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Energy Efficiency in the building sector: skills, business models and public private partnerships

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Dario DI SANTO, Giuseppe TOMMASETTI, Veronica VENTURINI,
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Research project

Energy efficiency in the building sector: skills, business models and public-private partnerships

The research project – that it is focused on the Italian situation - is structured in ten chapters and proposes a series of recommendations for political decision makers and market operators. The recourse to the energy service companies (ESCO) and Energy Performance Contracting (EPC) is deemed as fundamental for the diffusion of energy efficiency investments on private and public buildings sector from economic and financial aspects. Nevertheless, even if the 2012/27/EU directive encourages member states to use EPC and ESCO “to finance renovations and implement plans to maintain or improve energy efficiency in the long term”, strong barriers impede a large diffusion of these instruments. The level of integration of available technologies, the barriers that impede a strong dissemination of efficient construction-industry technologies on a larger scale, the actual implementation of innovative and successful business models to improve energy efficiency in the public building sector are the main aspects taken into consideration.

The research analyses three main parts:

1. The degree of integration of available technologies, the skills asked for and the skills necessary to manage this integration, and the interaction between the various players and the (public and private) parties concerned.
2. The (financial, administrative and legal) barriers that are obstacles to the massive dissemination of efficient construction-industry technologies on a larger scale, and that impede an integrated and holistic approach – instead of the actual fragmented approach – from catching on.
3. The actual implementation of innovative and successful business models to improve energy efficiency in the public building sector.

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Abstract

After the launch of the Kyoto Protocol numerous EU directives were issued on energy efficiency related themes, such as cogeneration, energy buildings performance, emission trading, renewable sources, and the launch of the 20-20-20 EU strategy. Energy efficiency presents a huge growth potential, but its characteristics and the market structure require the introduction of new business models – together with adequate policies and the development of new skills and competences – in order to achieve the impending targets.

Starting from the present market situation and the current energy policies this research analyses the available energy efficiency solutions and the skills and approaches needed in order to exploit them, both in terms of new policies and of innovative business models. New business models and approaches are already being tested on the market, aiming at overcoming the existing barriers that impede traditional approaches. This implies the availability of energy audits and energy management systems, the diffusion of EPC contracts and of the requested professional competences, the development of models capable of creating large projects by collecting small and dispersed ones, and, last but not least, a leadership change towards building and companies management.

The research proposes a series of recommendations and possible solutions for political decision makers and market operators trying to exploit the opportunities of energy efficiency in buildings.

Keywords: energy, energy efficiency, policy, ESCO, EPC, TPF, barrier, building, public administration, incentive, bank, financing, case study, business model, energy manager, energy efficiency expert, technology, renewable energy solution, energy efficiency solution

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Disclaimer

The findings, interpretations and conclusions expressed in this publication are those of the author and do not necessarily reflect the positions of Enel Foundation, nor does citing of trade names or commercial processes constitute endorsement.

Abbreviations

AEEGSI - Italian electricity, gas, and hydric services authority

APE - Energy performance certificate for buildings (as provided by directive 2010/31/EU)

CHP - Combined heat and power, high-performance cogeneration

DHW - Domestic hot water

DSO - Distribution system operator, electricity or natural gas distributor

EC - European Commission

EED - Energy efficiency directive (directive 2012/27/EU)

EEM - Energy-management expert

EEO - Energy efficiency obligation

EM - Energy manager

EMS - Energy management system

ENEA - Italian agency for new technologies, energy and sustainable economic development

EnPI - Energy performance indicator, any KPI designed to monitor energy consumption

EPBD - Energy performance of buildings directive (directive 2010/31/EU)

EPC - Energy performance contract

ESCO - Energy service company

EU - European Union

GME - Italian energy markets operator

GPP - Green public procurement

GSE - Italian energy services operator

HV - High voltage

IRR - Internal rate of return

LV - Low voltage

MV - Medium voltage

NEEAP - National energy efficiency action plan (as provided by directives 2006/32/EC and EED)

NPV - Net present value

PA - Public administration

RES - Renewable energy sources

SEN - Italian national energy strategy (as provided by D.M. 8 March 2013)

SEU - Efficient end user consumption system

SME - Small and medium enterprise

SSP - On-site exchange (net metering)

TOE - Ton of oil equivalent

TPF - Third-party financing

WhC - White certificates

Introduction

The severe international energy crisis in the seventies generated ideal conditions for new players to look at the international energy market: energy managers (EM) and energy service companies (ESCO). The main objectives of both of these players included a proposed reduction in energy consumption in buildings and businesses, with various important significant results achieved in those years.

