2017
executive summary

65% FISCAL DEDUCTIONS

FOR ENERGY RENOVATION OF EXISTING BUILDINGS

NATIONAL AGENCY
FOR ENERGY EFFICIENCY

ENEA

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.

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ANNUAL REPORT 2017 – 65% Fiscal deductions
Executive summary

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

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Foreword

The time to repair the roof is when the sun is shining.

J. F. Kennedy

All of us believe that the house is a fundamental good, and in order to make it an agreeable place to live in we try to pay special attention to its functional, technological, qualitative and sustainable aspects, which make it even more liveable.

For this reason, a few years ago, when I had not been appointed President of ENEA yet, I agreed with great favour the choice of our Country to incentivise people to renovate their own houses obtaining, in this way, a substantial energy saving and improving the quality of life and the environment at the same time.

After more than 10 years since the beginning of this experience, we have reason to believe that 55-65% fiscal deductions for energy renovation of existing buildings have represented a veritable break in the world of energy efficiency.

Since that moment on, the culture of sustainability has found application in the transformation of everyone's house, obtaining real energy saving and lower CO_2 emissions thanks to energy renovation.

Such interventions have allowed to curb the heavy economic crisis faced by the building sector (building firms, producers of raw materials), which has experienced an investment decrease by 30% in the last few years.

In terms of spin-off, technicians and retailers who carry out their activity far from urban areas had to meet the disparate requests from customers and were obliged to adapt their competences and storehouses to satisfy them; also research and innovation had to meet a high demand from producers of raw materials and machineries.

All this implied the valorisation of buildings, which increased their market quotations thanks to energy efficiency interventions. Several studies have estimated a price increase of 6%, which buyers would be willing to pay for an energy renovated building. Not least, new significant scenarios are going to open up thanks to the relevant legislative interventions proposed by ENEA in the field of the energy renovation of whole buildings, facing the issue posed by post-war buildings.

To sum up, a significant, partly unexpected result was achieved, which crossed the borders of the incentive tool and became an impressive driver to bring energy efficiency in the houses of Italian people.

Since we believe that such results deserve to be described and valued with more frequent updates and market analysis of incentivised technologies, ENEA, starting from this year, has decided to prepare a new Report on 65% deductions.

The Report is published in a completely renewed and extended version relative to previous years, both in contents and design, and aims to go beyond the simple institutional report complying with the law obligation.

In thanking the working group, constituted both by ENEA researchers and authors external to the Agency, I wish that the information and thoughts included in this Report can find a wide echo both in our Country and at international level, becoming the object of debate and comparison, and inspiring the future choices about the best policies to achieve the 2030 targets.

Let's all keep the good work going!

Federico Testa

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1. The national context

Directive 2012/27/UE set indicative national energy efficiency targets: such targets, as defined in the National Energy Strategy (SEN), are monitored yearly in the Annual Report prepared for the European Commission, as envisaged by article 3 of the Directive. In particular, from 2011 to 2020, Italy should save 15.5 Mtoe (20 Mtoe of primary energy), reducing consumption by around 24% relative to the value projected for 2020 by the European reference scenario, based on an inertial evolution of the system.

Italy complies with article 7 of the Energy Efficiency Directive with the White Certificates obligation scheme, from which a saving of around 5.5 Mtoe/year of final energy is expected, combined with two alternative measures, Fiscal Deductions (1.38 Mtoe/year) and Thermal Account (1.47 Mtoe/year starting from 2014).

The 2017 Stability Law extended fiscal deductions for all the interventions already incentivised with previous regulations. Relative to the energy renovation of common parts of apartment blocks, the mechanism has been extended for five years, for interventions involving the envelope with an incidence higher than 25% on the gross dispersing surface, with a deduction equal to 70%; if such interventions achieve at least the average quality (D.M. 26 June 2015) for winter and summer energy performance, the deduction increases to 75%. In both cases, the beneficiaries could choose the transfer of receivables to the suppliers realising the interventions or to other private actors.

Table 1.1 provides a picture of the characterisation of the fiscal deduction mechanism and the main technologies associated to incentivised interventions.

Table 1.1 – Characterisation of the deductions for energy renovation

Intervention	Description	Associated technologies
Comma 344	Reduction of energy demand for heating the whole building	Biomass boilers; overall renovation
Comma 345a	Improvement of thermal performance of buildings opaque structures	Thermal insulation of vertical walls, roofs, slabs
Comma 345b		Replacement of windows and shutters
Comma 345c		Solar shading
Comma 346	Installation of solar panels	Solar panel for sanitary hot water
Comma 347	Replacement of winter air conditioning systems	Condensation boilers; heat pumps; biomass boilers; heat pump boilers for sanitary hot water
B.A.	Installation of building automation system	
Condominium 70%	Intervention on common parts of apartment blocks involving the envelope for more than 25% of the dispersing surface and, for interventions called *Condominium 75%*, achieving the medium quality for winter and summer performances	
Condominium 75%		

Source: Stability Law 2017

Relative to the 2011-2020 target as set in 2014 NEEAP and consistent with SEN 2013, 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 1.2). Around one quarter of such savings derives from the 65% fiscal deductions for energy renovation of existing buildings and, partly, from the 50% deduction for building renovation.

