2016 by almost 2%, around the double of the previous decade average. Such a trend is connected, on the one hand, to the ongoing transition towards a service economy and, on the other, to energy efficiency policies and the growth in the associated technology market and investments.

In Italy in 2014 and 2015 a decoupling between economic growth and energy consumption was not observed, but it should be considered that Italian energy intensity is historically lower that the average of 28 EU member states and, in particular, lower than our main competitors', except for the United Kingdom. In Italy, indeed, although in the long run a decrease in both primary and final energy intensity was observed, after the economic crisis and its additional impact on the ongoing decreasing trend, consumption followed the GDP recovery with a one-year lag. Clearly, policies influence such coupling relationship, differentiating energy efficiency paths and intensities according to the sector.

Certainly Italy has achieved good results, reaching the 2016 targets set in the 2011 Energy Efficiency Action Plan, but a lot remains to be done. As confirmation of the good results achieved, in 2016 the *American Council for an Energy-Efficient Economy* (ACEEE) positioned Italy at the second place, after Germany and equally to Japan, concerning the implemented energy efficiency policies and the observed performances. In 2017, World Bank positioned Italy at the eleventh place (out of 111 countries) relative to the implemented energy efficiency policies and regulations, aimed to enhance sustainable development.

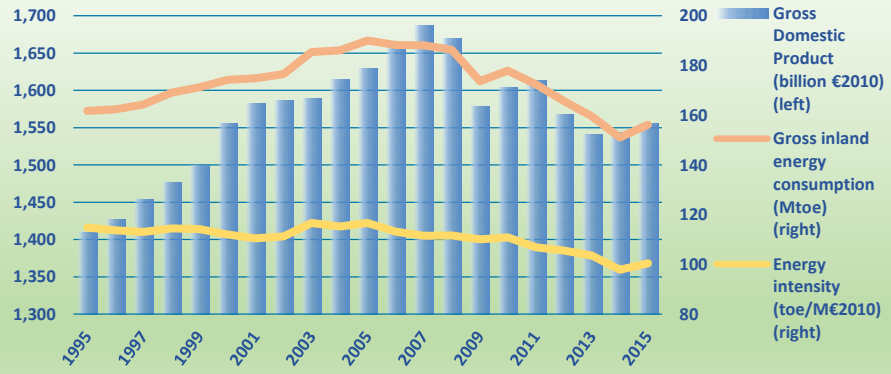
The current year will have particular importance for the national energy efficiency policies, since the Italian Ministry of Economic Development (MiSE), with the support of ENEA, has elaborated NEEAP 2017 and also the National Energy Strategy (SEN), currently on public consultation. The main strategic choices in the energy field, identified by the SEN, will take into account also the *Clean Energy Package*, published by the European Commission at the end of 2016. The SEN 2017 will define, indeed, the new target to be achieved by 2030, coherent with the scenarios defined at EU level. In reaching these targets, Italy will have to consider the cost-benefit ratio of different measures, as well as security of supply and the adequacy and quality of the electricity and gas networks, with the aim of integrating increasing quantities of RES and managing variable flows and peaks in gas demand.

These programming documents, together with a stable and favourable investment environment and R&TDI activities, will contribute to reinforce energy efficiency, energy system security and environmental sustainability in our Country.

1. Energy demand and consumption

In 2015, primary energy demand equalled 156.2 Mtoe, +3.4% relative to 2014, counteracting the trend observed in previous years (-4.0% per year in the 2010-2014 period). The Gross Domestic Product (GDP) confirmed the positive sign shown last year: +0.8% relative to 2014. The higher growth in primary energy demand relative to GDP implied an increase in primary energy intensity: in 2015 primary energy intensity was equal to 100.4 toe/M€$_{2010}$ (+2.6% relative to 2014), differently from the 2010-2014 period, when it showed a negative change equal to 3.1% per year (Figure 1).

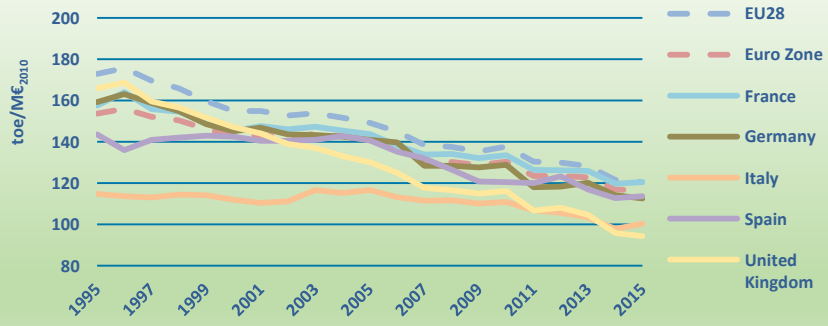
Figure 1 – Gross inland consumption, GDP, primary energy intensity, years 1995-2015



Source: ENEA elaboration based on data from the Italian Ministry of Economic Development and ISTAT

In 2015 Italy, as other main Mediterranean countries, showed a positive change in primary energy intensity, differently from the average of EU 28 member countries (Figure 2). Despite this increase, Italy's primary energy intensity is still lower than the EU average (-16.6%) and the Eurozone countries average (-13.7%).

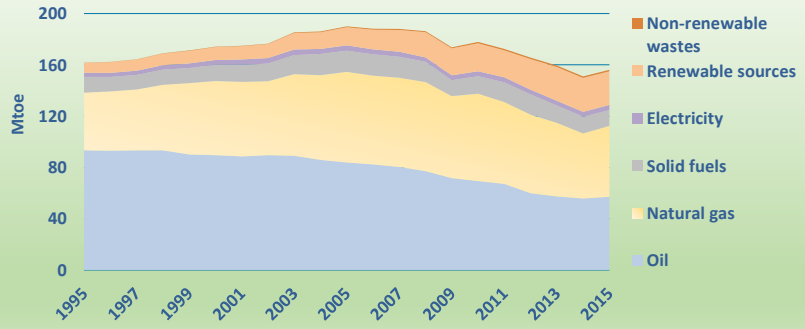
Figure 2 – Primary energy intensity in EU28 (toe/M€2010), years 1995-2015



Source: EUROSTAT

The national primary energy demand in 2015 showed a constant decrease starting from 2005: +4.3% relative to 2014, absorbing 80% of gross inland consumption. Renewable energy sources decreased by 0.9% relative to 2014, due to a reduction in hydroelectric production, -22% relative to 2014 (Figure 3). In absolute terms, in 2015 oil consumption was equal to 57.2 Mtoe (+2.4 % relative to 2014), gas consumption to 55.3 Mtoe (+9.1%) and renewable sources to 26.3 Mtoe (-0.9%).

