ANNUAL REPORT ENERGY EFFICIENCY

2018
executive summary

ANALYSYS AND RESULTS
OF ENERGY EFFICIENCY POLICIES IN ITALY

ITALIAN NATIONAL AGENCY
FOR ENERGY EFFICIENCY

ENEA

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2018 ENERGY EFFICIENCY ANNUAL REPORT

Executive summary

2018 ENEA – National Agency for new technologies, energy and sustainable economic development

Preface

My mantra is:
if you want to help people to accomplish some goal, make it easy.
Richard H. Thaler

I want to open the Seventh ENEA Energy Efficiency Report with this quote from Richard Thaler, father of behavioural economics and 2017 Nobel Prize winner for identifying and theorising human traits that systematically influence individual decisions and market outcomes.

Extending the principle of "make it easy" to the national objectives of Energy Efficiency, I think "simplification" is precisely the key word that describes 2017, the year in which our country put in place measures and structural instruments to overcome a series of barriers that had made the implementation of national energy efficiency policies very complex.

First of all, the National Energy Strategy outlined for the construction industry - considered the most critical at a European level - a long-term programme of building redevelopment, the optimisation of tax deductions and the use of the National Fund for Energy Efficiency, the latter mechanism designed to reduce uncertainties in investments and stimulate bank financing.

So all much more simple and definitely more effective. Like the observation that energy efficiency could not be separated from the improvement of our buildings' resistance to earthquakes. A single intervention that combines energy saving and safety can certainly simplify the life of a family that intends to invest in the redevelopment of its property, to a construction company that will not be forced to intervene several times, but also to the state that can optimise its resources.

Remaining in the construction industry, I will never tire of underscoring the mechanism of credit transfer for energy redevelopment introduced in 2016 and finalised with the latest directions of the Ministry of Economy and Finance.

Again, this is a great innovation for the industry that aims to simplify the incentive mechanism, breaking down two of the main barriers theorised by behavioural economics: risk aversion and loss aversion, both factors that can inhibit the realisation of the works that represent a fundamental step for the attainment of national objectives.

In perspective, I believe that the transfer of credit can have an important positive fallout on two main categories of parties. Firstly, apartment owners who are communities of consumers in which decision-making dynamics and, in particular, conflicts often prevent the introduction of innovations useful for improving the quality of the renovated environment, safety and energy saving. The transfer of credit is a lever that can influence these dynamics, making them more agile and thus facilitating the decision-making process.

Another category that can benefit indirectly from the transfer of credit is that of so-called vulnerable parties, which represent about 10% of the Italian population. They are not in a position to renovate their homes because they are limited by a series of factors that have to do with the ownership of the property, the availability of savings to invest or even the need to allocate a large part of their income to other priorities. The transfer of credit can relieve those parties of unbearable costs and, at the same time, restore them to a social dignity undermined by the deprivations induced by forced savings.

Therefore, simplifying also means informing end users of the economic and environmental benefits of Energy Efficiency. To do this our country has put in place a multi-year programme of information and training, now in its second year and implemented by ENEA, which this year has travelled throughout the country, passing through 10 Italian cities and reaching families, public administrations, trade associations and SMEs, as well as through social networks.

In addition to positive results from innovative programmes, there have also been excellent results from policies that have been active for several years and that continue to feed the "*savings meter*". The results for 2017 continue to be encouraging, but above all they are measurable. This allows us a careful assessment of the goals achieved, at the same time facilitating information and ensuring data transparency.

Below you will find some summary data, but for further information I invite you to browse this volume, the result of the work of our researchers engaged in constant monitoring and measurement:

- 5.8 million White Certificates issued (62% in the industrial sector and 31% in the civil sector), with savings of almost 2 million tonnes of oil equivalent (Mtoe).
- 421,997 requests for a 65% tax deduction for energy-related renovations of existing real estate, for a total of over 3.7 billion euros of investment and an estimated savings of 112 ktoe/year.
- 43,227 requests with the Renewable Energy for Heating and Cooling Support Scheme (*Conto Termico*), corresponding to over € 180 million in incentives, of which € 62 million related to energy efficiency measures by the public administration.
- 10 million contacts through the second year of the Three-Year Information and Training Programme (pursuant to art. 13 of Italian Legislative Decree 102/2014).

In conclusion I want to thank all my colleagues at ENEA and the authors outside the Agency that every year offer their collaboration in producing this Report that takes complex subjects and simplifies them to make them more understandable to those involved in the achievement of common objectives.

Thank you all and...*Make it easy!*

Federico Testa

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Summary

1. The National Energy Strategy

Following the guidelines of the measures contained in the *Clean Energy for All Europeans* package, presented at the end of 2016 by the European Commission, the 2017 National Energy Strategy (NES) confirms the key role of energy efficiency in our country's energy transition path. The NES aims to strengthen energy efficiency policies by facilitating the measures that have the best cost-effectiveness ratio in order to achieve 30% energy savings by 2030 compared to the expected consumption at that date.

Extensive additional energy efficiency investments are expected over the entire period: 110 billion euros out of the 175 overall which are expected to be spent over the period thanks to the NES. This amount of resources will result in a reduction in final energy consumption from active policies of around 10 Mtoe/year in 2030, equal to about 1 Mtoe of annual savings from new works in the period 2021-2030, to be mainly focused in residential sector, services and transport.

For the residential sector it is expected that there will be an expansion of works under the National Fund for Energy Efficiency, launched in March 2018 to support projects that require a high initial investment, stimulating their financing by banks. The NES also seeks to optimise the *Ecobonus* mechanism, and for this purpose the 2018 Budget Law has further developed the incentive system by adding new deduction rates as appropriate, new interventions and new technical and performance conditions, as well as significant changes to credit transfer which was extended to all taxpayers and for any project, and which may benefit suppliers who have carried out the work or other private parties with the option of subsequent credit transfer. With regard to this last point, the recent bulletin of May 2018 from the Revenue Agency clarified that the credit transfer must be considered limited to a single transfer subsequent to the original one, and that by "other private parties" must be understood parties other than suppliers, provided they are connected to the relationship that gave rise to the deduction.

Particular attention was also paid to public buildings through the continuation of the Programme for the Energy-related Renovation of Buildings of the Central Public Administration (PREPAC) in the period 2021-2030 and the definition of mandatory savings clauses in the contracts of energy services supplying the public administration.

For the industrial sector, besides strengthening and simplifying the obligation scheme of White Certificates, efforts will be focused on Impresa 4.0 National Plan, and the promotion of energy efficiency in SMEs will continue through calls for co-financing of energy audits and management systems.

For the transport sector, the NES underlines the need to reduce the use of private mobility through measures aimed at encouraging a shift towards smart mobility and local public transport. As far as road freight transport is concerned, an important contribution in terms of efficiency is expected from the optimisation of the logistics system, promoted through

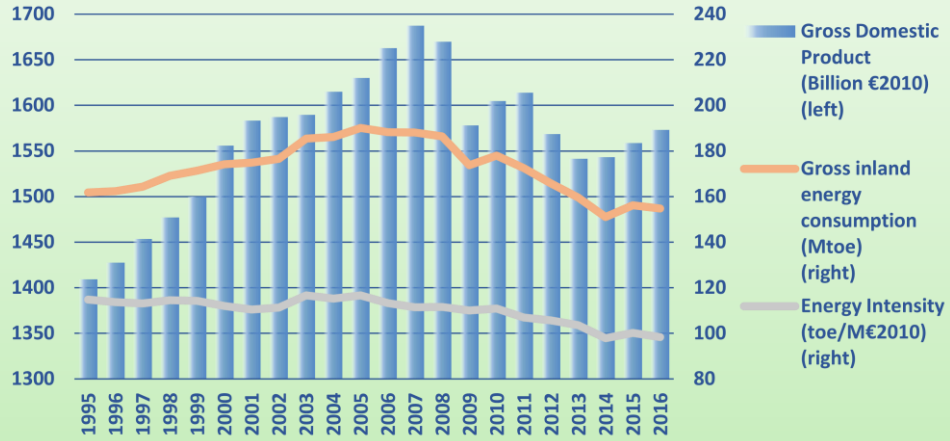
the diffusion of new ITS (Intelligence Transport Systems) technologies. Some measures consistent with these guidelines have already been included in the Budget Law for 2018.

The NES will be incorporated in the *Energy and Climate Action Plan* which, in the first formulation, Italy will send to the European Commission by the end of the year, which will also include the provisions of the 2017 National Energy Efficiency Action Plan in which the measures already implemented or planned for the achievement of 2020's targets were analysed, assessing their expected impact and the barriers that hinder their complete implementation throughout the country, and, therefore the achievement of the energy savings potential.

2. Energy demand and final consumption

The primary energy demand in 2016 was 154.7 Mtoe (-0.9% compared to 2015), continuing the negative trend of the last decade after the 2015 break (Figure 1).

Figure 1 - GDP, gross inland energy consumption of energy and primary energy intensity, years 1995-2016

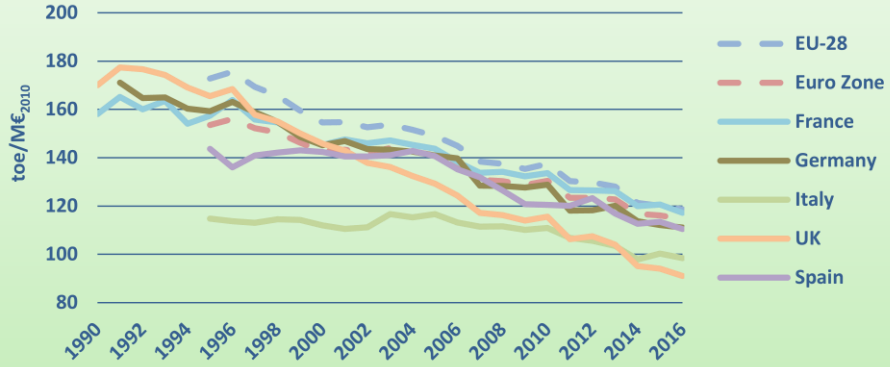


Source: ENEA elaboration of EUROSTAT, ISTAT data

Italy has values of primary energy intensity lower than both the average of the 28 European Union countries (EU-28) (118.6 toe/M€$_{2010}$) and the countries belonging to the Euro Zone (114.7 toe/M€$_{2010}$, Figure 2).