Table 1.2 – Achieved energy saving by sector, years 2011-2016, and expected saving for 2020 (final energy, Mtoe/year), according to 2014 NEEAP

Sector	White Certificates	Fiscal Deductions *	Thermal Account	Other measures **	Energy saving		Achieved target (%)
					Achieved 2016***	Expected for 2020	
Residential	0.59	1.56	-	0.94	**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	-	-	-	1.17	**1.18**	**5.50**	**21.4%**
Total	**2.56**	**1.60**	**0.003**	**2.35**	**6.41**	**15.50**	**41.4%**

* Estimated
** Legislative Decree 192/05 for new buildings; Ecoincentives, EU Regulations and High Speed railways in the transport sector; replacement of big appliances in the residential sector
*** Net of duplications
Source: ENEA elaboration based on data from Ministry of Economic Development, Gestore dei Servizi Energetici S.p.A., ENEA, ISTAT, FIAIP, GFK

Concerning the cumulative energy saving target of 25.8 Mtoe of final energy over the 2014-2020 period, according to EED Article 7, Table 1.3 shows the results achieved in 2014, 2015 and 2016 (estimated with regards to fiscal deductions) for each of the measures notified to the European Commission. Figures are on track of expected trend towards the 2020 target: of the over 4.5 Mtoe of cumulated energy saving obtained in the period 2014-2016, around one third derives from the 65% fiscal deductions.

Table 1.3 – Achieved energy saving by notified measure, according to EED Article 7 (final energy, Mtoe), years 2014, 2015 and 2016

Notified policy measures	New achieved savings 2014	New achieved savings 2015	New achieved savings 2016	Cumulated savings 2014-2016	Cumulated savings expected for 2020
Obligation scheme – White Certificates	1.050	0.896	1.135	3.081	16.00
Alternative measure 1 – Thermal Account	0.000004	0.001	0.002	0.003	5.88
Alternative measure 2 – Fiscal Deductions	0.248	0.502	0.731*	1.481	3.92
Total savings	**1.298**	**1.399**	**1.868**	**4.564**	**25.80**

* Estimated
Source: Ministry of Economic Development

2. The management of the fiscal deductions mechanism for energy renovation of existing buildings

The management of the fiscal deductions mechanism for energy renovation of existing buildings was assigned to ENEA since the creation of the incentive in 2007. In addition to the collection of the applications for fiscal deductions, this task includes training and information activities to potential beneficiaries and professionals, the evaluation of the energy savings achieved by the incentivised interventions and, for the interventions realised starting from 2017, the implementation of checks, also by sample, as introduced by the 2017 Stability Law.

Applications are collected each year through a dedicated portal, by which they can be filled out and transmitted online with the relevant technical documentation required to access the incentive, according to the type of intervention realised (for the current year: http://finanziaria2017.enea.it/index.asp). In the last ten-year period, the applications received amounted to around 3 million, an average of 300,000 each year.

More than 4 million users connect yearly to the portal, both for filling out the application for the incentive and searching information, made also available by three more channels:

- the information portal (http://efficienzaenergetica.acs.enea.it), costantly updated, receiving more than a million of unique accesses each year;
- the technical-procedural consultancy service, provided through a specific email address (gdl.effener@enea.it), which, starting from 2007, replied to more than 100,000 questions;
- the information technology consultancy service, provided by the creation of a specific "ticket" (http://ticketing-finanziaria.enea.it/), in which users can point out particular issues as, for example, the online filling of deduction applications or the information queries about applications already sent to ENEA.

Relative to the analysis of the data collected by filling the specific forms online, the information amount from beneficiaries is quite large, and refers not only to the single intervention for which the deduction is claimed but also to the whole building-plant system in which the renovated apartment is located. In past years, ENEA assessed the achieved energy savings and computed the main indicators identified in the documentation received, on aggregate level and on national and regional scale.

Compliance with the obligations set by the Energy Efficiency Directive concerning the building stock renovation strategy and communication to the European Commission of achieved results and, more in general, the evolution of regulatory framework, in particular for apartment blocks, all need an in-depth analysis, both at territorial level and in terms of impact of the mechanism on the building sector and national market of the incentivised technologies and machineries.

3. Achieved energy savings

In the 2014-2016 period approximately a million of interventions were realised (Table 3.1), of which more than 360,000 in 2016, when more than half involved the replacement of windows and shutters (para 345b), and around 20% the replacement of winter air conditioning systems (para 347) and the installation of solar shading (para 345c).

Table 3.1 – Number of realised interventions by paragraph, years 2014-2016

Year	2014		2015		2016		Total	
Paragraph	n.	%	n.	%	n.	%	n.	%
para 344	3,753	1.3%	3,308	1.0%	3,517	1.0%	**10,578**	**1.1%**
para 345a	27,719	9.4%	23,375	7.1%	21,661	6.0%	**72,755**	**7.4%**
para 345b	185,862	63.2%	180,858	54.6%	185,909	51.6%	**552,629**	**56.1%**
para 345c			47,674	14.4%	69,874	19.4%	**117,548**	**11.9%**
para 346	15,347	5.2%	10,612	3.2%	8,883	2.5%	**34,842**	**3.5%**
para 347	61,600	20.9%	65,301	19.7%	69,762	19.4%	**196,663**	**20.0%**
B.A.					661	0.2%	**661**	**0.1%**
Total	**294,281**	**100%**	**331,128**	**100%**	**360,267**	**100%**	**985,676**	**100%**

Source: ENEA

The investments activated in the three-year period equalled around 9.5 billion euros (Table 3.2): more than 40% of resources were allocated to para 345b; 25% to the thermal insulation of slabs and roofs (para 345a); slightly more than 9% to the reduction of energy demand for heating the whole building (para 344).