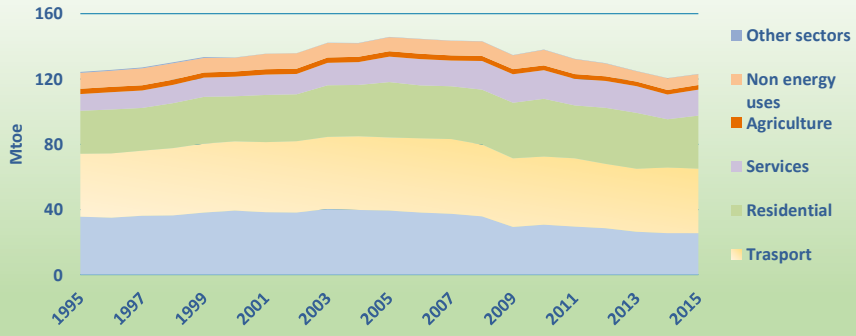
Figure 3 – Primary energy consumption by source (Mtoe), years 1995 and 2015



Source: EUROSTAT

In 2015 final energy consumption was equal to 123.0 Mtoe, increasing by 2.1% relative to 2014, similar to 1995 consumption level (124.3 Mtep) but with a different consumption structure (Figure 4).

Figure 4 – Final energy use by sector (Mtoe), years 1995 and 2015



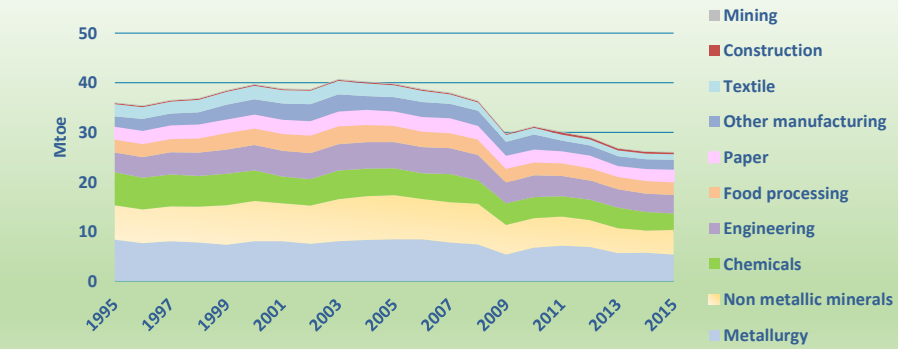
Source: EUROSTAT

In 2015, one third of final consumption was attributable to the transport sector, followed by the residential sector with 26.4% (which in 1995 consumed 21.2%) and by the industrial sector with 20.7%: the increase of the residential sector in the 1995-2015 period was 23.4% against a reduction of 28.4% in the industrial sector. In 2015 the increase of final energy consumption

was due to the growth registered in the residential sector (+10.0%), followed by the service sector (+4.8%), and agriculture (+2.7%). Consumption is decreasing in the transport sector by -1.4%, and in industry by -0.6%, confirming the trend observed in the last few years.

In absolute terms, in 2015 industrial energy consumption was equal to 26.0 Mtoe (-0.6% relative to 2014): energy consumption increased only for non-metallic minerals, paper and machinery, respectively equal to 10.8%, 5.7% and 1.8% (Figure 5). Energy-intensive sectors account for more than 60% of final industrial energy consumption, but they show a decreasing final consumption over the last few years. In particular, in 2015 metallurgy continued the negative trend, interrupted in 2014, and chemicals confirmed their decrease; the increase in non-metallic minerals and paper confirmed the positive data of the previous year. The other sectors showed reductions of energy consumption, except for machinery and other manufacturing.

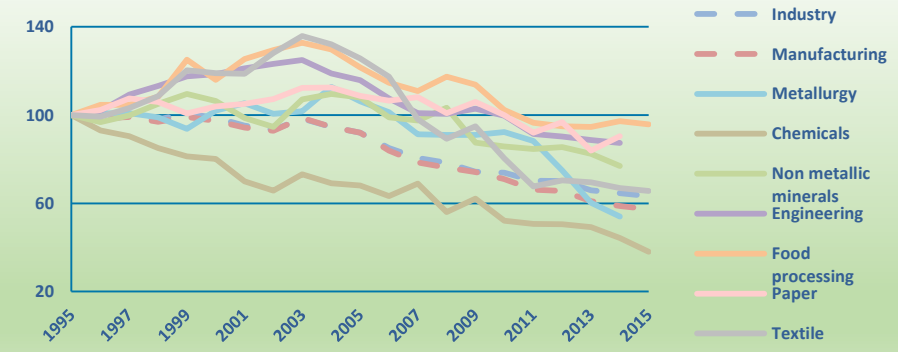
Figure 5 – Industrial energy consumption by branch (Mtoe), years 1995-2015



Source: ENEA elaboration on EUROSTAT data

Energy intensity in industry reflects the decrease in energy consumption: starting from 2005, a steady reduction of energy intensity is observed in the whole sector (Figure 6).

Figure 6 – Energy intensity in industry (1995=100), years 1995-2015

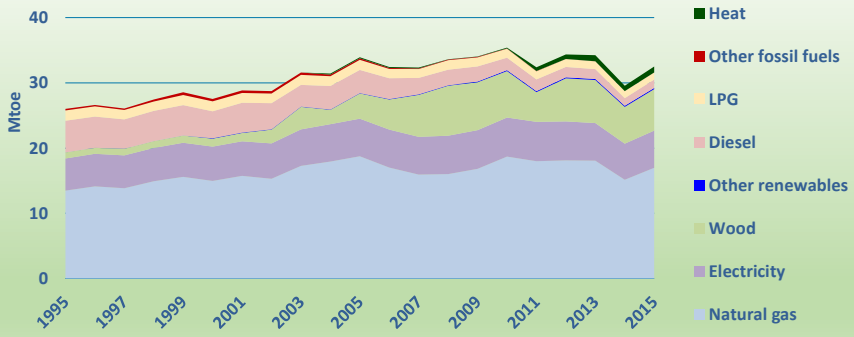


Source: ENEA elaboration on EUROSTAT and ISTAT data

In particular, industrial energy intensity in 2015 was equal to 84.4 toe/M€$_{2010}$, with a reduction of 2.0% relative to the previous year, and 3.7% per year in the period 2005-2015. Such trend is mainly explained by the reduction of final energy consumption in metallurgy and chemicals: respectively, -36.6% and -39.3% in the 1995-2015 period, which caused an annual reduction of energy intensity equal to 5.6% for chemicals (2005-2015 period) and equal to 7.3% for metallurgy (2005-2014 period).

In 2015, residential energy consumption was equal 32.5 Mtoe with an increase by 10.0% relative to 2014 (Figure 7). Natural gas is the main energy source: it covers more than 50% of sectoral energy consumption, followed by wood (19.5%) and electricity (17.5%). In 2015, an increase in the consumption of all energy sources was observed in the sector: in particular, relative to 2014 consumption increased by 12.8% for wood, by 12.1% for natural gas and by 11.0% for heat.