It should be emphasised that Italy's good positioning makes it more complex to continue to reduce the energy intensity: in the period 1995-2016 energy intensity decreased by 14.3% in Italy, by 31.3% for the EU-28 and 25.4% for the Euro Zone. Despite these differences in the reduction rate, in 2016 the Italian primary energy intensity was 17% lower than the EU-28 average and 14.1% below the average of the Euro Zone countries.

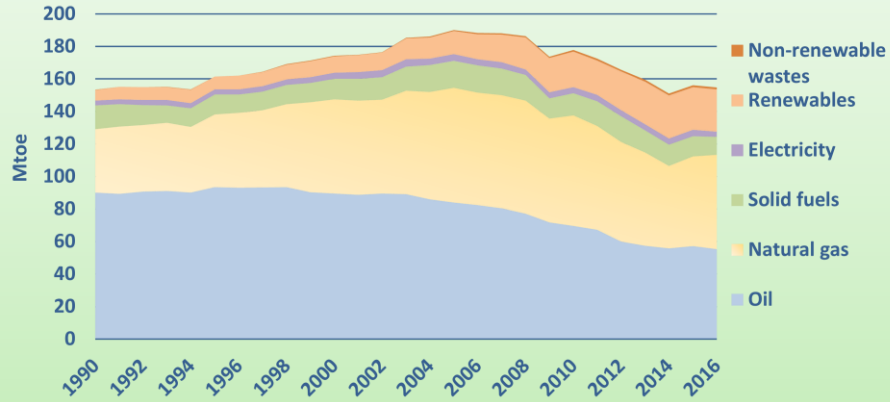
Figure 2 - Primary energy intensity in some European Union countries (toe/M€$_{2010}$), years 1990-2016



Source: EUROSTAT

Gross inland consumption in 2016 was 154.7 Mtoe, the energy demand remaining fairly stable for the last few years. The fall in primary consumption since 2005 has brought Italy back to the consumption levels of the first half of the 1990s (Figure 3), but with a different mix of energy sources.

Figure 3 - Primary energy demand by source (Mtoe), years 1990-2016

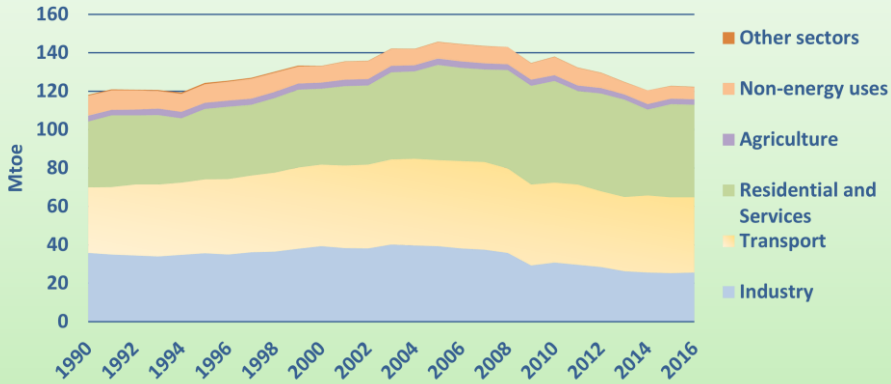


Source: EUROSTAT

In 2016, fossil fuels covered about 80% of primary energy demand compared to 94% in 1990, with an increasingly important contribution of natural gas (37.5%) in place of oil (35.7%). The share of renewable sources is constantly growing: 16.8% in 2016, of which one third was solid biomass, followed by geothermal energy with 20.8% and hydroelectricity with 14.9% (in 1990 both covered over 40% of sources renewable). The contribution of electricity also increased (2.1%). In absolute terms, in 2016 natural gas consumption was 58.1 Mtoe, followed by oil with 55.3 Mtoe and renewable sources with 26 Mtoe.

In 2016, final energy use amounted to 122.2 Mtoe, down 0.5% compared to 2015, returning to the negative trend of the last few years that had been interrupted in 2015. In the period 2010-2016, the end uses decreased at a rate of 2% per annum. The analysis of the evolution of final energy consumption in the period 1990-2016 - shown in Figure 4 - shows that Italy has returned to consumption levels equivalent to the early 1990s: the stable growth of all sectors until 2005 was followed by a period of constant reduction in consumption for industry and oscillating results in other sectors. In particular, in the period 1990-2016 the only sectors that recorded positive growth rates were the civil sector (+40.7%) and the transport sector (+14.3%).

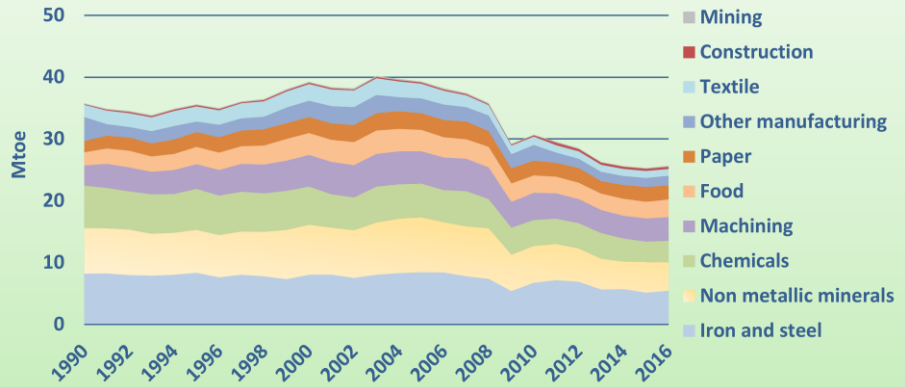
Figure 4 - Final energy consumption by sector (Mtoe), years 1990-2016



Source: EUROSTAT

Industry's final energy consumption in 2016 was equal to 25.6 Mtoe, +1.4% compared to 2015. All the sectors saw significant increases in final consumption with the exception of non-metallic minerals (-7%), paper (-2.5%) and textiles (-0.7%) (Figure 5).

Figure 5 – Final energy consumption in industry by sub-sector (Mtoe), years 1990-2016

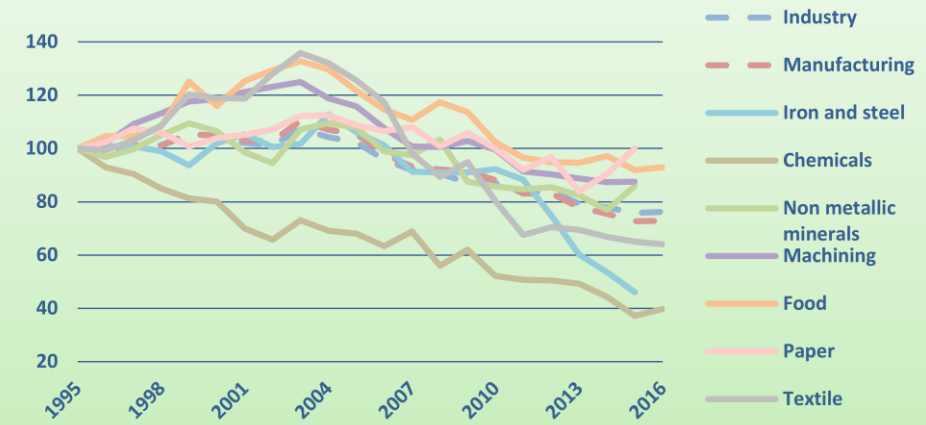


Source: EUROSTAT

Energy-intensive sectors absorb more than 60% of industry's overall final consumption, but their weight has been declining in recent years. In 2016, about one-fifth of total industry consumption was absorbed by metallurgy, followed by non-metallic minerals and chemicals. The other industrial sectors absorb less than 10% of the total overall consumption, with the exception of mechanical engineering (14.9%) and food (11.0%).

In 2016, the energy intensity of the industry was equal to 85.7 toe/M€$_{2010}$, a slight increase of 0.6% compared to 2015. In the last 20 years, the decreasing trend of energy intensity has been mainly attributable to the chemical, metallurgy and non-metallic mineral sectors, due to their significant weight: chemicals showed a decreasing trend between 1995 and 2016, achieving a reduction in energy intensity of 60.2% (-4.3% per year). Metallurgy showed an increase in energy intensity until 2004 and then drastically dropped: -53.9% in the period 1995-2015 (-3.8% per year). During the same period, the non-metallic mineral sector showed a contraction in energy intensity of 14.1% (-0.8% per year). In addition, the energy intensity of the textile sector dropped by 35.9%, while for food there was a reduction of -7.1%. The other sectors showed an increase in energy intensities up to 2003, then decreased in subsequent years (Figure 6).

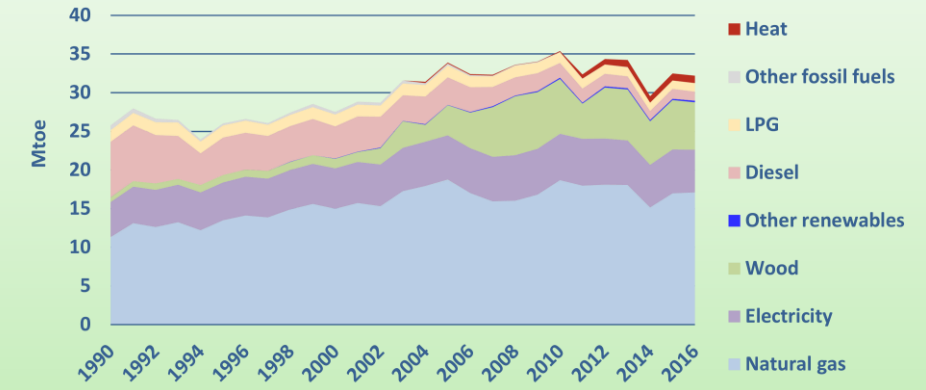
Figure 6 - Final energy intensity in industry (1995=100), years 1995-2016



Source: ENEA elaboration of EUROSTAT, ISTAT data

In 2016, the energy consumption of the residential sector was equal to 32.2 Mtoe, 1% lower than the previous year (Figure 7). Increases in the consumption of natural gas (+0.7%) and heat (+4.2%) were seen, while there was a decrease in the consumption of electricity (-2.8%) and wood (-3.5%). Other renewable sources grew by 5.3%, especially solar thermal (+5.4%), even if at present they only contribute marginally to the mix. The consumption of LPG has also recorded an increase of 3%, in contrast with the trend of recent years, probably due to the very cold temperatures of that particular year. Natural gas is the main source of energy: in 2016 it met more than 53% of the energy consumption in the sector, followed by wood (19%) and electricity (17.2%).