The total investments activated in 2016 were equal to more than 3.3 billion euros (7% more than in 2015): the maximum potential of fiscal deduction which could be claimed by beneficiaries in the next ten years is equal to 2.1 billion euros.

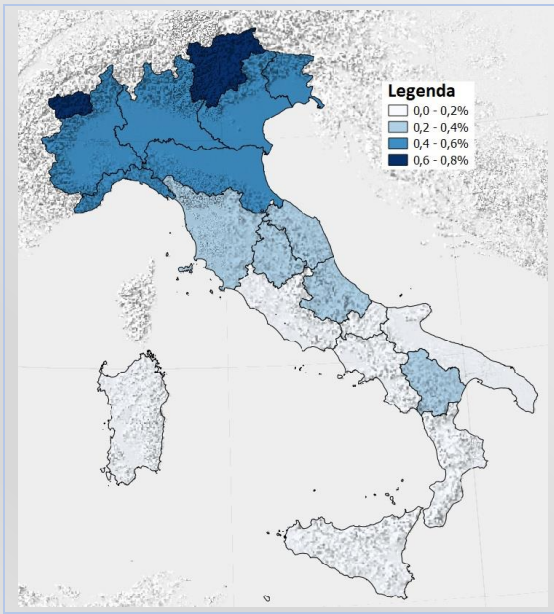
Table 3.2 – Activated investments by paragraph (M€), years 2014-2016

Year	2014		2015		2016		Totale	
Paragraph	M€	%	M€	%	M€	%	M€	%
para 344	283.3	9.2%	275.6	8.9%	303.9	9.2%	**862.9**	**9.1%**
para 345a	861.3	28.1%	776.1	25.1%	764.2	23.1%	**2,401.6**	**25.4%**
para 345b	1,345.5	43.9%	1,296.0	42.0%	1,355.5	41.0%	**3,997.0**	**42.2%**
para 345c			100.4	3.2%	148.4	4.5%	**248.8**	**2.6%**
para 346	99.9	3.3%	66.3	2.1%	56.4	1.7%	**222.6**	**2.4%**
para 347	476.4	15.5%	574.0	18.6%	671.0	20.3%	**1,721.3**	**18.2%**
B.A.					9.2	0.3%	**9.2**	**0.1%**
Total	**3,066.4**	**100%**	**3.088,2**	**100%**	**3.308,7**	**100%**	**9.463,3**	**100%**

Source: ENEA

Figure 3.1 shows the regional distribution of investments share on net disposable income, equal on average to 0.3%, with peaks equal to around 0.7% in Aosta Valley and Trentino South Tyrol.

Figure 3.1 – Ratio between activated investments and net disposable income (I/R), year 2016



Region	I/R
Piedmont	0.51%
Aosta Valley	0.67%
Liguria	0.46%
Lombardy	0.41%
Trentino South Tyrol	0.66%
Veneto	0.44%
Friuli Venezia Giulia	0.51%
Emilia Romagna	0.44%
Tuscany	0.27%
Umbria	0.22%
Marche	0.30%
Latium	0.18%
Abruzzo	0.20%
Molise	0.17%
Campania	0.11%
Apulia	0.15%
Basilicata	0.25%
Calabria	0.11%
Sicily	0.10%
Sardinia	0.16%
Italy	**0.32%**

Source: ENEA elaboration on ENEA and ISTAT data

Achieved savings are equal, overall, to around 3,300 GWh/year, equivalent to slightly more than 0.28 Mtoe/year (Table 3.3).

Table 3.3 – Achieved saving by paragraph (GWh/year), years 2014-2016

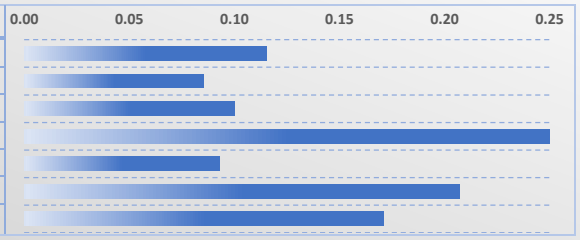
Year	2014		2015		2016		Total	
Paragraph	**GWh/year**	**%**	**GWh/year**	**%**	**GWh/year**	**%**	**GWh/year**	**%**
para 344	87.7	8.1%	80.0	7.3%	82.4	7.4%	**250**	**7.6%**
para 345a	339.4	31.5%	302.9	27.7%	295.8	26.6%	**938**	**28.6%**
para 345b	443.9	41.2%	427.8	39.2%	458.4	41.2%	**1,330**	**40.5%**
para 345c			13.4	1.2%	19.8	1.8%	**33**	**1.0%**
para 346	71.2	6.6%	48.4	4.4%	40.3	3.6%	**160**	**4.9%**
para 347	135.1	12.5%	219.5	20.1%	210.4	18.9%	**565**	**17.2%**
B.A.					5.4	0.5%	**5**	**0.2%**
Total	**1,077.3**	**100%**	**1,091.9**	**100%**	**1,112.5**	**100%**	**3,282**	**100%**

Source: ENEA

The interventions realised in 2016 allowed to reach a saving higher than 1,100 GWh/year, associated in particular to the replacement of windows and shutters (more than 41%) and the thermal insulation of slabs and roofs (more than 26%). Such interventions, together with the reduction of energy demand for heating the whole building, are characterised by the best cost-effectiveness, with an associated cost in the 9-12 eurocent range for each kWh of energy saved during the whole useful life of intervention (Table 3.4).