Figure 7 – Residential energy consumption by source (Mtoe), years 1995-2015

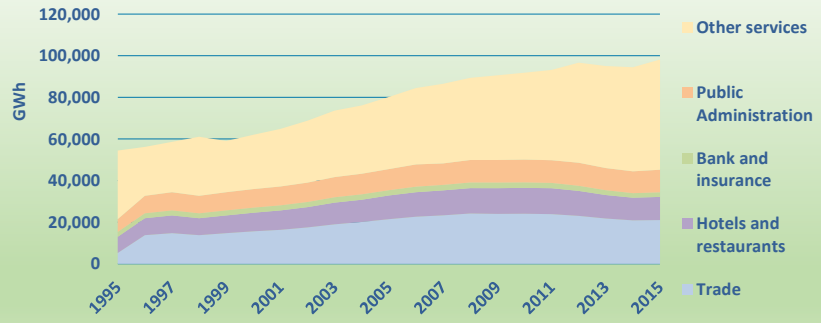


Source: ENEA elaboration on EUROSTAT data

The non-residential sector in 2015 started to increase again after its reduction in the previous year: +4.8% relative to 2014, with total consumption equal to 15.9 Mtoe. The main energy source is electricity, covering more than 50% of sectoral energy consumption, followed by natural gas with more than 40%.

In 2015, electricity consumption in non-residential sector was slightly lower than 100,000 GWh, i.e. +3.9% relative to previous year (Figure 8): the exponential growth observed in the whole sector characterised all subsectors in the 1995-2015 period, slowed only by the recent economic crisis, particularly strong for trade, hotels and restaurants. The transport sector exclusively consumes fossil fuels: until 2004 they satisfied sectoral energy demand for around 98%. Since 2004 the contribution of fossil fuels has begun a slow decrease, to be associated with the increasing use of biofuels and, in a much lower proportion, of electricity: it is important to mention that the decrease in oil products was partially counterbalanced by the increase in natural gas consumption.

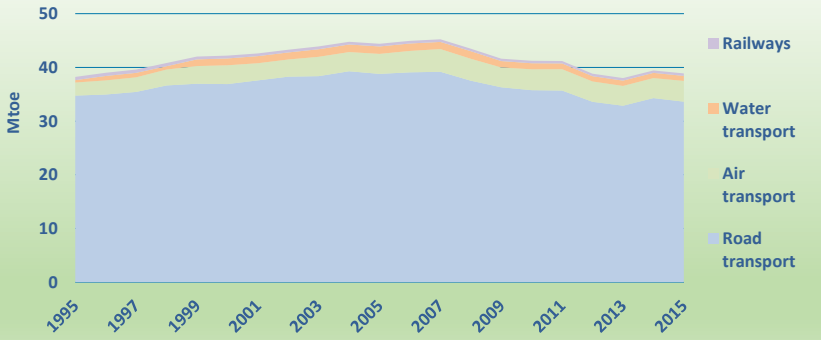
Figure 8 – Non-residential electricity consumption by sector (GWh), years 1995-2015



Source: TERNA

The transport energy consumption by mode (Figure 9) highlights the Italian peculiarity characterised by the absolute predominance of road transport, both passengers and goods especially, covering more than 86% of the sectoral energy consumption, which is slightly decreasing in recent years.

Figure 9 – Transport energy consumption by mode (Mtoe), years 1995-2015



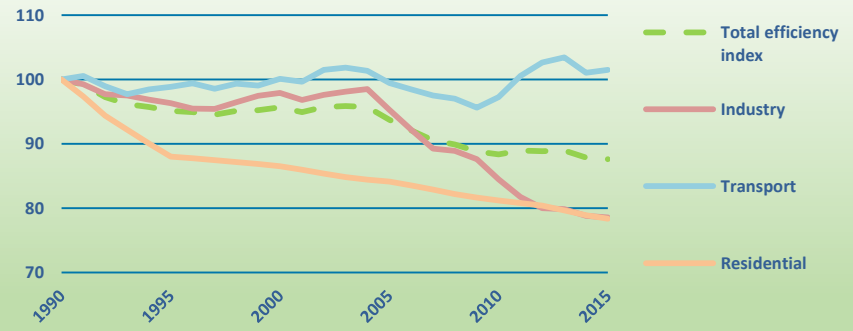
Source: EUROSTAT

The ODEX energy efficiency index, developed in the European project ODYSSEE-MURE, can be used for an overall evaluation of energy efficiency improvements in different sectors. It provides a more reliable assessment than energy intensity figures, since it does not include structural changes and other factors not associated to efficiency.

In 2015, the ODEX index (lower the value, better the performance) for the whole Italian economy was 87.6, confirming the decrease, albeit moderate, of the previous year, after a period of relative stability mainly associated to efficiency losses in the transport sector, and after the steady improvements observed until 2010. Sectors have contributed to this trend in a different way. The residential sector registered regular and constant progresses

over the 1990-2015 period, with main progresses in the early Nineties and reduced later on due to changes associated to housing comfort. Industry has obtained significant improvements starting from 2005, with different trends depending on the sector: in particular, sectors which previously experienced steady improvements in energy efficiency, such as iron and steel and paper, in recent years reduced such increases reaching negative results instead. The transport sector has the greatest difficulties in achieving energy efficiency improvements due to the characteristics of the freight transport system, almost exclusively based on road transport: both number of travels and energy consumption are growing, although with a lower load factor. Despite the critical issues highlighted, improvements were observed in the transport sector, albeit low, mainly due to energy efficiency increases in passenger and other transport modes (Figure 10).

Figure 10 – ODEX energy efficiency index (1990=100), years 1990-2015



Source: ODYSSEE-MURE

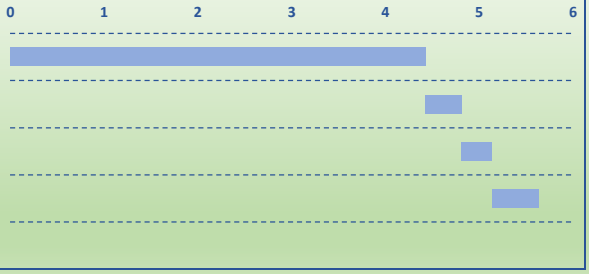
2. Achieved energy savings

Quantitative evaluation of achieved savings has been made both with reference to National Energy Efficiency Action Plan 2011 (2011 NEEAP) objectives, relative to the 2005-2016 period, and to the Italian National Energy Strategy objectives, relative to the 2011-2020 period, further revised in 2014 NEEAP. For the 2014-2016 energy savings and information for the mandatory targets of Energy Efficiency Directive (EED), article 7, are also provided. The increasing availability of data and detailed information has allowed to enrich the adopted methodology. At the same time, energy saving deriving by interventions on the adoption of RES has been excluded from calculations.

The energy saving from projects implemented since 2005 through standard sheets (ex-ante estimation based on algorithms), and analytical and final balance sheets (ex-post measure), in 2016, was equal to 5.64 Mtoe/year of primary energy (equivalent to around 4.8 Mtoe/year of final energy).