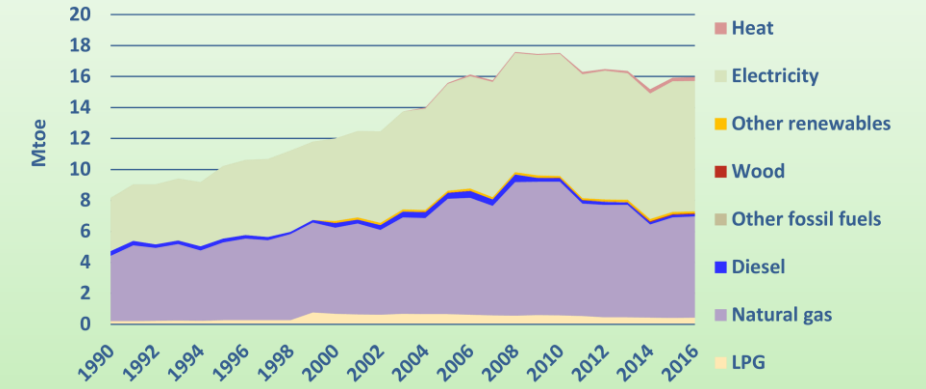
Figure 7 - Residential final energy consumption by source (Mtoe), years 1990-2016



Source: EUROSTAT

Energy consumption in the non-residential sector, which includes buildings used for services, business and the public administration, amounted to 16 Mtoe in 2016, similar to 2015 (+0.3%). The non-residential sector was the leading sector in the period 1990-2016, energy consumption practically doubling, growing at an annual rate of 2.6% despite a decline due to the economic crisis, reflecting the growth of the service sector (Figure 8).

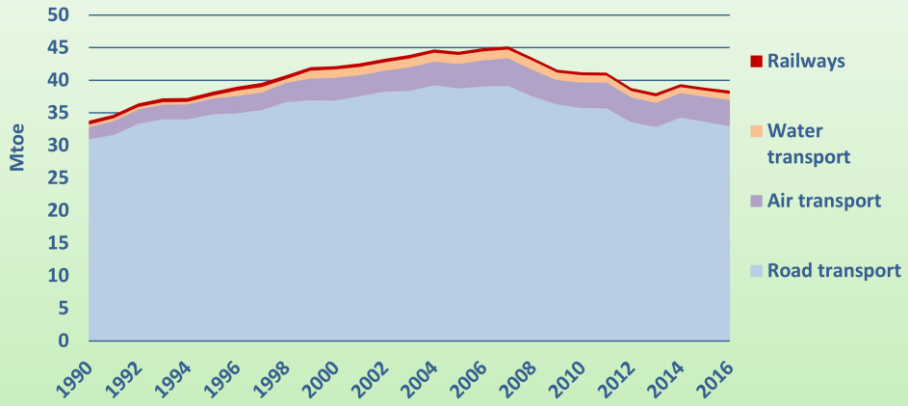
Figure 8 - Non-residential final energy consumption by source (Mtoe), years 1990-2016



Source: EUROSTAT

In 2016 energy consumption of the transport sector (excluding transport for pipelines and other unspecified means) amounted to 38.4 Mtoe, down 1.2% compared to 2015, continuing the reduction started in 2007 with the exception of 2014 (Figure 9). The main mode of transport is road transport (especially for freight), which accounted for about 85% of total sector use. In 2016 energy consumption amounted to 33 Mtoe, with a decrease of 1.9% compared to 2015, confirming the negative trend in recent years, as mentioned before interrupted only in 2014 (-15.8% between 2007 and 2016).

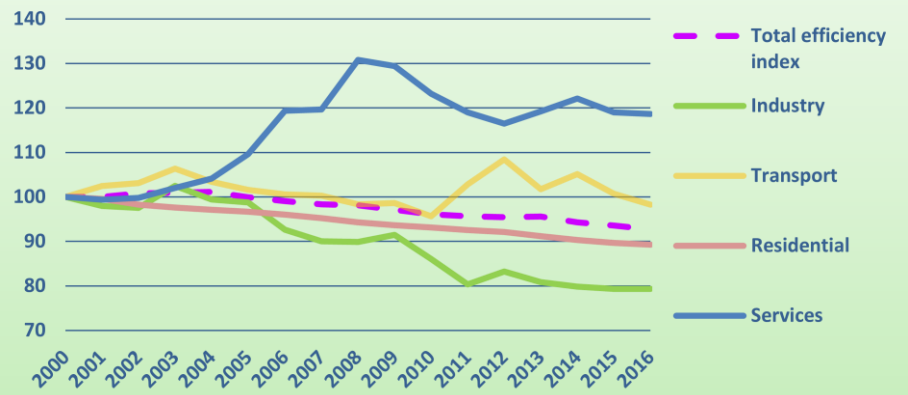
Figure 9 - Transport final energy consumption by mode (Mtoe), years 1990-2016



Source: EUROSTAT

The improvements in energy efficiency in the various sectors, net of the effects of structural changes and other factors not related to efficiency, have been assessed using the ODEX index[1] (Figure 10), which shows a negative trend for the considered period. Using 2000 as a base year set equal to 100, the ODEX index for the entire Italian economy in 2016 was equal to 92.7, confirming the improvements recorded since 2005, year of entry into force of the White Certificate incentive mechanism.

Figure 10 - ODEX energy efficiency index by sector, years 2000-2016



Source: ODYSSEE

In the period 2000-2016 the sectors that most contributed to the improvement of energy efficiency were industry and the residential sector. The former achieved the greatest increase, equal to 20.7%. Indeed, starting from 2005 all industrial sectors have achieved

[1] For more information, see http://www.odyssee-mure.eu/.

improvements in energy efficiency, even if they have not been constant due to the economic downturn and the consequent unused production capacity. The residential sector achieved an energy efficiency gain of 10.7%, lower than the previous decade due to changes associated with living comfort. Finally, the transport sector has experienced the greatest difficulty in achieving energy efficiency gains because freight transport is almost exclusively done on the road: railways, shipping and air navigation have seen significant gains in energy efficiency in recent years, but to date they represent 15% of total transport only.

3. Analysis of the achievement of national energy savings targets

White Certificates. Since the start of the White Certificate mechanism in 2005, overall additional primary energy savings of approximately 25.7 Mtoe have been certified and more than 47.5 million Energy Efficiency Certificates (EEC) have been issued.

The annual amount of the EEC issued in 2017 amounts to approximately 5.8 million, a level similar to that of the two-year period 2012-2013, but far from the peak of over 7.5 million observed in 2014. The volume of certified savings in 2017, equal to about 2 Mtoe, was practically unchanged compared to 2016, but far from the over 3 Mtoe recorded in the period 2010-2012.

Table 1 shows the energy savings generated in 2017 by projects started from 2005: projects started with standard sheets (ex-ante estimation based on predefined algorithms), analytical and final balance sheets (ex-post measure) have saved about 5.9 Mtoe/year of primary energy (equivalent to just over 5 Mtoe/year of final energy).

Table 1 - Savings from White Certificates (primary energy, Mtoe/year), years 2005-2017

Period	Savings (Mtoe/year)
Cumulative 2005-2013	3.95
Annual 2014	0.87
Annual 2015	0.32
Annual 2016	0.50
Annual 2017	0.24
Total 2005-2017	**5.88**

Source: Elaboration of the Ministry of Economic Development on data from Gestore dei Servizi Energetici S.p.A.

Tax relief. With regard to tax relief for upgrading the energy efficiency of buildings (so-called *Ecobonus*), in the four years 2014-2017 approximately one and a half million projects were carried out, including more than 420,000 in 2017, with more than half of them involving the replacement of windows and shutters and 20% the replacement of heating systems. Since 2011, over 2.3 million projects have been carried out; over 3.3 million since

the start of the mechanism in 2007. Table 2 shows a detail of the energy savings obtained, according to the different types of projects carried out. The trend is positive, with 0.112 Mtoe/year obtained in 2017. During the considered period, energy savings amounted to just over 0.4 Mtoe/year, and starting from 2011 the energy savings achieved amounted to 0.77 Mtoe/year. Since the start of the mechanism in 2007, total savings amount to 1.31 Mtoe/year.

Table 2 - Savings from tax relief for energy-related renovations (Ecobonus) (Mtoe/year), years 2014-2017

Year	2014-2016		2017		Total	
Action	**Mtoe/y**	**%**	**Mtoe/y**	**%**	**Mtoe/y**	**%**
Overall renovation of the building	0.0221	7.59%	0.0084	7.5%	0.0306	7.6%
Thermal insulation of the envelope	0.0831	28.54%	0.0283	25.3%	0.1115	27.6%
Replacement of windows and shutters	0.1180	40.52%	0.0443	39.6%	0.1623	40.3%
Solar shading	0.0030	1.03%	0.0022	2.0%	0.0052	1.3%
Solar panels for sanitary hot water	0.0141	4.84%	0.0031	2.8%	0.0173	4.3%
Replacement of space heating systems	0.0504	17.31%	0.0247	22.1%	0.0751	18.6%
Building automation systems	0.0005	0.17%	0.0009	0.8%	0.0014	0.3%
Total	**0.2912**	**100%**	**0.1120**	**100%**	**0.4033**	**100%**

Source: ENEA

In addition to the *Ecobonus* further tax relief is also provided for 50% of costs incurred in respect of building renovation work, as laid down in Law 449/1997. Given the large number of renovations carried out in recent years, it is reasonable to hypothesise that, thanks to the 50% tax relief for building renovation, condensing boilers and heat pumps sold on the market and intended for the replacement of old systems have been incentivised, as well as for window and shutters to replace old ones.