Table 3.4 – Cost-effectiveness by paragraph (€/kWh), average of years 2014-2016

Paragraph	Useful life	€/kWh
para 344	30	0.12 €
para 345a	30	0.09 €
para 345b	30	0.10 €
para 345c	30	0.15 €
para 346	15	0.09 €
para 347	15	0.21 €
B.A.	10	0.17 €

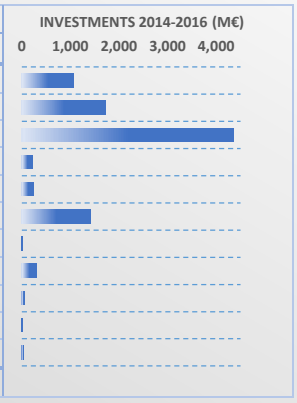


Source: ENEA

In terms of specific interventions and installed technologies, Table 3.5 shows the activated investments, both for 2016 and the 2014-2016 period: in the three-year period, the main share of resources around 4.36 billion euros was allocated on the replacement of 1.9 million windows and shutters (which could be incentivised not only by para 345b, but also by paras 344 and 345a in the case of multiple interventions); more than 1.7 billion euros were instead allocated to more than 52,000 interventions on vertical and sloping walls.

Table 3.5 – Investments (M€) by technology, year 2016 and total of years 2014-2016

Year	2016		2014-2016	
Technology/Intervention	M€	%	M€	%
Vertical walls	301.1	9.1%	1,074	11.4%
Horizontal walls	651.2	19.7%	1,734	18.3%
Windows and shutters	1,447.9	43.8%	4,357	46.0%
Solar thermal	56.4	1.7%	223	2.4%
Solar shading	148.4	4.5%	249	2.6%
Condensation boilers	543.3	16.4%	1,412	14.9%
Geothermal plants	4.1	0.1%	11	0.1%
Heat pumps	110.3	3.3%	297	3.1%
Hot water heat pumps	20.7	0.6%	59	0.6%
Building automation	9.2	0.3%	9	0.1%
Other	16.1	0.5%	39	0.4%
Total	**3,308.7**	**100%**	**9,463**	**100%**



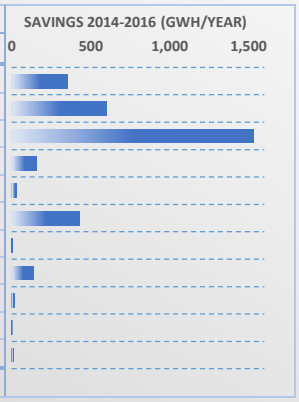
Source: ENEA

The distribution of investments in 2016 mirrors the one observed in the three-year period, with around 1.5 billion euros for 647,000 replaced windows and shutters, more than 650 million euros for around 16,000 interventions on vertical and sloping walls, and more than 300 million for around 16,000 interventions on vertical walls.

Also in terms of energy saving achieved in the 2014-2016 period (Table 3.6), the main contribution derives from the replacement of windows and shutters (46.6% of the total), followed by the interventions on horizontal and sloping walls (18.4%), and vertical walls (10.7%), as well as on the installation of condensation boilers (13%).

Table 3.6 –Savings (GWh/year) by technology, year 2016 and total of years 2014-2016

Year	2016		2014-2016	
Technology/intervention	GWh/y	%	GWh/y	%
Vertical walls	106.9	9.6%	351	10.7%
Horizontal walls	239.1	21.5%	603	18.4%
Windows and shutters	482.3	43.4%	1,531	46.6%
Solar thermal	40.3	3.6%	160	4.9%
Solar shading	19.8	1.8%	33	1.0%
Condensation boilers	167.8	15.1%	428	13.0%
Geothermal plants	0.9	0.1%	3	0.1%
Heat pumps	37.5	3.4%	138	4.2%
Hot water heat pumps	5.6	0.5%	16	0.5%
Building automation	5.4	0.5%	5	0.2%
Other	6.9	0.6%	13	0.4%
Total	**1,112.5**	**100%**	**3,282**	**100%**



Source: ENEA

Examining 2016 only, the main contribution comes from windows and shutters (482 GWh/year out of 1,100), whereas almost one third of the saving was achieved thanks to intervention on walls, vertical, horizontal and sloping (346 GWh/year).

Around 80% of investments activated in 2016 (2.6 billion euros out of 3.3) were devoted to buildings built before the '80s; in particular, around one fourth of total resources (more than 810 million euros) was spent on buildings built in the '60s. Relative to the building typology, around 40% of investments, equal to more than 1.3 billion euros, involved a detached house (for example a small house mono o multi-households); more than 31% of resources (equal to slightly more than 1 billion euros) concerned interventions on the block of flats with more than three floors; finally, slightly more than 20% of activated resources, equal to more than 670 million euros, were devoted to the block of flats with up to three floors.