Table 1 – Savings in 2016 from projects incentivised in 2005-2016 period by White Certificates (primary energy, Mtoe/year)

Period	Saving
Cumulated 2005-2013	4.43
Annual 2014	0.39
Annual 2015	0.32
Annual 2016	0.50
Total 2005-2016	**5.64**

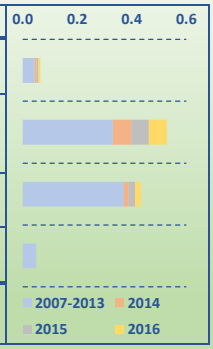


Source: Ministry of Economic Development elaboration on Gestore Servizi Energetici (GSE) data

From 2007 to 2016 fiscal deductions for energy requalification of existing buildings have incentivised around 3 million interventions, with almost 32 billion euros invested by households. Until September 2017 it is still possible to modify data relative to interventions implemented in 2016. The energy saving for 2016 was then estimated on the basis of preliminary data and was equal to 0.1 Mtoe/year of primary and final energy. The overall energy saving in primary and final energy in the 2007-2016 period was equal to 1.08 Mtoe/year (Table 2).

Table 2 – Savings from fiscal deductions for energy renovation (primary energy, Mtoe/year), years 2007-2016

Intervention	2007-2013	2014	2015	2016*	Total
Overall renovation	0.04	0.01	0.01	0.01	**0.07**
Thermal insulation of the envelope, substituion of windows and shutters, solar shading	0.33	0.07	0.06	0.07	**0.53**
Efficient heating system installation	0.37	0.02	0.02	0.02	**0.43**
Multiple actions	0.05	-	-		**0.05**
Total	**0.79**	**0.09**	**0.09**	**0.10**	**1.08**



* Estimate

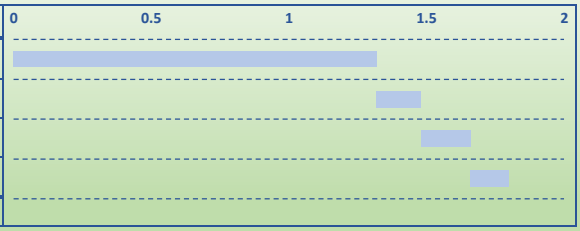
Source: ENEA

The incentivised interventions by fiscal deductions for building renovation include also condensation boilers and windows and shutters, both covered also by fiscal deductions for energy requalification. Given the high number of renovations realised in the last few years, it is reasonable to suppose that fiscal deductions for building renovations have incentivised both condensation boilers and windows and shutters for the substitution of old equipment. Adopting for condensation boilers the unitary energy saving derived from fiscal deductions for energy requalification and for windows and shutters the saving

associated to the substitution of single with double glazing, the consumption reduction achieved in 2016 by the installation of condensation boilers and windows substitution, incentivised by fiscal deductions for building renovation, was equal to 0.14 Mtoe/year (Table 3). On the overall 2006-2016 period, the energy saving was equal to 1.8 Mtoe/year.

Table 3 – Savings from fiscal deductions for building renovation (primary energy, Mtoe/year), years 2006-2016

Period	Saving
Cumulated 2006-2013	1.32
Annual 2014	0.16
Annual 2015	0.18
Annual 2016	0.14
Total 2005-2016	**1.80**

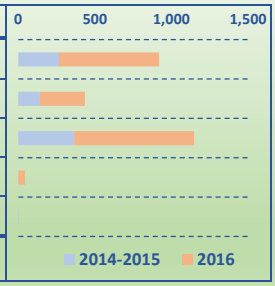


Source: ENEA

Table 4 shows the annual energy saving achieved until 2016 by the Renewable Energy for Heating & Cooling Support Scheme (so-called *Thermal Account*) relative to the energy efficiency interventions realised by Public Administration. The total saving amount since the launch of the mechanism has been equal to around 2.55 ktoe/year of primary and final energy.

Table 4 – Savings from energy efficiency interventions in *Thermal Account* (primary energy, toe/year), years 2014-2016

Measure	2014-2015	2016	Saving
1.A – Opaque envelope	266	653	**919**
1.B – Windows and shutters	140	295	**435**
1.C – Condensation boilers	366	781	**1,147**
1.E - nZEB	-	45	**45**
Other	5		**5**
Total 2005-2016	**777**	**1,774**	**2,551**



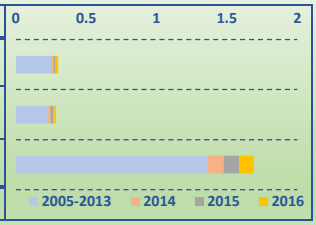
Source: Gestore Servizi Energetici S.p.A.

Relative to the transposition of Directive 2002/91/CE and implementation of Legislative Decree 192/05, with reference to the Minimum Energy Efficiency Requirements for buildings, the overall primary energy saving was 2.28 Mtoe/year, mainly deriving from the substitution of heating systems in residential buildings (Table 5).

The contribution associated to the construction of new buildings with energy performance above law requirements, both in residential and non-residential sector, has been less important, due to the crisis which still affects the building sector.

Table 5 – Savings deriving by the implementation of Legislative Decree 192/05 (primary energy, Mtoe/year), years 2005-2016

Intervention	2005-2013	2014	2015	2016	Total
New buildings - Residential	0.25	0.02	0.02	0.02	**0.30**
New buildings – Non residential	0.23	0.02	0.02	0.02	**0.28**
Heating system replacement	1.36	0.12	0.11	0.10	**1.69**
Total	**1.84**	**0.15**	**0.15**	**0.14**	**2.28**

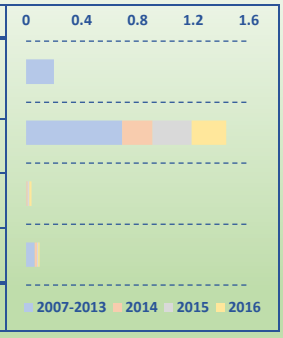


Source: ENEA elaboration

Incentivising the purchase of more efficient vehicles, implementing EU regulations and the commissioning high speed railways and the corresponding demand reduction on the corresponding flight and road routes implied the cumulated primary energy saving shown in Table 6, equal in 2016 to 1.71 Mtoe/year (equal to around 1.56 Mtoe/year of final energy).

Table 6 – Savings from measures in the transport sector (primary energy, Mtoe/year), years 2007-2016

Intervention	2007-2013	2014	2015	2016*	Total
2007-2009 incentives for new cars	0.20	0	0	0	**0.20**
EC Regulation 443/2009	0.69	0.22	0.28	0.25	**1.44**
EC Regulation 510/2011	0.00	0.01	0.01	0.01	**0.04**
High speed railways	0.06	0.01	0.01	0.01	**0.10**
Total	**0.96**	**0.24**	**0.30**	**0.27**	**1.77**



* Estimate

Source: ENEA elaboration

Relative to the European Structural and Investment Funds (ESIF) programming 2007-2013 period, Table 7 provides a synthesis of a selection of more than 3,200 projects relevant for energy efficiency. These projects total more than 9 billion of public financing and 2,164 of them (66% of the total) are concluded and paid off.

The selection was identified based on detailed information relative to single projects, available on the institutional websites expressly created by the Presidency of the Council of Ministers and the Ministry for Economic Development. The savings deriving from these projects are not included in the summary tables shown in the following paragraphs.