Table 3 shows the total savings achieved in the period 2014-2017, net of the savings already counted with the White Certificates and the *Conto Termico* for projects of the same type: overall, primary and final energy savings amounted to 1.164 Mtoe/year. Over the period 2011-2017 savings rose to about 2.13 Mtoe/year.

Table 3 - Savings from tax relief for building recovery and energy-related renovations (Mtoe/year), years 2014-2017

	2014	2015	2016	2017	TOTAL
Ecobonus 65%	0.093	0.099	0.096	0.106	**0.394**
Condensing boilers 50%	0.064	0.037	0.022	0.027	**0.149**
Heat pumps 50%	0.015	0.019	0.025	0.022	**0.081**
Windows and shutters 50%	0.135	0.137	0.133	0.135	**0.540**
Total	**0.306**	**0.292**	**0.275**	**0.291**	**1.164**

Source: ENEA

Conto Termico. In 2017 the Renewable Energy for Heating and Cooling Support Scheme showed a clear acceleration, for that year along generating requests equal to 130% of all

those received in the period 2013-2016: over 43,000 (+189% compared to 2016), which correspond to incentives equal to 183 million euros (+168% compared to 2016). There was also a significant increase in requests for the "reservation" type of access by the public administration (from 141 requests in 2016 to 333 in 2017), for almost 62 million euros. Table 4 shows the details of the requests received in 2017 by type of energy efficiency project within public administration buildings.

Table 4 – Conto Termico: requests received, requested incentive (M€) and energy savings (toe/year) by type of project, year 2017

Type of project	Projects (n)	Incentives requested (M€)	Primary fossil energy saved (toe/year)
1.A - Opaque building envelope	166	6.10	364
1.B - Transparent closures	131	2.85	214
1.C - Condensing boilers	1,079	2.92	1,123
1.D - Shading	17	0.07	1
1.E - NZEB buildings	1	1.06	3
1.F - Lighting systems	70	0.70	166
1.G - Building Automation	19	0.08	10
Total	**1,483**	**13.78**	**1,881**

Source: Gestore dei Servizi Energetici S.p.A.

Impresa 4.0 National Plan. Between January and November 2017, thanks to hyper-depreciation, super-depreciation and the new Sabatini law an overall increase of 11% was recorded for internal purchase of capital goods, with peaks of 13% for machinery and other equipment. Thus a value of investments of € 80 billion was achieved, 8 more than the approximately 72 of the same period of the previous year. The estimated savings for the year 2017 is 0.3 Mtoe of final energy. It is hypothesised that the ongoing performance of the measure involves a further increase in investments, which will allow achieving up to 1.8 Mtoe/year of savings by 2020.

Implementation of Italian Legislative Decree 192/2005 and Italian Decree 26 June 2015 "minimum requirements". For 2016, the estimated surface area of new buildings sold that meet the minimum requirements set by the Decree of 26 June 2015 is approximately 150,000 m^2; for the first nine months of 2017 it is approximately 1 million m^2. According to preliminary estimates made by ENEA, the average consumption for new residential properties that meet the minimum requirements set by the Decree of 26 June 2015 is just over 48 kWh/m^2, while the average savings associated with new buildings that are more energy efficient is estimated in the order of 10 kWh/m^2.

Therefore, the energy savings obtained, additional to the minimum requirements, is estimated at 42 toe/year for 2016 and around 275 toe/year for 2017. Preliminary estimates for the non-residential sector indicate a savings of just over 20 toe/year for 2017. With

regard to the replacement of efficient heating systems in the residential sector, in consideration of the fact that all the condensing boilers were previously calculated in the context of tax relief, only the replacements of traditional boilers were considered in the calculation. Starting from 2011, the total savings in terms of primary and final energy was more than 0.94 Mtoe/year, deriving mainly from the installation of "traditional" heat generators in residential buildings (Table 5).

Table 5 - Savings arising from the implementation of Italian Legislative Decree 192/05 and Italian Decree 26 June 2015 "minimum requirements" (Mtoe/year), years 2011-2017

	2011-2013	2014	2015	2016	2017	Total
New buildings - Residential	0.065	0.016	0.015	0.00004	0.0003	**0.096**
New buildings - Non-residential	0.080	0.017	0.018	0.000003*	0.00002*	**0.115**
Replacement of heating systems	0.463	0.116	0.111	0.020	0.022	**0.732**
Total	**0.608**	**0.149**	**0.144**	**0.020**	**0.022**	**0.943**

* Preliminary estimate
Source: ENEA elaboration of data from ISTAT and ASSOTERMICA

Transport sector. The overall energy savings of the transport sector achieved since 2011 amounted to about 1.9 Mtoe/year for the period 2011-2017, due both to the application of EU regulations and to the increase of the High Speed railway network, which led to a decrease in demand for flights and road travel (Table 6).

Table 6 - Savings from transport sector (primary energy, Mtoe/year), years 2011-2017

	2011-2013	2014	2015	2016	2017*	Total
EC Regulation 443/2009	0.540	0.22	0.28	0.25	0.44	**1.730**
EC Regulation 510/2011	0.003	0.01	0.01	0.01	0.04	**0.073**
High speed rail	0.014	0.01	0.01	0.01	0.01	**0.054**
Total	**0.557**	**0.24**	**0.30**	**0.27**	**0.49**	**1.857**

* Estimate
Source: ENEA elaboration

Summary of achieved energy savings. Compared to the 2011-2020 target, envisaged in the National Energy Efficiency Action Plan (NEEAP) of 2014 and consistent with the 2013 NES, the energy savings achieved in 2017 amounted to just over 8 Mtoe/year, equivalent to almost 52% of the final target. Approximately 37% of these savings derive from the obligation scheme of the White Certificates and over a quarter from tax relief. At a sectoral level, the residential sector has already reached its target for 2020, while industry is half way to its goal (Table 7).

Table 7 - Achieved energy savings by sector, period 2011-2017 and expected for 2020 (final energy, Mtoe/year) according to the 2014 NEEAP

Measure / Sector	White Certificates	Tax Relief *	Conto Termico	Impresa 4.0 National Plan *	European Regulations and High-Speed Rail *	Italian Legislative Decrees 192/05 and 26/6/15 **	Energy savings		Achieved target (%)
							Achieved in 2017 **	Expected by 2020	
Residential	0.71	2.08	-	-	-	0.85	**3.64**	**3.67**	**99.2%**
Services	0.15	0.02	0.005	-	-	0.04	**0.22**	**1.23**	**17.5%**
Industry	2.1	0.03	-	0.3	-	0.07	**2.5**	**5.1**	**49.0%**
Transport	0.01	-	-	-	1.68	-	**1.69**	**5.5**	**30.7%**
Total	**2.97**	**2.13**	**0.005**	**0.3**	**1.68**	**0.96**	**8.05**	**15.5**	**51.9%**

* Estimate for the year 2017.

** Estimate for the period January-September 2017. The residential sector includes the savings from the replacement of large household appliances also.

Source: ENEA elaboration of data from the Ministry of Economic Development, ISTAT, Gestore dei Servizi Energetici S.p.A., ENEA, FIAIP, GFK

Compliance with the Energy Efficiency Directive. With regard to the obligation to carry out energy-related renovations of 3% of the total floor area of heated and/or cooled buildings owned and occupied by the Italian central public administration, in the four-year period 2014-2017 projects for over 190 properties were completed or planned for a total area of over 1,870,000 m^2 (Table 8).

Table 8 - Renovated surface area of Italy's central government buildings pursuant to art. 5 of the Energy Efficiency Directive, years 2014-2017

	2014	2015	2016	2017
Total area of buildings with a total useful floor area of over 500 m^2 owned and occupied by the central government that do not meet the energy performance requirements referred to in article 5 (1) of the EED	14,828,984	14,441,992	13,973,749	13,414,012
Total area of buildings with a total useful floor area of over 250 m^2 owned and occupied by the central government that do not meet the energy performance requirements referred to in article 5 (1) of the EED	Not subject to the obligation	361,360	361,360	361,360
Total area of the heated and/or cooled buildings owned and occupied by central public administrations that has been renovated or whose renovation has been planned during the year	386,992	468,243	559,737	459,045
Percentage of the area subject to mandatory renovation	**2.61%**	**3.16%**	**3.90%**	**3.33%**

Source: Ministry of Economic Development on data from the State Property Agency and Ministry of Environment

The figure is primarily attributable (both in terms of projects and in terms of renovated surface area) to the Programme for the Energy-Related Renovation of the Buildings of the Central Public Administration, while the remainder is attributable to other specific incentive

measures (such as those from Structural Funds) and the projects carried out by the Italian Government Agency for State Property as part of the centralised maintenance system, as per Italian Law Decree 98/2011.

With regard to the minimum energy saving target of 25.5 Mtoe of overall final energy to be achieved in the years 2014-2020 pursuant to article 7 of the Energy Efficiency Directive, Table 9 shows the savings achieved in the years 2014-2016 and 2017 (estimated) through the notified measures.[2] The results are in line with the expected savings trend to achieve the 2020 target.

Table 9 - Mandatory savings (Mtoe) pursuant to article 7 of the Energy Efficiency Directive, years 2014-2017

Notified measures	New Savings achieved				Cumulative savings	
	2014	2015	2016	2017 *	2014-2017	Expected in 2020
Mandatory scheme White Certificates	0.872	0.859	1.101	1.341	4.174	12.51
Alternative measure 1 Conto Termico	0.003	0.008	0.019	0.045	0.075	0.43
Alternative measure 2 Tax relief	0.306	0.597	0.873	1.164	2.940	8.39
Alternative measure 3 National Energy Efficiency Fund	0.000	0.000	0.000	0.000	0.000	0.18
Alternative measure 4 Impresa 4.0 National Plan	0.000	0.000	0.000	0.300	0.300	4.00
Total savings	**1.181**	**1.465**	**1.993**	**2.850**	**7.489**	**25.50**

* Preliminary estimate on data not yet consolidated

Source: Elaboration of the Ministry of Economic Development based on data from ENEA and Gestore dei Servizi Energetici S.p.A.