The main market segments of energy renovation identifiable in 2016 are the buildings with more than three floors of the '60s (45,000 interventions for more than 330 million euros invested) and the detached houses of the post-war period (around 19,000

interventions, around 250 million euros of investments), in '60s (around 25,000 interventions, around 320 million euros of investments) and in '70s (more than 23,000 interventions, around 280 million euros of investments). The allocation of resources observed for years 2014 and 2015 is very similar to the one observed in 2016, shown in Table 3.7.

Table 3.7 – Investments (M€) by building period and typology, year 2016

	Detached house	Block of flats with less than three floors	Block of flats with more than three floors	Other	Total	Total (M€)
< 1919	3.4%	1.8%	2.2%	0.4%	7.8%	258.3
1919-1945	3.2%	1.5%	2.2%	0.3%	7.2%	239.6
1946-1960	7.5%	3.2%	6.4%	1.0%	18.0%	596.6
1961-1970	9.6%	3.5%	10.0%	1.5%	24.5%	811.5
1971-1980	8.4%	4.3%	6.1%	2.5%	21.3%	706.1
1981-1990	3.6%	2.9%	2.3%	1.7%	10.4%	344.9
1991-2000	1.8%	1.6%	0.8%	1.0%	5.3%	175.0
2001-2005	0.5%	0.5%	0.2%	0.2%	1.5%	50.3
> 2006	1.9%	1.0%	0.6%	0.2%	3.8%	125.8
Total (%)	39.8%	20.3%	31.1%	8.8%	100%	
Total (M€)	1,317	672	1,028	291		3,308

Source: ENEA

The saving distribution (Table 3.8) mirrors the allocation of resources: 36% of total savings (400 GWh/year) is achieved in the four segments previously mentioned.

Table 3.8 – Savings (GWh/year) by building period and typology, year 2016

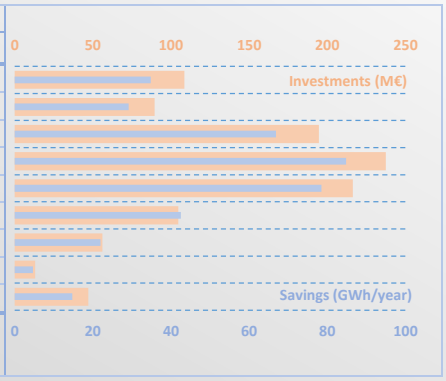
	Detached house	Block of flats with less than three floors	Block of flats with more than three floors	Other	Total	Total (GWh/y)
< 1919	3.3%	1.8%	2.0%	0.4%	7.4%	82.8
1919-1945	3.1%	1.5%	2.0%	0.3%	6.9%	77.2
1946-1960	7.4%	3.2%	6.3%	1.2%	18.2%	201.9
1961-1970	9.7%	3.6%	10.2%	2.0%	25.6%	284.3
1971-1980	8.5%	4.3%	6.2%	3.1%	22.0%	244.7
1981-1990	3.4%	2.5%	2.1%	2.5%	10.5%	117.0
1991-2000	1.7%	1.3%	0.7%	1.4%	5.1%	57.0
2001-2005	0.5%	0.4%	0.2%	0.2%	1.3%	14.5
> 2006	1.6%	0.7%	0.4%	0.2%	3.0%	33.0
Total (%)	39.3%	19.2%	30.1%	11.5%	100%	
Total (GWh/y)	436.9	213.6	334.4	127.6		1,112

Source: ENEA

The interventions relative to the reduction of energy demand for heating the whole building (para 344) and to thermal insulation of slabs and roofs (para 345a) activated around one third of total investment (1.07 billion euros) and achieved more than one third of total saving observed in 2016 (378 GWh/year, equivalent to 0.032 Mtoe). In particular, around 80% of such resources were devoted to interventions on buildings built before '80s and, more in detail, more than 40% concentrated on an envelope dating '60s and '70s (Table 3.9).

Table 3.9 – Investments (M€) and savings (GWh/year) for interventions on the building envelope, year 2016

	Investimenti		Savings	
	M€	%	GWh/y	%
< 1919	108.6	10.2%	34.8	9.2%
1919-1945	89.6	8.4%	29.2	7.7%
1946-1960	194.8	18.2%	66.9	17.7%
1961-1970	237.5	22.2%	84.8	22.4%
1971-1980	216.4	20.3%	78.5	20.8%
1981-1990	104.7	9.8%	42.5	11.2%
1991-2000	56.1	5.3%	21.9	5.8%
2001-2005	13.2	1.2%	4.7	1.2%
> 2006	47.2	4.4%	14.7	3.9%
Total (%)	**1,068.1**	**100%**	**378.2**	**100%**



Source: ENEA

Table 3.10 describes the distribution of investments in replaced windows and shutters: more than half of the market of incentivised frames in 2016 is relative to PVC (53%); for glazing typologies, low-emission glazing covers more than 70% of activated resources.

Table 3.10 – Distribution of investments in windows by frame and glazing typology (%), year 2016

	Wood	Metal, thermal cut	PVC	Mixed	Total
Double	3.8%	3.8%	11.2%	1.9%	**20.7%**
Triple	1.2%	0.9%	2.8%	1.3%	**6.1%**
Low emission	11.3%	13.2%	38.3%	7.8%	**70.6%**
Other	0.3%	0.4%	0.7%	1.3%	**2.7%**
Total	**16.5%**	**18.2%**	**53.0%**	**12.3%**	**100.0%**

Source: ENEA

In particular, PVC windows with low-emission glazing cover more than 38% of the market (more than 550 million euros of investments), to which corresponds around 45% of achieved savings (214 GWh/year) by this intervention typology.