Table 7 – ESIF 2007-2013: financed and concluded selected projects, and available resources (M€), programming period 2007-2013

European Structural and Investment Funds 2007-2013	N° project	Total public financing	Eligible cost	Total payment
Regional Operational Programme (ROP) Regional Competitiveness and Employment - ERDF				
Horizontal measures, funds and incentives, information and training	669	190.6	190.6	166.8
Public and private buildings	433	207.7	200.1	190.6
Public lighting	400	70.7	68.8	64.1
Industry	249	39.7	34.2	34.5
Sustainable transport	177	528.3	532.2	477.9
Energy distribution	96	6.3	6.2	6.1
Regional Operational Programme (ROP) Convergence - ERDF				
Horizontal measures, funds and incentives	63	255.6	255.6	245.9
Public buildings	61	42.6	35.1	28.3
Public lighting	419	61.2	55.1	49.2
Industry	1	1.4	1.4	0.7
Sustainable transport	90	2,654.7	2,193.2	1,261.9
Energy distribution	36	47.0	41.3	32.4
Interregional Operational Programme (IOP) "Renewable energy and energy saving", Axis II				
Horizontal measures, funds and incentives, information and training	47	166.2	166.2	148.2
Public buildings	133	130.9	131.2	117.4
Public lighting	58	48.4	48.4	38.0
Energy distribution	18	280.6	280.6	267.0
Regional Action Plan of Cohesion and Development Fund (CDF)				
Public and private buildings	39	31.3	26.6	7.5
Public lighting	12	10.0	8.7	3.3
Sustainable transport	110	934.7	944.9	635.6
Cohesion Plan of Action				
Horizontal measures	23	6.7	6.7	6.7
Public buildings	39	20.1	20.1	12.2
Public lighting	48	12.1	12.1	9.7
Sustainable transport	17	259.1	109.7	72.4
Energy distribution	4	2.0	2.0	1.2
National Operational Program (NOP) Convergence ERDF "Networks and Mobility" Regional Action Plan of Cohesion and Development Fund (CDF) Special Action Plan Railway Routes				
Sustainable Mobility	25	3,325.6	629.7	398.0

Source: ENEA elaboration based on data from the Italian Presidency of the Council of Ministers

For the 2005-2016 temporal horizon as set in NEEAP 2011, the overall energy saving in 2016 deriving from analysed measures is equal to around 11.6 Mtoe/year: the planned objective has been then exceeded by 0.7 Mtoe/year, thanks in particular to the contribution of industrial and residential sectors (Table 8).

Table 8 – Achieved energy savings by sector, years 2005-2016, and expected for 2016 (final energy, Mtoe/year), according to 2011 NEEAP

Sector	White Certificates	Tax deductions*	Thermal Account	Legislative Decree 192/05*	Measures in transport sector*	Other measures**	Energy saving		Achieved target (%)
							Achieved in 2016***	Expected for 2016	
Residential	1.86	2.77		1.99		0.1	6.72	5.16	130.2%
Services	0.23	0.03	0.003	0.09			0.35	2.11	16.4%
Industry	2.71	0.05		0.2			2.95	1.73	170.8%
Trasport					1.47	0.09	1.56	1.87	83.4%
Total	4.79	2.85	0.003	2.28	1.47	0.19	11.58	10.87	106.5%

* Estimated for 2016; ** Residential sector includes saving associated to the substitution of big appliances; transport sector includes saving associated to high speed railways; *** Net of duplications
Source: ENEA elaboration

Relative to the 2011-2020 target as set in 2014 NEEAP, energy savings achieved in 2016 amounted to slightly more than 6.4 Mtoe/year of final energy, equivalent to more than 40% of the target (Table 9). Around 40% of such savings derives from the White Certificates scheme. At sectoral level, the residential sector has already achieved 84% of the expected 2020 target, while the services and transport sectors are relatively more distant from their respective targets.

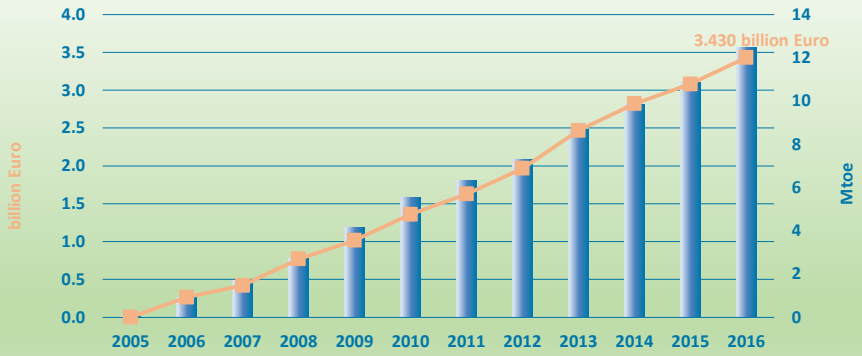
Table 9 – Achieved energy savings by sector, years 2011-2016, and expected for 2020 (final energy, Mtoe/year), according to 2014 NEEAP

Sector	White Certificates	Tax deductions*	Thermal Account	Legislative Decree 192/05*	Measures in transport sector*	Other measures**	Energy saving		Achieved target (%)
							Achieved in 2016***	Expected for 2020	
Residential	0.59	1.56		0.91		0.02	3.09	3.67	84.2%
Services	0.13	0.02	0.003	0.05			0.19	1.23	15.4%
Industry	1.84	0.03		0.09			1.95	5.10	38.3%
Trasport					1.13	0.04	1.18	5.50	21.4%
Total	2.56	1.60	0.003	1.05	1.13	0.07	6.41	15.50	41.4%

* Estimated for 2016; ** Residential sector includes saving associated to the substitution of big appliances; transport sector includes saving associated to high speed railways; *** Net of duplications
Source: ENEA elaboration

Figures provided in Table 9 imply, in 2016, an annual cumulated saving in Italian energy bill equal to almost 3.5 billion euros, due to avoided oil and gas imports (Figure 11).

Figure 11 – Saving in the Italian energy bill and energy saving, years 2005-2016



Source: ENEA elaboration

Concerning the cumulative energy saving target of 25.8 Mtoe of final energy over the 2014-2020 period, according to EED Article 7, Table 10 shows results achieved in 2014, 2015 and 2016 (estimated with regards to tax deductions) for each of the measures notified to the European Commission. Figures are on track of expected trend towards the 2020 target.

Table 10 – Achieved energy savings by notified measure, according to EED Article 7 (final energy, Mtoe), years 2014, 2015 e 2016

Policy measures	Achieved savings 2014	Achieved savings 2015	Achieved savings 2016	Total savings 2014-2016	Expected total savings 2020
Obligation scheme – White Certificates	1.05	0.896	1.135	**3.081**	**16.00**
Alternative measure 1 – Thermal Account	0.00004	0.001	0.002	**0.003**	**5.88**
Alternative measure 2 – Fiscal deductions	0.248	0.502	0.731	**1.481**	**3.92**
Total saving	**1.298**	**1.399**	**1.868**	**4.564**	**25.80**

Source: Ministry of Economic Development

As regards the renovation of 3% of the total floor area of heated and/or cooled buildings owned and occupied by the Italian central government, interventions on more than 150 buildings are planned, in the pipeline, or completed during the 2014-2016 period. More specifically, a total floor area of 1,414,972 m^2 is involved.