Cost-effectiveness of incentive mechanisms. In preparing the overall analysis of costs and savings of the various mechanisms, account was taken of the cumulative amount over time of: economic savings due to lower energy procurements; excise duties on electricity and natural gas; amount of the *Ecobonus* tax relief; incentives granted for White Certificates, the Feed-in Tariff for photovoltaic systems, incentives for other electric RES; expenditure for investments in efficient components/plants (hypothesis that the projects have a return time of two years in the case of White Certificates); business turnover; system charges; tax and contributory income (IRES, IRPEF, social security contributions, VAT, etc.). Table 10 shows the years in force of each instrument, the total stimulated investment I_0, the savings achieved both in energy and in cash flow, the induced costs and the cost/effectiveness indicator (c€/kWh). The results are assessed throughout 2017, not considering any inertial

[2] The table does not include the reduction of energy consumption deriving from other energy efficiency measures, in particular at a regional level, for which reference should be made to the full report. The six regional measures that do not allow the cumulation with the described national incentive schemes and for which energy savings data are available, even if only estimated, have produced a cumulative energy savings of just over 9 ktoe over the period 2014-2017.

effects that can be produced in future years. The effects of the Feed-in Tariff for photovoltaic (PV) systems and incentives for "Other electric RES" devices are considered over 20 years. The preliminary analysis shows that energy efficiency mechanisms have a better cost effectiveness than renewables, as evidenced by the cost incurred by the actors involved for each kWh saved: 2.9 euro cents for White Certificates and 8.6 for the Ecobonus, compared with 32 for renewable electric sources.

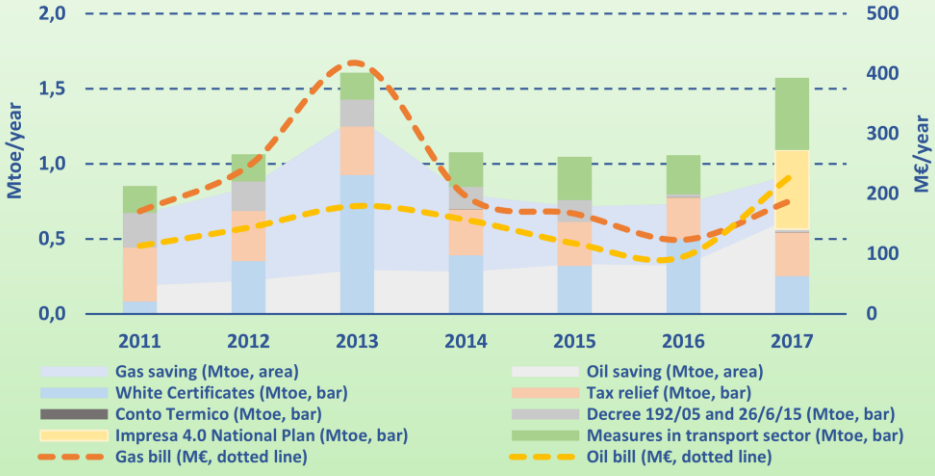
Table 10 - Cost-effectiveness of incentive mechanisms, cumulative data for 2017

Mechanism	Years	I_0	Savings		Costs		Cost-effectiveness
	(n)	(G€)	Energy (Mtoe)	Financial (G€)	(G€)		(c€/kWh)
White Certificates	13	12.0	57.3	38.0	7.0		2.9
Ecobonus	11	34.6	8.6	5.4	20.5		8.6
PV (Feed-in Tariff)	12		82.7		134	(20 y)	32.0
Other electric RES	<25				110	(20 y)	

Source: ENEA elaboration of data from ARERA, CSEA, Chamber of Deputies, ENEA, GME, Gestore dei Servizi Energetici S.p.A., Ministry of Economic Development

National energy bill. For the period 2011-2017, the cumulative energy savings achieved amounted to approximately 8.3 Mtoe of primary energy, of which about 6 Mtoe linked to lower consumption of natural gas (Figure 11). The assessment of the bill savings was based on the price trend of crude oil and natural gas over the years in question. Overall, the cumulated savings on bill exceeds 2.5 billion euros per year in 2017, of which 1.5 for lower imports of natural gas. The savings achieved in 2011-2017 prevented the emission of about 19 $MtCO_2$ in 2017, equal to more than 5% of the CO_2 emissions reported for Italy in 2016.

Figure 11 - Savings on National energy bills (M€/year, on the right) and energy savings (Mtoe/year, on the left), years 2011-2017



Source: ENEA elaboration

Table 11 - Funds based on the 2007-2013 Cohesion Policy, energy efficiency projects concluded and paid off, and related available resources (M€)

Programme	Projects (n)	Total public financing (M€)	Eligible cost (M€)	Total payment (M€)
Regional Operational Programmes (ROP), Regional Competitiveness and Employment (RCE) - ERDF				
Public, residential, private and industrial buildings	413	191.9	188.9	188.1
Public lighting	393	68.0	66.7	65.9
Horizontal measures, funds and incentives, information and training	518	141.2	141.7	140.5
Industry	154	27.4	26.6	26.6
Sustainable mobility	204	240.8	281.1	251.1
Energy distribution	99	7.0	6.9	6.9
Regional Operational Programmes (ROP), Convergence (CONV) - ERDF				
Public buildings	59	29.9	29.0	28.9
Public lighting	295	38.6	36.9	36.2
Horizontal measures and funds	29	135.1	134.7	134.7
Industry	1	1.4	1.4	1.4
Sustainable mobility	48	247.2	244.8	240.0
Energy distribution	25	40.2	73.6	53.2
Interregional Operational Programme (IOP) "Renewable energy and energy saving", Axis II				
2.1 - Creation of businesses and networks	497	117.0	96.9	107.1
2.2 - Energy efficiency measures for buildings and public energy users	160	189.2	189.2	188.8
2.3 - Promotion and dissemination of energy efficiency in protected natural areas and in the smaller islands	56	38.0	38.0	37.9
2.4 - Upgrading and adaptation of transport networks	16	260.9	260.9	260.9
2.5 - Heat distribution	16	33.1	33.1	32.7
2.6 - Awareness and training	2	23.2	23.2	23.2
2.7 - Energy efficiency measures in the context of sustainable development actions	344	81.2	81.2	81.1
Regional Action Plan of Cohesion and Development Fund (CDF)				
Public and residential buildings	13	6.1	5.8	6.0
Lighting	7	8.6	8.3	8.3
Sustainable mobility	72	572.2	574.2	573.1
Cohesion Plan of Action				
Private buildings	6	0.7	0.7	1.0
Lighting	1	0.2	0.2	0.2
Sustainable mobility	7	59.9	61.9	59.9
National Operational Programme (NOP) ERDF Convergence "Networks & Mobility"				
Sustainable mobility	13	473.3	472.8	473.3
TOTAL energy efficiency projects concluded and paid off	**3,448**	**3,032.3**	**3,078.7**	**3,027.0**
TOTAL energy efficiency projects	**4,130**	**10,011.9**	**6,839.8**	**5,320.3**
of which started from 2014 onwards, concluded and paid off	**1,752**	**1,251.8**	**1,320.7**	**1,275.2**

Source: ENEA elaboration of data from the Presidency of the Council of Ministers and Ministry of Economic Development

Cohesion Policy Funds 2007-2013. Table 11 (previous page) shows the situation for the 2007-2013 programming cycle of the Funds based on the Cohesion Policy, with a total of over 10 billion in financing allocated to more than 4,100 projects related to measures for different areas, all related to energy efficiency. Of these, at the moment 3,448 (about 83% of the total) have been concluded and paid off. Approximately 42% of all selected projects have been launched from 2014 onwards and are concluded or paid off, for a total of over 1.25 billion euros of public funding.

4. Energy efficiency in the industry

The European *Strategic Energy Technology Plan* (SET-Plan) aims to accelerate the development and use of low carbon technologies within the European Union, promoting research and innovation. Following the consultative process, launched in 2016, eight implementation plans have been adopted, including the *Continued effort to make EU industry less energy intensive and more competitive*. As shown in Table 12, 98% of final energy consumption in the EU-28 is attributable to eight groups of industrial sectors.

Table 12 - Consumption and potential savings of the most energy-intensive industrial sectors

Indicator	Final energy consumption	Economic potential savings by 2030 (payback <= 2 years)	Technical potential savings by 2030	Energy cost/ value added	Number of employed	Value added, gross
Sector	**Mtoe/year**	**Mtoe/year**	**Mtoe/year**	**%**	**Millions**	**€ Billions**
Pulp and paper	34.3	1.1	7.2	16%	1.43	79.0
Iron and steel	50.8	2.9	16.3	36%	0.63	39.7
Non-metallic mineral	34.2	1.2	7.1	23%	1.29	63.9
Chemical and Pharmaceutical	51.5	2.6	16.5	12%	1.72	229.8
Non-ferrous metals	9.4	0.5	1.9	23%	0.46	23.7
Petroleum refineries	44.7	1.7	10.6	44%	0.12	24.3
Food and beverage	28.4	1.4	6.8	10%	4.53	251.4
Machinery	19.3	1.0	5.3	3%	9.03	579.8
Total	**306.9**	**13.5**	**78.9**		**20.64**	**1,370.6**