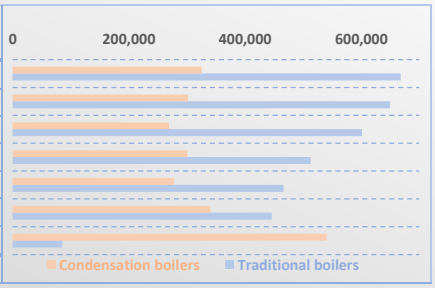
4. The market of incentivised technologies

In last years the market of technologies incentivised by fiscal deductions 55-65% is considerably changed and the products and services offered today are able to combine innovation and limited costs: such effect is the joint result of incentives and regulation. For example, with the entrance into force of the Ecodesign Directive in September 2015 all heating devices can be admitted on the market only if they satisfy minimum energy efficiency requirements and pursue environmental protection.

At the beginning, the obligation of launching on the market only products meeting minimum energy efficiency requirements involved boilers producers, that since 26 September 2015 could not launch on the market models with seasonal efficiency below a certain threshold (in practice, the boilers different from condensation ones), excluding available stock of traditional boilers previously produced. The new obligation livened up the air-conditioning market, involving all branches: in fact, the development of boilers market affected also other markets (regulation and emission) strictly connected to the boilers world, since they together work in conjunction to substitute a thermal plant. In 2016, more than 530,000 gas condensation boilers were sold, an increase by around 70% relative to 2015, representing an impressive trend, strictly connected to the introduction of the new obligations. This pattern implies that air-conditioning market is in recovery, although the sales data registered some years ago for these appliances are still far to be reached again (Table 4.1).

Table 4.1 – Boilers sold on the national market, years 2010-2016

	Traditional boilers	Condensation boilers	Total
2010	668,000	325,500	**993,500**
2011	650,000	302,000	**952,000**
2012	601,500	269,000	**870,500**
2013	513,000	301,000	**814,000**
2014	466,500	277,800	**744,300**
2015	446,000	340,000	**786,000**
2016	85,600	540,600	**626,200**
Total	**3,430,600**	**2,355,900**	**5,786,500**



Source: Assotermica

Final prices, in the case of interventions on the building blocks (inclusive of optionals, but not of installation cost and VAT), are in the range 15,000 euros (140 kW total capacity) and 21,000 euros (220 kW total capacity) for wall-mounted boilers constituted by two power

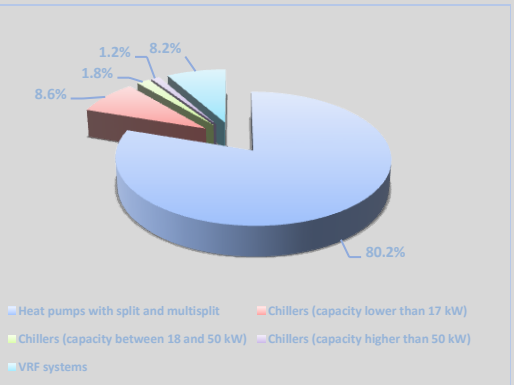
units; they reach around 28,000 euros in the case of three power units (270 kW total capacity). In the case of baseboard boilers with a single power unit, price range between 23,000 euros (230 kW capacity) and 27,000 euros (280 kW capacity); in the case of three power units they range between 29,000 euros (290 kW total capacity) and 31,000 euros (330 kW total capacity) (source: Assotermica).

The introduction, in 2014, of the D1 electricity experimental tariff for the heat pumps used as primary heating device in the residential sector, the possibility to obtain different incentives at national level, and the climatic conditions in the last few years, all together have contributed remarkably and in a synergic way to the growth of associated market. The new tariff seems to have reached the objective: in December 2016, the heat pumps benefitting of D1 tariff (namely, the ones used as primary heating device in the residential sector) were 16,000, three fourths of which installed between 2014 and 2016, during the experimental phase of the tariff. Moreover, around 60% of users having installed heat pumps and applied for D1 tariff have, at the same time, combined the plant with a photovoltaic net-metering system (the so-called "scambio sul posto"). D1 tariff has then contributed to the increase in heat pumps sales, or better, given its characteristics, to the increase in the sales of plants usable in the residential sector.

The national market in 2016 of the heat pumps used as primary heating device in the residential sector can be estimated in around 220,000 machineries, of which 176,000 with split and multi-split, given the ease of application. Also air cooled chillers, conceived for use in the service sector and now commonly used also in the residential one, in 2016 had a good increase in their sales: for those with capacity up to 17 kW, the increase was 25% relative to previous year, and the increase in turnover equalled 27% (Table 4.2).

Table 4.2 – Heat pumps used as primary heating device sold on the national market (million units), years 2016

	N.	%
Heat pumps with split and multisplit	176,000	80.1%
Air cooled chillers (capacity lower than 17 kW)	19,000	8.6%
Air cooled chillers (capacity between 18 and 50 kW)	4,000	1.8%
Air cooled chillers (capacity higher than 50 kW)	2,700	1.2%
VRF systems	18,000	8.2%
Total	**219,700**	**100.0%**



Source: Assoclima

Relative to the unitary prices of the machinery in wholesale market, in the last five years the price of split and multi-split heat pumps decreased, whereas in 2016 a yearly increase equal to 2% for reversible chillers and a decrease equal to 3% for VRF systems were observed (source: Assoclima).