Laws were promulgated in many countries in the seventies and eighties to stimulate energy efficiency and to counteract the risks associated with the scarcity or high cost of fossil fuels. Many legal measures regarded buildings and sought to popularize thermal insulation and high-efficiency systems, in addition to bioclimatic solution studies.

In the nineties, however, the costs of fossil fuels, and petroleum in particular, reached historical lows. This countered the extensive application of what the laws had prescribed and decelerated energy-efficiency investments.

Global policies took hold between the end of the nineties and the first decade of this century, starting from the Kyoto Protocol. At European level first came the directives on ecodesign and labeling, renewable sources, emission trading, building energy performance, and cogeneration, followed by the 20-20-20 Package and the enforcement of the previous directives. This environmental and energy conscious approach, together with the increase of the cost of fossil fuels around 2005 and the worldwide financial crisis, set the basis for a new re-launching and development of end-use energy efficiency, and renewable and alternative sources.

Unfortunately, the scarcity of economic resources and market uncertainties render energy efficiency investments difficult for many users especially when it would be most necessary.

One advantage of energy improvement projects is the cash flow generated from savings, which can form the basis for funding the necessary energy-efficiency investments and bank lending, allowing intervention through third-party funding, even when the end user has no resources of his or her own. A type of contract that encompasses this feature is Energy Performance Contracting (EPC), particularly interesting for customers who wouldn't otherwise be capable of sustaining this type of operation: this is why the Public Administration and residential customers are ideal targets in current circumstances in many European Countries, given the severe economic crisis and high energy prices. The EPC offered by ESCOs is accompanied by guaranteed results, and this can be used as a starting point to devise a bank loan based totally or to a large part on project financing and not on collateral or the customers' creditworthiness.

The European Commission (EC) recognized the importance of recourse to EPC (as well as TPF) in public and private building industries in several public documents, for example with Directive 2006/32/EC on energy efficiency and energy services, and more recently in the 2011 Energy efficiency plan and in the consequential directive 2012/27/EU.

The civilian sector was characterized by continuous growth of energy consumption in past decades; for this reason there are interesting opportunities to improve energy use and control demand. Despite this, several barriers have played a part in delaying the dissemination of energy-efficiency measures: the lack of resources for public buildings, the relatively low energy expenses in the services sector (if compared with total expenses), the minimal awareness and knowledge of the problem in the residential sector and in general.

The public sector is recognized as a core sector, both for the spending review, common to several European Countries because of the financial crisis, and due to its guiding role in private-sector investments: it is no coincidence that the new energy efficiency Directive focuses on energy savings originating from the public administration as the key point of the European energy-efficiency policy.

In the models described above, Europe and Italy see a solution capable of meeting the 2020 objectives and responding to the contingencies related to the crisis, therefore they promote the role in various legal measures. The barriers that impede traditional approaches however also regard the EPC approach; therefore it is necessary to develop innovative business models able to transform policies and opportunities in the building sector into true accomplishments.

1 Research objectives

The project aims to analyze innovative tasks, business models, and public support to promote energy efficiency in the public building sector, linking up with the development of an industrial policy in line with the Green Growth Strategy, also through the development of the ESCO model.

The study in particular examines:

1. The degree of integration of available technologies, the skills asked for and the skills necessary to manage this integration, and the interaction between the various players and the (public and private) parties concerned.
2. The (financial, administrative and legal) barriers that are obstacles to the massive dissemination of efficient construction-industry technologies on a larger scale, and that impede an integrated and holistic approach – instead of the actual fragmented approach – from catching on.
3. The actual implementation of innovative and successful business models to improve energy efficiency in the public building sector (ESCO, utilities, “green banks”, etc.).

The analyses concentrates on the Italian situation and is presented as a study structured in ten chapters, gathering interesting suggestions and solutions, even from major European countries.

Based on experiences and analyses acquired from the above activities, the study proposes a series of recommendations for political decision makers and certain market operators, also suggesting possible solutions to accelerate and simplify the existing dynamics. The study also illustrates the best experiences and best practices with the public and private parties concerned and sets out to provide solutions to promote networking, associations, and partnerships for energy efficiency among the parties concerned in the building sector.