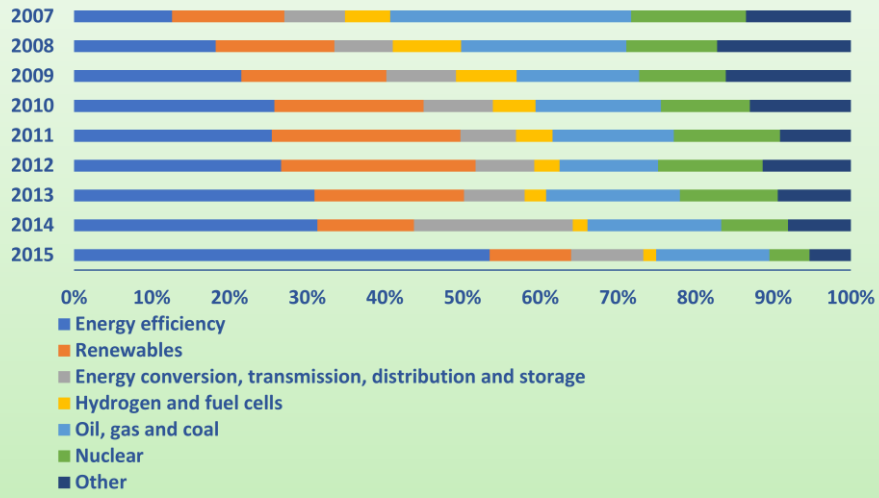
Source: SETIS

The companies in the iron and steel, and chemical-pharmaceutical industries are the most energy-intensive companies, and for these investments in energy savings can have a greater return. These activities have been considered a priority due to their high potential for energy savings and their socio-economic importance, given the added value and employment generated. These sectors together account for about 38% of the final energy consumption of the European industry and for around 45% of the energy savings potential

achievable through investments, with a return time of up to two years. These energy intensive sectors are joined by transversal technologies for heat recovery, arriving at three macro-groups of technologies on which the Plan focuses attention: steel; chemicals and pharmaceuticals; heat recovery.

Overall, spending on energy R&D in Italy increased from 926 million euros in 2014 to over 1.5 billion in 2015 (+65%), particularly in the private sector and largely due to the contribution of energy efficiency (Figure 12). In fact, in 2015 energy efficiency alone accounted for over 54% of spending, a value that has more than quadrupled since 2007. Energy efficiency together with renewable sources and technologies for energy conversion, transmission, distribution and storage represent about three quarters of Italian energy research, an amount that more than doubled in the last 9 years.

Figure 12 - Distribution of R&D in the energy sector by topic, years 2007-2015



Source: Ministry of Economic Development

The research results will find direct application in the companies of the various industrial and service sectors. Pursuant to article 8 of Italian Legislative Decree 102/2014 implementing the Energy Efficiency Directive, as at 31 December 2017 ENEA received 15,460 energy audits of production sites relating to 8,686 companies. Over 45% of the audits were carried out on sites related to the manufacturing sector and over 10% in trade, where the consumption of large-scale retail chains is accounted for.

From the analysis of the received audits, the potential for energy savings deriving from projects having a payback time of at most 3 years is considerable: with approximately 8,400 projects, energy savings of around 0.78 Mtoe/year are possible with around 650 million euros of investment. Approximately 5,300 projects have been identified in the manufacturing sector, for a savings of about 0.6 Mtoe/year with about 500 million euros of investments (Table 13).

Table 13 – Energy audits received by ENEA pursuant to article 8 of Italian Legislative Decree 102/2014 in December 2017 and savings potential from projects with a payback time of less than 3 years

ATECO sector	Number of enterprises	Audited sites	Projects with payback time less than 3 years	Potential savings (ktoe)	Necessary investments (M€)
A - Agriculture, forestry and fishing	61	108	59	2.5	2.2
B - Mining and quarrying	40	75	31	5.7	3.5
C - Manufacturing	5,131	7,032	5,271	595.3	491.4
D - Electricity, gas, steam and air conditioning supply	232	492	194	38.1	32.2
E - Water supply, sewerage, waste management and remediation activities	324	921	276	24.3	18.7
F - Construction	175	323	97	10.1	6.9
G - Wholesale and retail trade; repair of motor vehicles and motorcycles	892	2,433	896	24.2	21.2
H - Transportation and storage	416	934	272	27.7	18.1
I - Accommodation and food service activities	110	309	112	2.6	3.1
J - Information and communication	160	664	255	19.6	20.6
K - Financial and insurance activities	244	597	151	2.4	2.3
L - Real estate activities	59	114	52	2.2	2.2
M - Professional, scientific and technical activities	255	316	66	1.4	1.0
N - Administrative and support service activities	250	449	62	1.0	0.8
Other	337	693	570	22.5	22
Total	**8,686**	**15,460**	**8,364**	**779.6**	**646**

Source: ENEA

5. Energy Performance Contracts: legal and technical aspects

In order to proceed with the energy-related renovation of its real estate assets, the public administration has a number of options:

- Use project financing to assign the management of integrated energy services aimed at the energy efficiency of its buildings and plants.
- Establish a public ESCo using an institutionalised public-private partnership form, provided that a tender is carried out for both the choice of the partner and the assignment of the energy service. In this case, a stable relationship is established between the public and the private entity, instrumental for carrying out the energy-related renovation required by the public body. It follows that in order to comply with competition rules the public ESCo will not be able to operate in the market as it will have to restrict its services to the public body alone.

- Entrust the management of the energy service directly to an in-house company, provided that the requirements of similar control, prevailing activity and total participation are met.
- After a public tender, contracting an energy performance contract to an ESCo, remunerating the company in proportion to the energy savings actually achieved following the energy-related renovation of the building.
- After a public tender, entrust the energy performance contract under concession to an ESCo, possibly also using financing from third parties, and repaying the investment made by the ESCo or a third-party company with a share of the energy savings achieved following the project.

Unlike the cases illustrated so far, which share the assumption of the material implementation of energy efficiency projects on the real estate assets of the public administration, for completeness we note that recently Italy's National Anti-Corruption Authority (ANAC) offered a new instrument in the field of energy efficiency that highlights the preparatory and conceptual phase of the development of the energy efficiency service. In particular, it is a pre-commercial procurement tool with which the public administration stipulates R&D contracts in order to stimulate and incentivise the production and research of innovative and competitive solutions in the energy and environmental sustainability sectors, excluding them from the application of public rules.

Projects implemented under contracted or concession-based energy performance contracts/Public Private Partnerships are an option that can certainly be used for the energy-related renovation of public and private buildings. The Guidelines for Energy Performance Contracts for the buildings of the public administration developed by ENEA go in this direction, albeit specifically set on the procedures of the service contract as agreed with the Ministry of Economic Development. They are intended to provide public administrators with a tool to support and guide the drafting of energy performance contracts specific to the individual project, consistent with the latest legislation, like Italian Legislative Decree 50/2016 as amended (New Code of Public Contracts), Italian Ministerial Decree 11 October 2017 concerning the Minimum Environmental Criteria of the assignment of design and works services, the EUROSTAT and ANAC guidelines, and implementing decrees of the Ministry of Infrastructure and Transport.

The legislative typing of the energy performance contract as a complex contract model is fundamental to facilitate both public and private practitioners in the process of energy-related renovation of their real estate through their standard use: a standard template increases the knowledge and awareness of the potential of the instrument, first of all by banks to boost new investments.

The main critical issues that emerged in the drafting of the Guidelines have been linked to the novelty of this contractual model to Italy's existing legal framework and to the need to coordinate its application with the discipline of the new code of public contracts. The interpretative analysis carried out in light of the combined provisions of Italian Legislative

Decree no. 102/2014 and of Italian Legislative Decree 50/2016 as amended (New Code of Public Contracts) was based on extensive doctrinal research and considered the guidance coming from judgements of the Superior Courts, above all for the framing of the procedures for assigning this contract. The second critical issue noted is that this is a contract that provides for the execution by the ESCo of diverse services (jobs, services and supplies), therefore it falls within the category of mixed contracts, pursuant to Italian Legislative Decree 50/2016 as amended. ENEA has deemed that even in the absence of a normative definition of the Energy Performance Service for Buildings, for the energy performance contract, which is a contract with multiple and deferred services, while these services are separate on a material level, functionally they are not as they all contribute to achieving the contractual objective (minimum guaranteed savings). The recognition that the activities that make up the Energy Performance Service are objectively not separable pursuant to art. 28, paragraph 9 of Italian Legislative Decree 50/2016 as amended, leads to the logical application of the procedure of assignment of the service contract.

Framing the energy performance contract as a service contract leads to the consequence of there being a sole design level in accordance with art. 23, paragraph 14 of Italian Legislative Decree 50/2016 as amended. In the absence of specific legislation, for the design relating to the works it was not possible to deviate from the provisions of article 59 (prohibition of integrated procurement) of Italian Legislative Decree 50/2016 as amended, and the public administration was assigned the burden of initiating a tender with already the final project, considering that such contracts require the application of advanced technology. However, it is not possible to exclude the possibility of the public administration calling for bids the energy audit also, accompanied by the feasibility plan drawn up pursuant to article 23, paragraph 6 of Italian Legislative Decree no. 50/2016 as amended, considering the prohibition of integrated procurement as not applicable to energy performance contracts, even if at present such an interpretation may not be accepted in the case of a legal dispute. For this reason, ENEA hopes that a legislative intervention for the reorganisation and typing of the energy performance contract will allow the public administration such practicability in a definitive manner, establishing that for this contract there is a sole level of planning, even for the part relating to the works. More generally, the study of the legal aspects has underlined the need for legislative intervention that establishes the nature of a "special contract" for energy performance contracts for public buildings, in order to solve interpretative doubts in this regard and give effective impetus to the energy efficiency market.

From a technical point of view, the energy audit plays a fundamental role both in the design phase and in the management and control phase of the Energy Performance Service: the Guidelines provide that its drafting is the responsibility of the public administration so that it can be aware of the energy status and the potential for improvement of its buildings, and so it can therefore make an unhurried decision in terms of the technical and financial convenience of the projects to improve the building's performance, which represents the fundamental of the contract, to be determined before, after and during the execution of the

contract, referring to the actual use of the building and the climatic conditions of the location. The energy audit carried out during the design phase is an indispensable tool for assessing the various possible works from a technical and financial point of view, to define the baseline data, determine the reduction of energy consumption (and related costs) and highlight the benefits achievable with the proposed investments. For an effective energy audit, the energy and mathematical calculation model must be validated through the consistency with real consumption data, so that the energy model well represents the actual state of the building. The model also assumes importance in the management phase because it is used to check the performance levels achieved and also allows for the normalisation of consumption in the case of changes in the contractual parameters that affect energy performance (for example, a change of use, changes in the volume heated, etc.) and, therefore, the restatement of the minimum energy savings to be contractually guaranteed.