In 2016 the Italian market of solar thermal panels saw the installation of around 210,000 gross m^2 of panels, as opposed to 231,000 gross m^2 in 2015 and 268,500 gross m^2 in 2014 (source: GSE S.p.A. - Assotermica). These data show that in the last few years the national market of solar thermal panels was characterised by a negative trend which, however, did not involve only our territory but also other European countries, who experienced in 2016 a decrease, relative to 2015, greater than the one observed in Italy: for example, in France the negative trend reached a 30% decrease and in the United Kingdom a 40% decrease.

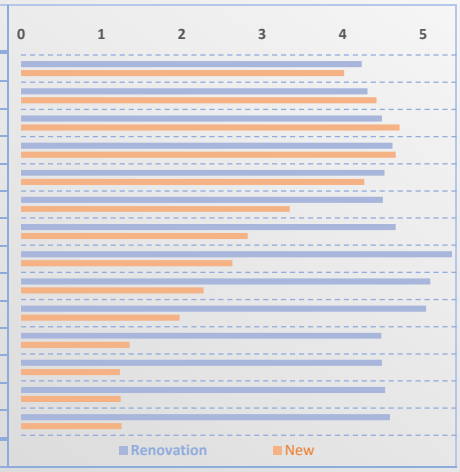
A significant contribution to this phenomenon should be attributed to the crisis of the construction sector or more precisely, the crisis of its activity associated to new buildings, the negative trend of which was counterbalanced, up to 2015, by the renovation of existing buildings. A moderate reversal of this trend has been observed since 2016.

Relative to the costs of a plant sized for a four-member household, on average a forced circulation kit could cost around 4,000 euros included VAT; 5,000 euros included VAT in the case of evacuated tubes technology. Such costs are difficult to compare to those associated to the solutions proposed in the last few years, since in the meantime both the technical characteristics and the performances of components have changed.

In 2016 the overall windows, shutters and continuous facades demand reached in the Italian market a value equal to around 4.27 billion euros, 2.75 of which in the residential sector and 1.52 in the non-residential, including 485 million euros of continuous facades (source: UNICMI). In particular, in the last three years the sales of windows used in the residential sector for renovation remained stable, around 4.5 million units per year, with a slight increase in the sales in 2016 (4.53 million units), which allows to foresee a further one (4.59 million units) in 2017. On the contrary, the sales of windows used in new buildings have undergone a severe reduction, showing a first weak reversal in this trend (1.24 million units) only in 2016, with a further increase in the sales (1.25 million units) foreseen for 2017 (Table 4.3). Between 2008 and 2016 a gradual change was observed in the market shares of the three main materials used to produce windows: the most significant increase concerned those in PVC, moving from a market share equal to 16% in 2008 to one equal to 26% in 2016, to the detriment of wood windows; aluminium windows did not undergo significant changes in time. In 2016 the market value equalled 990 million euros for PVC windows, 1,420 million euros for wood windows and 1,400 million euros for metallic ones.

Table 4.3 – Windows sold in the residential sector for new buildings and renovation of existing ones (million units), years 2004-2017

	New	Renovation	Total
2004	4.02	4.24	**8.26**
2005	4.42	4.31	**8.73**
2006	4.71	4.49	**9.2**
2007	4.66	4.62	**9.28**
2008	4.27	4.52	**8.79**
2009	3.34	4.5	**7.84**
2010	2.82	4.66	**7.48**
2011	2.63	5.36	**7.99**
2012	2.27	5.09	**7.36**
2013	1.97	5.04	**7.01**
2014	1.35	4.48	**5.83**
2015	1.23	4.49	**5.72**
2016	1.24	4.53	**5.77**
2017*	1.25	4.59	**5.84**
Total	**22.37**	**47.26**	**69.63**



* Estimated

Source: UNICMI

The increase in market shares of PVC windows is clearly attributable to their good quality-price ratio which, for the same thermal performances required to access fiscal incentives, has a lower sale price relative to other technologies. Such characteristic is ascribable to the increasing imports of these products, since 2012, from countries as Poland and Romania, at lower prices relative to the traditional trade partners, Germany and Austria, from which Italy still imports PVC windows. In 2016 total imports of PVC windows (considering all partners, not only the main four mentioned above), reached a total market value, and then a total volume of sales, equal to 200 million euros, almost 7% of the total market of windows and shutters. Although the impact is numerically negligible when examining the overall market value, it still contributes to influence the trend of minimum prices for final users.

Faced with the competition of PVC windows, in the last years the enterprises of aluminium windows focused on average and high array products, meeting the demand from users having average-high income: a decrease of unitary sales was observed, combined with a stability of the market turnovers.

Relative to the average market price, computed as average of the prices of the three windows typologies in the three main materials, PVC windows cost around 20% less than the average, aluminium and wood windows respectively 4% and 13% more.

5. The building sector and the actors involved in condominium renovation

Fiscal incentives for building renovation (50% deduction) and for energy renovation (65% deduction) implied between 1998 and 2016 more than 14.2 million interventions, implemented by 55% of total Italian households. The investments corresponding to these interventions are equal to 237 billion euros, 205 billion of which concerned building renovation and slightly less than 32 billion energy renovation. In 2016 the first signs of reversal of the trend were observed, lowering the recessive cycle that hit the construction sector and starting a positive trend no longer associated to new buildings but rather to the renovation of the existing building stock.