Table 11 includes, for years 2014, 2015 and 2016, the total floor area under the renovation obligation and the floor area of building under intervention. It is worth

mentioning that, in 2014, the obligation was in force only for buildings with total useful floor area over 500 m^2.

Table 11 – Energy renovation of Italian central government buildings, years 2014, 2015 and 2016

	2014	2015	2016
Total floor area of buildings with a total useful floor area over 500 m2 owned and occupied by the central government of the Member State concerned that, on 1 January of each year, do not meet the national minimum energy performance requirements set in application of Article 5 (1) of EED	14,828,984	14,441,992 m^2	13,973,749 m^2
Total floor area of buildings with a total useful floor area over 250 m2 owned and occupied by the central government of the Member State concerned that, on 1 January of each year, do not meet the national minimum energy performance requirements set in application of Article 5 (1) of EED	Not under obligation	361,360 m^2	361,360 m^2
Total renovated (or planned or in the pipeline) floor area	386,992 m^2	468,243 m^2	559,737 m^2
%	**2.61%**	**3.16%**	**3.90%**

Source: Italian Ministry of Economic Development

3. Energy audit and energy saving potential for the Italian industrial sector

On 31st December 2016, 15.154 audits were transmitted to ENEA, corresponding to 8.130 enterprises. Thanks to this result, Italy is positioned at the top of the list of more virtuous EU member states in implementing article 8 of EED and its obligation to energy-intensive and large industries. In the rest of EU, indeed, at the end of the first obligation period on December 2015, 13.000 audits were elaborated, 7.000 of which represented by audit declarations.

Table 12 shows the sectoral breakdown of Italian audits: almost 45% of them was performed on site in the manufacturing branch and more than 10% in trade, where energy consumption of Mass Retail Channel has a relevant share. To sensitise enterprises to transmitting the documentation in the planned terms, ENEA created *ad hoc* discussion tables with interested parties to identify fully shared solutions, in line with Legislative Decree 102/2014. Such advice moments have enabled the Ministry of Economic Development to develop clarifying documents, in May and October 2015 and in November 2016.

Table 12 – Energy audits undergone according to article 8 Legislative Decree 102/2014

NACE classification	Number of enterprises	Audited sites	ISO 50001 enterprises	Large enterprises	Large energy-intensive enterprises	Non-large energy-intensive enterprises
A – Agriculture, forestry and fishing	60	99	2	55	1	0
B – Mining and quarrying	37	53	2	22	2	10
C - Manufacturing	4,827	6,793	97	2,490	722	1,528
D - Electricity, gas, steam and air conditioning supply	226	507	8	191	3	6
E - Water supply, sewerage, waste management and remediation activities	302	890	12	245	17	14
F - Construction	159	346	9	144	2	1
G - Wholesale and retail trade, repair of motor vehicles and motorcycles	835	2,286	4	728	24	11
H - Transportation and storage	392	942	7	320	27	9
I - Accommodation and food service activities	93	258	2	81	4	0
J - Information and communication	150	596	4	130	4	3
K - Financial and insurance activities	238	684	6	220	2	0
L – Real estate activities	57	95	1	46	2	1
M - Professional, scientific and technical activities	229	472	4	197	3	3
N - Administrative and support service activities	222	471	2	196	5	3
Q - Human health and social work activities	208	451	2	184	12	4
R - Arts, entertainment and recreation	43	118	0	33	4	1
Other	52	93	1	37	2	3
Total	**8,130**	**15,154**	**163**	**5,319**	**836**	**1,597**

Source: ENEA

In collaboration with the main involved stakeholders, ENEA proposed an innovative scheme to analyse the energy structure of the audited productive site, starting with the definition of a tree scheme which, by means of a multi-level procedure, allows to better define the energy performance of a plant or productive site, for each energy vector (electric, thermal, steam, hot water, etc.) purchased and used in the examined site, distinguishing annual consumption by the different users in the site itself.

Together with the discussion tables, ENEA elaborated different documents to provide operational advices to auditors, in order to standardise reporting and accounting. In particular, a logic operational path has been proposed, along which structuring and organising the energy audit and, together with different trade associations, specific guidelines were conceived. Publicly available, the guidelines provide the enterprises with

useful indications to fully comply with article 8 of Legislative Decree 102/2014, in particular for multi-site enterprises.

The high number of performed audits is very likely to be continue to grow thanks to the the compliance actions of MiSE and to the existence of a database of Small and Medium Enterprises participating to regional calls in the framework of the Decree of 12nd May 2015, aimed at favouring SMEs in realising energy audits and energy savings. 15 million euros were made available in 2015, for co-financing regional programs to incentivise energy audits in SMEs or the adoption of energy management systems conform to ISO 50001 standards.

Regions in turn made available additional 15 million euros, and total public financing covers 50% of energy audit realisation costs. It is estimated that at least 15,000 SMEs per year could be involved in this initiative and that an equal number of energy efficiency projects would be enhanced by energy audits. The initiative was replicated in 2016 and will be renewed annually with analogous resources until 2020. Relative to the 2015 public notice, six regions have made available more than 11.5 million euros to SMEs for co-financing energy audits and the adoption of energy management systems.

Over the next years a significant increase in energy efficiency projects realised by enterprises is expected, as a result of the audits performed by energy-intensive and large firms and of the promotion of energy audits in SMEs.

The analysis of energy audits provides an overview of possible interventions to increase the energy efficiency of productive processes. Table 13 synthesizes the cumulated total of interventions suggested in the concluding section of performed audits, sorting them by payback time: the potential saving is equal to more than 1.5 Mtoe, more than 1.1 Mtoe of which could be achieved by around 14,000 interventions associated to investments with payback time equal or lower than 5 years.

Table 13 – Interventions, investments (€) and savings (toe) of energy efficiency interventions identified in energy audits performed according to article 8 of Lgs. D. 102/2014 by payback time, cumulated values

Payback (years)	Interventions	Investments (€)	Savings (tep)	Potential saving (Mtep) 0 0.5 1 1.5
≤ 3	8,364	646,335,323	779,560	
≤ 5	14,193	1,631,881,852	1,168,814	
≤ 10	21,923	2,657,662,287	1,414,719	
≤ 20	25,698	3,341,674,298	1,501,881	
≤ 30	26,284	3,449,551,432	1,509,606	

Source: ENEA

4. Energy Performance Contracts and barriers to public buildings renovation

Energy Performance Contracts (EPC) are an effective tool for achieving the energy saving target set by existing laws since they favour the adoption of energy efficiency interventions of the whole building and ensure their implementation and management over time. In fact, the contract objective is the improvement of building efficiency: energy efficiency interventions should imply guaranteed energy (and economic) savings, verified and monitored during the entire duration of the contract. Moreover, the realised investments should be repaid in function of the energy efficiency improvement obtained.

Consistently with the regulation in force, ENEA elaborated a contractual format with "guarantee of results" aimed at favouring energy efficiency interventions for the whole building and ensuring their realisation and management in time. Considered the peculiarity and complexity of this contractual model in its different legal, technical and economic aspects, and the high number and diversity of possible scenarios, ENEA also developed explanatory guidelines. The intention is providing public administrations with a tool that allows to use the EPC for reaching energy efficiency objectives whilst favouring the involvement both of private operators as ESCO and banks and, more in general, to make the results to be achieved transparent and definite respecting the procedures for subcontracting and meeting the new requirements on energy efficiency of buildings.