6. Nearly Zero Energy Buildings in Italy

The characteristics of a Nearly Zero Energy Building (NZEB) in Italy are established by the Italian Decree 26 June 2015 "*Minimum requirements*": new and existing buildings are considered NZEBs if both the decree's performance requirements and the obligations regarding the integration of renewable sources dictated by Italian Legislative Decree 28/2011 are met.

As a transition to NZEBs, for new buildings or those subject to major renovation, the aforementioned 2015 Decree sets performance requirements in terms of primary energy that are more stringent by 15% compared to the previous standards and will be progressively stricter in 2017, 2019 and 2021. In addition to the overall limit on primary energy consumption, the Italian NZEB standard requires compliance with other minimum requirements: useful thermal performance indexes, to be compared with the limit values of the reference building, the overall average heat transmission transfer coefficient, the equivalent summer solar area per unit of useful area, the performance of the winter and summer air conditioning systems and the production of domestic hot water, the limits on the transmittances of the dispersing elements.

In 2017, ENEA launched a national NZEB Observatory that allowed statistics on number and type of NZEBs, information on regional policies, public and private initiatives for information and training and the state of research in the sector. From an initial estimate, based on the data of NZEB buildings with an Energy Performance Certificate (called APE in Italy) in a sample of regions (Lombardy, Piedmont, Abruzzo, Marche), the Italian NZEBs (according to the 2015 standards) in 2016-2017 period are approximately 600, mainly new (80%) and residential buildings (88%). Despite the still limited number, there is a rapid increase in NZEBs, also due to the even more stringent obligations imposed in advance with respect to the deadlines of 2019 and 2021: in Lombardy the date was brought forward to January

2016; in Emilia Romagna to 2017 for public buildings and to 2019 for others; in the province of Bolzano starting from 1 January 2015, according to local regulations.

From the first analysis it emerges that most of the NZEBs apply a reduced set of technologies: high envelope insulation, electric heat pumps (mostly air-water) and photovoltaic systems for the production of electricity is the most frequent combination, with the variant of condensing boiler combined with a solar thermal system for the production of domestic hot water. Wood construction is widely adopted, not only for passive or detached buildings, as it allows construction of large-scale buildings with high insulation performance and reduced building time.

With regard to costs, in the absence of an approach focused on the life cycle of the building, the payback time of investment in NZEBs is in many cases longer than the useful life of the building itself. Initial costs vary from 3,000-3,500 €/m^2 for detached houses to around 1,500 €/m^2 for multi-family buildings.

7. The financing of energy-related renovations of buildings

Making loans for energy-related renovation projects that affect the entire building attractive to the financial world is one of the first steps to be taken to facilitate what is today a fragmented demand, which often corresponds to an equally fragmented supply from the credit system, as this type of investment is yet considered to be high risk.

The European Investment Bank recently implemented a new financial instrument, the *Smart Finance for Smart Buildings Facility*, which aims to release additional 10 billion euros of public and private funds by 2020 through a more effective use of available public funds and support to professionals with technical assistance services, to make energy-related renovation projects easier to finance and aggregate. The European Commission, in collaboration with the Energy Efficiency Financial Institutions Group, has developed the *De-Risking Energy Efficiency Platform* (DEEP) platform, an open source database for monitoring and benchmarking investments in energy efficiency, with data from more than 10,000 projects in the residential and industrial sectors, thanks to which we can identify an array of standard and flexible investment models based on their risk and return.

In order to attract investments, therefore, a de-risking of the financing is required through ad hoc finance models by type of building and project, able to highlight the key technical parameters related to the project, to be considered in the analysis for the assessment of the financial product that banks can offer to support energy-related renovation. In fact, banks usually link the granting of loans to the assessment of their customers' merit or seeking to obtain specific guarantees. This is due not only to the lack of specific technical skills, but also to the lack of sufficiently robust data and/or statistics that allow banks to reliably estimate the energy savings that can be obtained from a given project. Furthermore, once the feasibility of the energy efficiency action has also been determined, even from a financial

point of view, the question arises of how the bank can have certainties that the additional cash flow generated by energy savings will be effectively used to repay the loan.

The issues raise the question of which service portfolio can be provided to all the actors involved to facilitate the renovation process. This portfolio should contain at least the following fundamental steps, starting from information and suggestions for a high quality energy renovation project, the analysis and identification of potential savings, up to the implementation of the projects (also offering guidance in the choice of companies), including the study of the related financing plan based on concessions, mortgages and/or incentive mechanisms, as well as after-sales assistance and insurance products. The link between these different steps in the process of energy-related renovation constitutes the so-called *one-stop-shop*, able to create a virtuous and integrated path for the energy renovation of buildings through the system of information, good practices, standardised packages that favours the connection and the meeting between an aggregate demand and a range of offers from suppliers, which is broader and better in terms of the quality of the products and services provided. The European Commission is counting on the development and dissemination of *one-stop-shops* as part of the *Clean Energy for All Europeans* package: European-wide programming is desirable for the implementation of information programmes, training, creation of good practice databases for the sharing and promotion of successful actions, combined with the systematic establishment of local support centres, currently entrusted to the single initiative or project.

8. Energy poverty in Italy

The main causes of energy poverty are linked to a complex interaction between low income, inadequate energy efficiency in housing and energy costs, all of which are grafted into the debate on the fight against climate change and the fight against poverty.

Energy poverty is a problem on the political agenda of many European countries and is one of the key objectives of the *Clean Energy for All Europeans* package, which emphasises the role of energy efficiency in countering the phenomenon. The European Commission estimates that the improvement of energy efficiency in buildings can contribute to raising 515,000 to 3.2 million families out of energy poverty (out of a total of 23.3 million families in energy poverty). This is the objective of the European Energy Poverty Observatory, launched in January 2018, which has developed a platform for sharing data, experiences and methods implemented and tested to date in order to foster a synergy and analysis to develop an effective strategy against the phenomenon.

One of the first issues to be tackled is the harmonisation of language at the European level. The absence of a common definition of energy poverty makes it even more difficult to establish a shared approach, as well as the implementation of more specific guidelines and requirements, there being an awareness that the technical and non-technical barriers

traditionally recognised for the implementation of energy efficiency instruments are usually accentuated in the case of low-income households. This is evident in the different ways in which Member States tackle the problem: some have implemented strategies explicitly addressed to energy poverty (United Kingdom, Ireland, France), but most tend to resort to social policies like direct subsidies, reduced tariffs and tolerance for default. In fact, these are transitional measures capable of guaranteeing rapid but not structural relief, like energy efficiency policies which permanently reduce the users' energy needs. In this regard, the measures that have shown greatest success are those that associate energy audit with financial instruments, which in addition to providing economic support for the energy-related renovation of housing also cover the information and behavioural aspects.

The NES underlines the need to establish an "official measure" of energy poverty at a European level, meant as the difficulty of purchasing a minimum basket of energy goods and services, or alternatively in an energy vulnerability meaning, when access to energy services involves a distraction of resources (in terms of spending or income) above a socially acceptable level. This definition frames the problem from a multidimensional perspective, going beyond domestic heating only and identifying a much more complex condition in which we try to develop a range of effective strategies that concern not only other energy uses within the home, but also transport and, more generally, the social life of different segments of the population: single-income households, the elderly, young people waiting to be employed, unemployed.

The NES implemented the indicator proposed by Faiella and Lavecchia (2015) for assessing the incidence of energy poverty in Italy, jointly considering three elements: the presence of a high level of energy expenditure; an amount of total expenditure (net of energy expenses) below the relative poverty threshold; a null value for the purchase of heating products for households with an overall expenditure lower than the median. By implementing this metric, on average around 8% of households (2.1 million) have been in a state of energy poverty in the last 20 years, with a peak of 8.5% in 2016 at a national level and reaching 14% in the southern regions of Italy. It should be noted that the national average is well below the estimate of the European Commission, equal to over 17%, which corresponds to 4.4 million Italian households.

9. Barriers and tools in the communication of energy efficiency

Actions to increase public awareness, induce behavioural changes and provide information necessary to act are fundamental components of policies and programmes for energy efficiency and savings at different local levels. The focus of the actions is not on technological measures, but on social and psychological aspects for individuals, communities and organisations.

Public policies to raise awareness about energy saving and efficiency have been based mainly on incentives of a financial nature, which is a good motivation to achieve the objectives set, but when these incentives end both the motivation of consumers and the persistence of the message are drastically weakened. In recent years, such evidence has pushed policymakers to experiment with policies that focus on an approach that combines economic incentives with environmental motivations, and that leverage a sense of community.

In many cases the message chosen was negative and extremely pessimistic, and, in most cases, the identified target considered the impacts related to a non-rational use of energy as a non-urgent and psychologically distant risk. The message, therefore, must be carefully selected and kept as simple as possible, and the key words to use are: entertain, involve, integrate and educate.

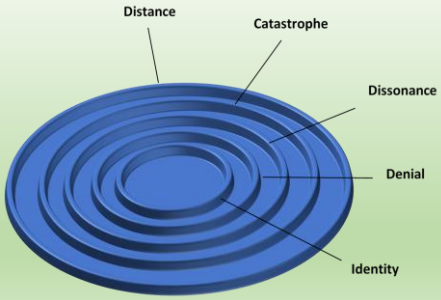
Once basic awareness is achieved, the second step is to provide targeted information on potential energy efficiency measures. For this reason it is essential to understand and study the selected target. In addition to the social component, policy guidelines, lessons learned and examples focusing on key psychological principles should be encouraged, which can guide the design and implementation of effective information and training measures on energy efficiency and related environmental impacts.