In terms of estimation of employment impacts, in the last four years (2013-2016) the incentivised investments generated slightly less than 270,000 direct jobs every year, whilst considering also indirect jobs the total is greater than 400,000 new employees per year: only in 2016, 419,000 new jobs have been created. Fiscal incentives have been an important tool against the crisis and fundamental to the recovery, as shown by the fact that overall, between 2008 and 2016, 600,000 jobs have been lost in the sector (source: CRESME).

Several institutional and professional profiles are involved in the renovation process, starting from local administrators.

The experiences on the territory confirmed the ongoing evolution process towards a construction industry more and more attentive to environmental sustainability issues. 1,251 Italian municipalities have changed their building regulations introducing sustainability parameters: overall they represent 15.6% of total municipalities and in terms of involved population they cover 24 million inhabitants. Most common issues are thermal insulation, photovoltaic and solar thermal. Regarding to the geographical distribution of sustainable regulations, the Regions in first position are those in Centre-North with Lombardy (503 municipalities), Tuscany (148), Emilia Romagna (139), Piedmont (104) and Veneto (102). Also in Southern Italy a growing number of administrations have introduced issues as renewable obligations, building orientation and thermal insulation in their building regulations (source: Legambiente).

The described process is perfectly coherent with the direction chosen by the Stability Law 2017, favouring global efficiency interventions of the whole building-plant system and of envelope insulation, in particular for medium-large buildings, showing the highest energy efficiency potential. In fact, more than 60% of building blocks were built before 1976, the year of Law no. 373 that introduced technical performances to regulate saving and energy performance. Moreover, when Law n.10/91 entered into force, aimed at limiting energy consumption for thermal uses in buildings, 82% of building blocks in Italy had already been built. Also for this reason, from a qualitative point of view, 30% of building blocks is currently in mediocre or very bad conservation conditions (source: ISTAT). Moreover, in

more than 400,000 of analysed building blocks (around one third of the total) having centralised heating systems, around two thirds were installed more than 15 years ago and would need renovation interventions, aimed at improving energy efficiency and living comfort (source: ANACI).

Such interventions typologies ensure the greatest consumption reduction, but at the same time require the highest financial contribution from the owners. Such issue constitutes a relevant barrier to the realisation of interventions, since the incentive is conceived as ex-post reimbursement, split on 10 years: then, the burden of financial contribution to realise the interventions is borne entirely by the owners, who should pay for the works before getting the incentive. Another obstacle to the use of the incentive as credit guarantee is the uncertainty on its amount, since the fiscal coverage of tax payer could change consistently due to reasons not depending on the intervention itself (job loss, retirement, etc...) and/or due to the access to other fiscal deductions (for example, deductions for dependents, for salaries or retirement incomes). Especially in the case of global renovation interventions, that are clearly the most expensive ones and then imply an incentive level potentially higher, the actual fiscal deduction could turn out to be lower than 65% of incurred cost. Indeed, during the ten years in which the incentive is provided, the tax owed by the beneficiary could prove to be lower than the deductions he is entitled to, nullifying in this way, completely or partly, the possibility to enjoy the fiscal benefit.

Applied to every single building block, such economic and fiscal issues could make it difficult to reach the majority in the condominium assembly to approve the renovation works. Indeed, the approval phase has always represented the weakest link to implement whatever activity at building block level. Moreover, reaching the ordinary quorum in the assembly is not enough to get the works started in the case of global renovation.

In the case of energy renovation of common parts of buildings, the possibility introduced in the Stability Law to transfer the corresponding credit to the suppliers who realised the interventions, or to other private actors having an adequate fiscal coverage, allows to make the amount of the incentive certain, and in the case of transfer to the suppliers, to consistently reduce the initial payment for the co-owners, condition which could turn out to be crucial to the approval of works in the condominium assembly.

The lack of any possibility to transfer the credit to financial institutions and intermediaries does not impede virtuous mechanisms to arise, which could make it possible to take out a condominium loan for the expenditure share not transferred as tax credit, relying on the lower amount required and, more in general, on the higher solvency of single co-owners.

The condominium administrator could have a central and proactive role in the promotion of intervention, being the first link of a decisional chain that involves, at different levels, a significant number of actors being in touch with the co-owners. Knowledge circulation is key to make choices simpler and more informed. Counting on the acquired competences and on the trust and responsibility relationship with the co-owners, the administrator

could value his role of “facilitator” and be in the best conditions to promote and follow all the phases of the energy renovation interventions, from the choice of most efficient and cost-effective solutions, also from the financing point of view, to the final trial.

Engineers, architects and surveyors are the main specialist professional profiles involved in the planning and implementation of works, and they play a responsibility role to ensure the effectiveness and conformity of building renovation interventions, both relative to the citizens and to the minimum quality levels required by the regulation framework and the market.

Basic knowledge and experience of the professionals have improved thanks to specific training programs, with the regard to both lifelong training and the acquisition of the qualification required by sectoral regulation, for example relative to the elaboration of building’s EPC. Such process, beyond ensuring the needed tools to direct citizens towards an appropriate planning of interventions, also to the aim of enjoying the incentive, would also allow them to ensure environmental sustainability more and more, and promote zero and almost zero emissions buildings as well as sustainable regeneration of cities (and abandoned areas).

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