1.1 Approach and methodology

The project was carried out in the following stages:

- researching the major studies and projects dedicated to public support activities, to ESCOs, and to energy-efficiency services (including those implemented by FIRE in recent years);
- defining the major obstacles, integrating available technologies, the skills and capacities of the energy services operators, and end-user's needs;
- analyzing certain case-studies that have overcome barriers mentioned;

- surveying the parties concerned based on the above results, with the purpose of verifying the possibility for success of certain feasible solutions;
- discussing the results with policy makers and possibility of intervening and amending the regulatory framework;
- defining proposals and conclusions.

In recent years, FIRE has collaborated with most the associations that bear interest in energy efficiency at the Italian level and has conducted numerous studies regarding end-use energy efficiency, including incentive policies, existing barriers, the building sector, ESCOs, and third-party financing. The Federation participated and participates in several European projects associated with the theme of energy efficiency for in both policy and in technological terms, and coordinates, upon commission by ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development), the energy services workgroup of the Concerted Action for Energy Efficiency Directive 2012/27/EU (www.esd-ca.eu) that guarantees a dense network of contacts on the European level. The experience acquired in recent years formed the basis of this study.

2 Italian building energy efficiency legislation

As far back as 1991 in Italy, with Italian law no. 10 on "regulations for the implementation of the national energy plan in matters of the rational use of energy, for energy savings, and for the development of renewable energy sources", aspects for building energy recovery were introduced with a special "title on provision to limit energy consumption in buildings". Italian law 10/1991, in addition to indicating the minimum performance requirements and the obligation to file an energy performance report in the authorization to build new buildings, anticipated Directive 2002/91/EC introducing a control scheme for heating and cooling systems and a mechanism similar to the energy certification for buildings. Unfortunately only the heating system scheme was initiated through Italian Presidential Decree 412/1993. Law 10/1991 was very innovative and characterized by a holistic approach, although only partially implemented.

In the years that followed, art. 30 of Italian Legislative Decree no. 112 dated 31 March 1998 delegated administrative functions in matters of energy to the regions, and, pursuant to the above law 10/1991, certain aspects associated with the role of assisting local entities for activities related to educating the public and training public and private operators in the fields of the design, installation, operations, and control of heating systems.

Therefore Italy had a part of the work already done upon the enactment of the Directive 2002/91/EC through Italian Legislative Decree no. 192 dated 19 August 2005 (amended and supplemented by Italian Legislative Decree no. 311 dated 29 December 2006). The enacting decree defined the general criteria, calculation methods, and the minimum requirements concerning energy performance of buildings and the heating systems for winter climate control, for the production of domestic hot water (DHW), for energy performance of heating systems for summer climate control, and limited to the tertiary sector, for artificial building lighting. Directive 2002/91/EC left the member states free with regard to detailed certification rules, allowing each country to assess its peculiar situation, making a comparison between the various schemes adopted on a community level complex. On 1 February 2012, directive 2002/91/EC was repealed by directive 2010/31/EC (EPBD2) dated 19 May 2010, enacted in Italy with Italian Decreed Law no. 63 dated 4 June 2013, converted with Italian Law no. 90 dated 3 August 2013. EPBD2 introduced the "nearly zero-energy building", making it mandatory for new construction as of 31 December 2020 (this dead line is pushed up two years for public buildings).

The application of the European directives on the energy performance of buildings in Italy have a rather complex history that is not yet over, with significant differences between the different Regions in terms of performance assessments, drafting the Energy Performance Certificate, and synergy with the regional legislation with regards to building upgrades.

As regards quality, doubt also remains concerning the quality of the certificates issued and the completeness of information that they contain. Energy Performance Certificates are often sold on the internet at prices that do not even come close to amortizing the cost of an audit of the property. It is no coincidence that the recommendation contemplated by the legislation – that information should be provided to the customer on how to improve the energy class – is often

lacking or generic. Only recently certain Regions have begun to initiate field audits to verify that the Energy Performance Certificates issued comply with regulatory specifications.

The constitutional decision to consider energy a concurrent matter between the Central government and Regional administrations therefore helped cloud the regulatory framework, but the central decisions certainly do not help to develop an organic framework, considering the delays and that even in 2013 the Italian D.L. 23 December 2013 No. 145 ("Destination Italy"), the Law 27 December 2013 No. 147 ("Stability Law"), and the D.L. 30 December 2013 No. 150 ("Deadline extension act") contained provisions in conflict with each other.