Therefore, when the communication strategy is prepared, the obstacles to public commitment to energy conservation are of a predominantly socio-psychological nature and refer both to individuals and to communities in general. More precisely:

- Distance from the problem: final consumers consider the waste of energy and its impact on the environment a serious problem, but they perceive it temporally and geographically distant.
- Catastrophe: emotional catastrophic appeals by communicators on the environmental effects of excessive energy use can be effective in the short term, but difficult to sustain in the long term.
- Cognitive dissonance: this occurs when attraction of end users for the comforts of everyday life conflicts with the beliefs on a given topic, like climate change.
- Denial of the problem: defence mechanism to avoid an overwhelming reality related to the possible impacts of our actions, for example rejecting the existence of environmental problems and climate change or denying that behavioural change can have an impact on the environment.
- Identity and convictions: people search for information that aligns with their own beliefs, creating a phenomenon of so-called confirmation judgement; personal identity overwrites the facts, particularly when the facts require changes in habits or lifestyle.

These are the main barriers that prevent messages on energy efficiency from engaging the public, creating concentric circles around the individual and the community, representing a challenge for communicators on issues of energy saving (Figure 13).

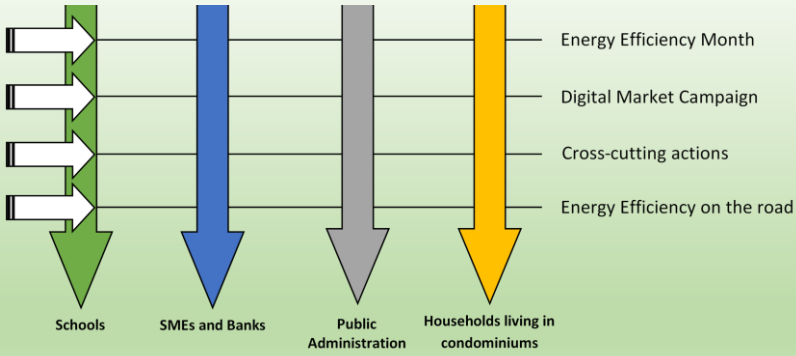
Figure 13 - The five barriers that block the energy-efficiency message



Source: ENEA

Communication regarding energy efficiency must also deal with lack of appeal for the media, lack of knowledge of these issues, fragmentation, discontinuity, the episodic nature of initiatives, few synergies and little interdisciplinarity with both the barriers and critical issues of each of the identified targets. In designing and implementing the second year of the three-year Information and Training Programme, foreseen by the Legislative Decree 102/2014, the most suitable means for a correct communication strategy for energy efficiency have been identified, also taking into account the abundance of communicative stimuli, and the relative difficulty of orientation among the sources for the citizens. For this reason, the operational plan implemented in 2017 was structured in terms of gradualness, flexibility, monitoring and constant verification of the achieved results, even through social networks, an additional element that has contributed to a redefinition of the concept of communication where the communicator is called to define content suitable to what consumers demand, speaking their language and using new communication tools. More specifically, the second year's operational programme was divided into four macro-projects for individual targets (schools, SMEs and banks, the public administration and households living in condominiums) and four horizontal multi-target actions (Figure 14).

Figure 14 - Three-year Information and Training Programme: macro-projects



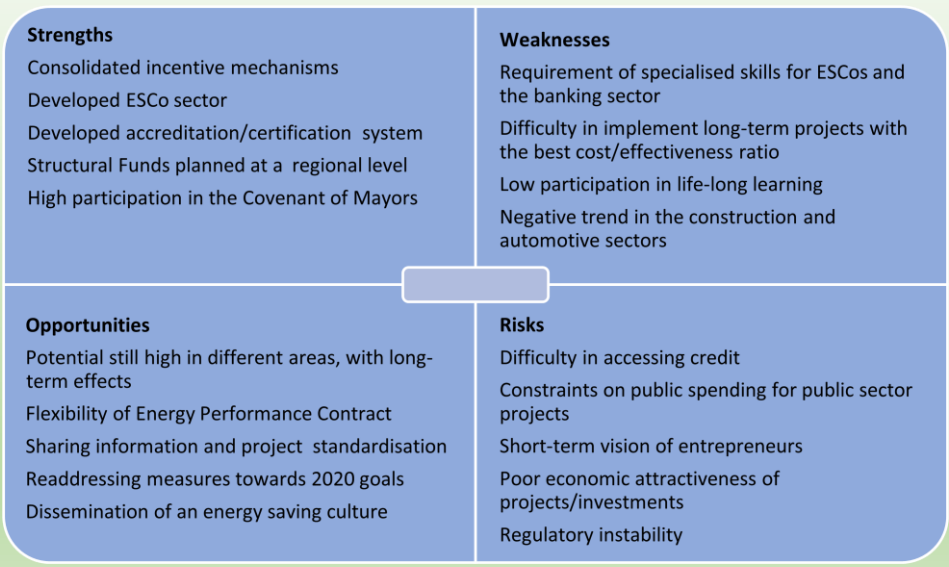
Source: ENEA

In particular, the campaign *Italy in Class A* has become itinerant and the promotion of the topic of energy efficiency to the various targets has been carried out throughout the country, visiting 10 medium-large Italian cities and with the collaboration of the various local stakeholders (public administration, professional associations, universities, professional associations). The *Italy in Class A* Facebook page was the primary point of reference and tool for disseminating the events of the 10 stops of the tour, disseminating the material from over 40 live linked events and with the possibility of reaching segmented targets, differentiating and personalising the messages, for example through geolocalised campaigns or posts targeted by age groups. Just on the official Facebook page of *Italy in Class A*, from the beginning of October 2017 to 10 April 2018 the timeline deliveries of the posts were about 1,200,000, for a total number of over 640,000 people reached (half of them in the age group ranging from 25 to 44 years) and over 23,000 user interactions.

10. Actions to achieve the energy efficiency objectives

The previous sections have underscored how the incentive mechanisms underlying the requirements set out in article 7 of the Energy Efficiency Directive are effective and consolidated tools, which can certainly be the main lever used to orient demand, still not inclined to the use innovative financing or management schemes, towards the most cost-effective energy efficiency measures (Figure 15).

Figure 15 - Barriers and opportunities for achieving energy efficiency objectives in Italy: SWOT analysis



Source: ENEA

As shown in the depicted SWOT analysis, the strengthening of coordinated and planned actions focused on information and training of users, like the aforementioned three-year Information and Training Programme prepared by the Ministry of Economic Development and implemented by ENEA, constitute an optimal instrument, shared and acknowledged by all sector operators and consumer associations, able to accelerate the behavioural change necessary to fully exploit the available opportunities, also in consideration of Italy's low participation in life-long learning.

Regarding the actions to be taken for buildings, there is an evident need to radically operate on them by addressing the envelope and the heating/cooling system together, a type of project with a better cost-effectiveness. To this end, a coordinated system of measures is required that - depending on the main building types, the climatic zones, the specific types of materials available in a given region - identifies and incentivises standard "packages" of solutions, also aimed at better integrating renewable sources in the envelope and the heating/cooling system and using prefabricated components in a systematic way. "Extreme" solutions, difficult to be implemented on a large scale, require the demolition and reconstruction of the building.

Measures that can be taken into consideration in an integrated form, and in part already present in the new provisions of the Stability Law of 2017 and 2018 concern:

- Incentive mechanisms.
  - Variation of the incentive rate, increasing according to the complexity of the project and/or the linking with other incentivised issues (e.g. anti-seismic works).
  - Possibility of transferring credit to corporate bodies that banks and financial institutions have invested in without having a majority shareholding.
  - Funds to facilitate access to credit and reduce its cost.
- Incentives to construction companies.
- Incentives for households and owners, also in order to resolve the problem of split incentives.

In order to orient demand towards the more complex activities of the industry process, the measures to be taken could provide incentives for such activities, already mentioned in the energy audits sent to ENEA, which have longer payback times. Considering that at the end of 2019, pursuant to art. 8 of Italian Legislative Decree 102/2014, a new audit will have to be presented by a large number of companies, even if the projects carried out at that date were not included in the first audit of 2015, incentives might be envisaged related to the reduction of specific energy consumption in the production process monitored by the two audits.

It is also necessary to take into account the new energy-saving decree (Italian Ministerial Decree of 12/21/2017) which seeks to finally combine incentives for energy-intensive industries with energy efficiency. Once the new mechanism is fully operational, incentives could be linked to the energy efficiency of the company and not only to the energy it consumes.

For the transport sector there are five strategic lines of action:

- Policies to support the renewal of the public and private vehicle fleet, aimed at improving energy efficiency and using sources other than fossil fuels.
- Construction of refuelling stations for vehicles powered by alternative energy (electricity for light vehicles, LNG for heavy vehicles, hydrogen for cars and buses).
- Rail development, both in urban areas, through the completion of the underground and tramway networks under construction, and nationally, through the development of the high-speed and regional rail network, the integration of logistics hubs with the national railway network for freight and the renewal of rolling stock.
- Reinforcement of collective transport in urban areas and development of soft and shared mobility.
- Support for the intermodality of goods on long journeys.

From a governance point of view, as mentioned above actions should aim to:

- Strongly orient existing and available resources from European funds, making sure that private and public activities include and increase the value of the investment of European funds, reducing the share of regional and national co-financing both through a model of public private partnership, and through voluntary agreements that involve the entire chain of stakeholders, from manufacturers to distributors, sellers, installers, construction companies.
- Guarantees for loans granted by banks: for large investments, the constitution of a Special Purpose Vehicle with a project financing approach might be envisaged. For smaller transactions, on the other hand, an evolution of the current contractual frameworks and their effective implementation is appropriate, with the aim of guaranteeing the lender all revenues deriving from energy efficiency projects to pay back the debt, even through the establishment of public guarantee funds able to cover the risks that banks are not able to assess on the basis of the available information.

In addition to the aforementioned three-year Training and Information Programme, for all the aforementioned actions and for a more general behavioural change, the dissemination and strengthening of the instrument of the energy performance contract and greater stability of the regulatory framework accompanied by a streamlining and simplification of the authorisation procedures will be crucial enabling factors.

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