One of the main aspects introduced by the guidelines is related to the contractual object: the services planned by the contract are all aimed at achieving the unique objective which is the Energy Performance Service for buildings, for which a fee is paid: it includes the realisation of intervention for the energy upgrade of buildings, the management, running, ordinary and extraordinary maintenance of upgraded buildings and, if planned, the provision of energy vectors, in addition to all the management and verification activities of the service itself. All this is finalised to achieve a minimum guaranteed energy saving, which does not sacrifices, yet improves, the micro climatic and indoor air quality parameters.

Another issue to focus the attention on is the importance of the project phase and the centrality in it of the energy audit as fundamental instruments to assess alternative project choices, combining energy efficiency and economic convenience. The audit allows to identify baseline data and energy upgrade interventions according to their feasibility and technical-economic convenience, assess energy consumption reduction (and associated costs), highlight benefits achievable by planned investments. The audit is fundamental also during the tender implementation since the data and energy model, validated and calibrated on real consumption or through measures, will be used in the verification phase for checking the achievement of minimum saving planned by the contract. On the verification will depend the application of bonus or sanctions to the

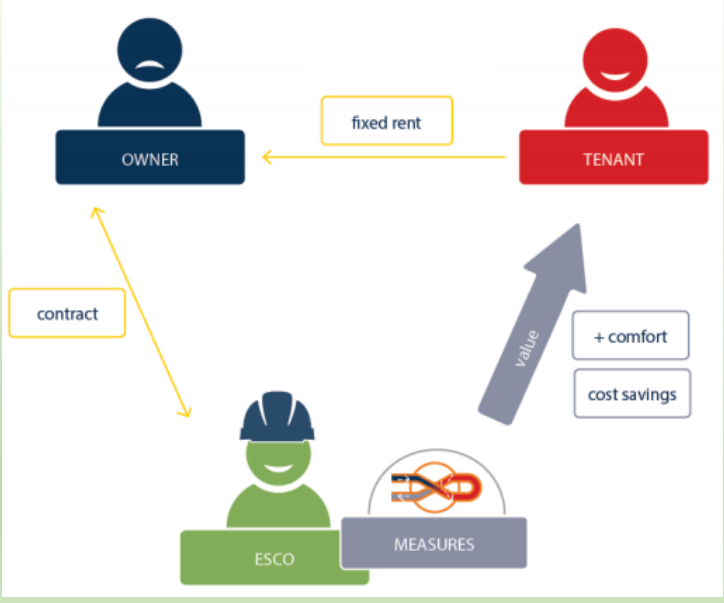
contractor that could lead to the contract resolution when savings are lower than a certain percentage set by contract, in such a way to identify a serious non-fulfillment.

These guidelines should be regarded as a "work in progress", considering the evolving regulation: for example, in May 2017 an amending decree to the new Tender Code entered into force and all the necessary strategic acts have not been emanated by ANAC yet.

The complete development and larger employment of EPCs for buildings could help in solving the split incentives dilemma, currently widely debated in EU countries. Split incentives arise when, between two parties, one pays the investment cost for energy efficiency intervention and does not fully take advantage of the associated benefits, while the other takes advantage of consumption and expenditure reduction obtained thanks to the investment: in buildings such issue is relevant when the tenant pays the rent and the energy bill and, consequently, the owner does not show interest in investing in energy efficiency of the envelope or machineries.

EPC, thanks to the in the ESCO involvement, favours the realisation of energy efficiency interventions in buildings, converting a barrier in an advantage for the three involved actors, the so-called *triple win* approach (Figure 12). Depending on the relationship among the parties and the intent to implement energy efficiency interventions, different solutions can be adopted which offer energy and non-energy benefits, for example the increase in the value of the property and the improvement of comfort level.

Figure 12 – Split incentives: *triple-win* approach among owner, tenant and ESCo



Source: GuarantEE

Another barrier to the realisation of energy requalification interventions is associated to the historical restriction which characterises the national building stock. For historical buildings, improving the energy performance could imply intervention on the building envelope that, if not carefully assessed by means of a proper energy audit, could affect the monumental value of the building. In general, the restrictions highly limit the possibility to operate on the building envelope, and for this reason, very often the upgrade interventions are mainly focused on cooling devices and even more on systems for the regulation, control and management of the building. Moreover, the presence of quality elements and environment, often imply the need of specific thermo-hygrometric and lighting conditions, the respect of which influences the choice and regulation of cooling equipment, air treatment and building lighting.

Even though the more efficient insulation is realised outside the structures, in the case of buildings under protection this strategy is in most cases inapplicable. The intervention should then insulate masonry, space between walls (if existing) or on their intrados after checking the feasibility of the setup and the reduction of useful internal volumes, being aware that this type of insulation will not allow to check the dispersion due to thermal bridges and to accurately assess the hygrometric behaviour of walls (check of possible formation of condensation).

For buildings not under historical protection, a solution for public and commercial buildings is constituted by green roofs and/or walls, the insulating effect of which is due to the air layer created between the green and the wall surface, acting as insulating buffer both in warm and cold period; moreover, part of infrared rays, irradiated by the building, is reflected by leaves whereas another part is absorbed, implying a reduction of radiative heat losses of the building. The advantages in terms of annual reduction of energy used for heating and cooling of buildings associated to vegetal systems are equal to around 0.2-17 kWh/m^2 and 9.0-48 kWh/m^2, respectively.

5. Implementation and planning at regional level of energy efficiency measures

For the around 3,300 selected projects in the framework of ESIF 2007-2013, total public funding amounts to 9,3 billion euros; around 40% of the projects have been started since 2014, for a total of more than 4.2 billion euros of available public financing. The areas with higher project number are represented by public lighting, public buildings, sustainable transport, funds and incentives (Jessica fund, revolving energy efficiency fund and different types of incentives); the implementation level is better in such areas as horizontal measures, public buildings and public lighting (Table 14). Relative to regional ESI funds, 68% of projects (corresponding to 2029 projects) are concluded and paid off, corresponding to an utilisation of 30% of total funding earmarked for all approved projects.

Table 14 – National Operational Programs, Interregional and Regional: selected projects, financed and concluded, and corresponding available resources (M€) by sector, programming period 2007-2013

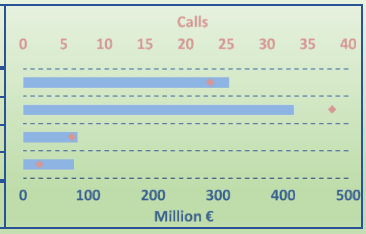
Sector	N° projects	Total public financing	Eligible cost	Total payment
Horizontal measures	384	114.8	81	68
of which since 2014	*30.5%*	*46.60%*	*41.50%*	*38.70%*
Funds and incentives	379	473	455	454
of which since 2014	*59.4%*	*2.00%*	*2.10%*	*2.00%*
Information and training	39	31	31	24
of which since 2014	*51.3%*	*0.30%*	*0.30%*	*0.40%*
Residential, industrial and commercial buildings	52	12	11	10
of which since 2014	*21.2%*	*47.00%*	*45.70%*	*45.00%*
Public buildings	653	421	402	346
of which since 2014	*34.6%*	*58.50%*	*59.20%*	*55.20%*
Public lighting	937	202	193	164
of which since 2014	*34.6%*	*58.50%*	*59.20%*	*55.20%*
Industry	250	41	36	35
of which since 2014	*13.6%*	*9.90%*	*10.50%*	*8.70%*
Sustainable transport	419	7.702	4.234	2.846
of which since 2014	*41.5%*	*48.20%*	*23.30%*	*17.20%*
Energy distribution	154	336	330	307
of which since 2014	*7.8%*	*23.80%*	*25.60%*	*22.10%*
TOTAL	**3267**	**9,334**	**5,773**	**4,254**
of which since 2014	***39.6%***	***45.00%***	***25.00%***	***20.20%***

Source: ENEA elaboration based on data from the Italian Presidency of the Council of Ministers

For the programming period 2014-2020, given 26 billion euros of total funding, Regional Operational Programme of European Regional and Development Fund (ROP-ERDF) earmarked around 2.5 billion euros to measures for energy saving and energy efficiency, sustainable urban development, decarbonisation and intelligent transport systems. Up to April 2017, 900 million euros have been earmarked, on 69 calls for bids, mainly devoted industrial sector, with 38 calls and around 416 million euros earmarked, and in the public sector (interventions on public buildings and public lighting), with 23 calls and around 316 million euros of available financial resources (Table 15).

Table 15 – ROP-ERDF programming 2014-2020: activated calls and financial resources (M€) by sector

Sector	Calls number	Earmarked amounts (€)	(%)
Public sector	23	316,790,791	35%
Industry	38	416,369,257	47%
Smart grids	2	83,900,000	9%
Sustainable transport	6	78,257,294	9%
Total	**69**	**895,317,343**	**100%**



Source: ENEA elaboration ENEA on Regions and Autonomous Provinces data

6. Energy efficiency information and training program: results of the first year

The Ministry of Economic Development assigned a specific role to information and training as fundamental driver to create, reinforce and develop the attention towards energy saving and energy efficiency.

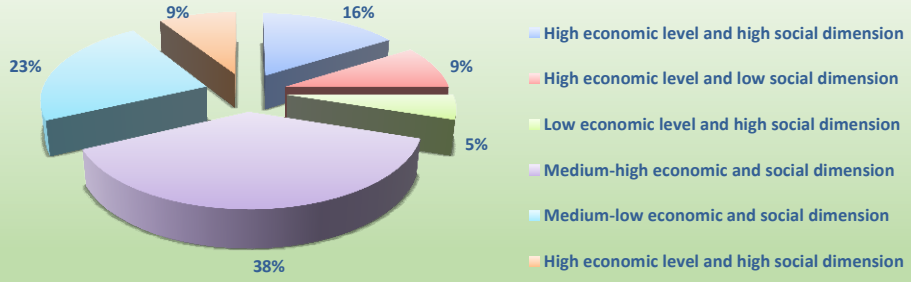
Article 13 of Legislative Decree 102/2014, indeed, envisaged a specific Three-Year Training and Information Program (PIF), the elaboration of which was realised by ENEA involving different actors as Regions, consumer associations, and associations of ESCos and energy services companies.

www.italiainclassea.enea.it

The first year of activity was characterised by information and training activities focused on public at large, by means of national campaign "Italia in classe A" ("Italy in A class").

The radio and television information campaign was organised from 13 October to 26 December 2016 on the three main RAI television broadcast channels (Rai 1, Rai 2, Rai 3), that identified, with ENEA's support, several TV programs well known by the public, covering the main television genres (news, soap opera, *infotainment*, quiz show, ecc.) and the most of broadcasting time slots (in Figure 13 the public distribution).

Figure 13 – Radio and television campaign: public distribution by socio-economic dimension



Source: ENEA

This allowed to reach very important results, rewarding the strategic choice of such mass information action:

- 55 million of gross contacts: in the case of advertising campaigns this would imply having achieved almost 1 GRP (Gross Rating Point, equivalent to the Italian population).

- Significant public changes in the broadcasts where contents relative to energy efficiency have been included, both relative to specific age segments and to socio-economic classes.

The Energy Efficiency Month initiative, devoted to the large public as well, started in 2016 and will become annual. November was chosen as the energy efficiency month, and companies, category associations, Public Administration and schools were invited to join the initiative, by organising, during the month, several events, promotional activities and information seminars, to promote a more conscious use of energy.

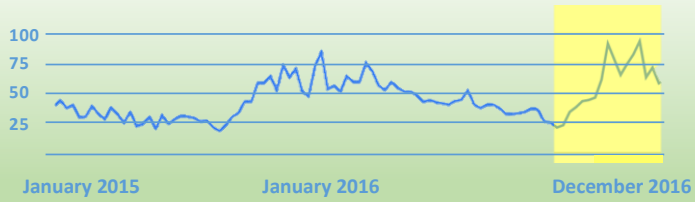
The reply to the initiative was more than promising:

- more than 2500 e-mails asking for technical and organisational information;
- 140 expressions of interest in being involved, through phone contact;
- 400 actual subscriptions;
- 270 events over the national territory.

The overall initiative result has been estimated in around 12 million of final consumers reached, a figure particularly interesting if one considers the wide range of targets associated to the different stakeholders involved.

Finally, thanks to *Big Data* analysis referred to web researches in Italy in the two-year period 2015-2016, it has been possible to obtain a first evaluation of the general impact of the campaign first year, in particular regarding the period of highest dissemination of "mass" awareness raising actions (October-December 2016) characterised by the two initiatives described above. More in detail, some of the keywords were included in the messages in the information campaign, for example "Condensation boiler" (Figure 14): all the keywords searches have markedly increased in the analysed period.

Figure 14 – Number of searches of "condensation boiler" on the web, 2015-2016 period



Source: Google Trends

In some cases, a renewed interest has been observed both for specific technologies and for incentivising tools such as the Thermal Account, which does not imply any specific expiration of the search period, as is the case for 65% fiscal deductions. Such evidences allow hypothesizing that the Information Campaign has influences increasing the awareness and the interest on such specific topics searched on the web.

ENEA REL-PROM 2017-ENG D303

L'ENEA has worked on energy efficiency for over 30 years, being particularly concerned with R&D on those technologies aimed at increasing the efficiency of energy production and use.
In its role of National Agency for Energy Efficiency, ENEA provides Public Administration with its support and advice to define methodologies for quantifying energy savings, to be used at the central and local levels as a mean to implement the various regulations and disseminate the culture of energy efficiency.
News, updates, in-depth information and other energy efficiency opportunities are available at:

www.efficienzaenergetica.enea.it

ITALIA
IN CLASSE A
Campagna nazionale per l'efficienza energetica

ENEA

Italian National Agency for New Technologies, Energy and Sustainable Economic Development

www.enea.it