Despite the doubts cast on the certification process, the number of new Class A and Class A+ buildings has been increasing over the years. Designers, builders, and technicians debate about energy topics and users demand high levels of quality. Thanks to the management of the Energy Performance Certificates, many Regions have also begun setting up an energy cadastre to store and manage the content of the certificates themselves. In Lombardy for example, more than 1,200,000 certificates have been filed and there is an active regional cadastre for heating systems. This way it is easier to perform audit, verification, and inspection activities.

Having made it mandatory to specify the energy class in property estate sales and lease announcements had also the benefit of disseminating sensitivity of end-users to these issues. The fact that the indicated energy class is G in the majority of the announcements (partially because until Italian Decreed Law 63/2013 was issued, it was possible to self-certify this class) places greater emphasis on high-class real-estate assets and helps to make them appealing.

The issuing of the new decrees enacting Decreed Law 63/2013 could be the occasion to reorganize the entire sector. In any case, a revision of the governance process in the country, as indicated in the National Energy Strategy ("SEN"), is fundamental to create the best possible conditions for developing the building energy upgrading market.

3 Energy efficiency in the Public Administration and background information

Directive 2006/32/EC, Italian Legislative Decree 115/08 with which it was transposed, and the more recent Directive 2012/27/EU, vests the public administrations, which must be an example for citizens and businesses, with a key role.

In carrying out its institutional duty, the public administration is therefore invested with a dual role: private and public. In the former, it is responsible for managing property and a series of services that include the public offices (municipal building, grammar and middle schools, pools, health facilities, etc.), public lighting and traffic lights, service infrastructures (waste collection and treatment facilities, waterworks), and transportation. These services may be supplied directly or entrusted to a third party. Knowledge of public assets and the services offered is indispensable for preparing the energy balances, proceeding with the analysis, proposing solutions, following-up on decisions, measuring results, and, based on this, securing access to incentivizing mechanisms that include the “*conto termico*” scheme and white certificates.

Important instruments in the field of public real-estate management include:

- *energy certification* (the first step to know needs/consumptions and the first type of energy indicator);
- *energy diagnosis and monitoring* (energy accounting is decisive both for the possibility of securing third-party financing, and for defining the energy-performance indicators – EnPI – essential to optimize the management of energy consumption);
- *energy manager (article 19 of Italian Law 10/1991)* (an energy manager is fundamental for implementing effective action);
- *ISO 50001 energy management system* (the EMS is the parallel program of the Covenant of Mayors applied to public real-estate);
- *energy performance contracts and third-party financing* (these allow energy renovation of buildings in the absence of the financial resources requested for the necessary investments);
- *Green procurement and LCCA¹* (energy-efficiency combines together with environmental aspects and with the exact assessment of investments);
- *incentives* (the “*conto termico*” subsidy, white certificates and the tariffs dedicated to renewable sources help finance the renovation of the real estate assets and the technical utilities).

¹ LCCA: life cycle cost analysis allows energy costs related to the use of a piece of equipment or a system to be taken into account, rendering the assessment of investment alternatives more exact and precise.

The second aspect, the public one, regards the regulation of citizens' consumption. Most energy consumption in industrialized countries in fact takes place in cities and is closely correlated with transportation, heating, and structural building characteristics.

The main instruments available in this case are:

- *the Covenant of Mayors*, adoption of a minimum energy-efficiency improvement policy of 20% and a territorial energy management system;
- *building regulations*, oriented towards promoting renewable sources and the efficient energy use;
- *management of public concessions*, the periodic renewal of concession contracts is a good time to reconsider contract conditions to enforce energy efficiency obligations;
- *contracted territorial planning*, new settlements or important upgrades allow integrated and energetically efficient systems – e.g. trigeneration systems serving new buildings – to be built at low cost. It is therefore important to anticipate these systems in the planning stage;
- *loans and competitions*, in the current situation where resources are limited, it is important to concentrate loans on energy diagnosis within in the territory and in businesses, in preparing general plans and specifications, in training and communication activities and especially in control and monitoring of the programs implemented;
- *audits*, without field inspections, most obligations risk being applied in name only.

The building types considered in this document are fundamentally those pertaining to “executive” sectors (e.g. offices of local authorities, research organizations, regions, ministries, tax agencies, museums, barracks, etc.) and “schools” (kindergarten, elementary, middle, and secondary school).

4 Public Administration buildings: figures and state-of-the-art of buildings assets

Energy consumption in a public administration building depends on various factors associated with the property – for example, the quality of the building structure, of the technological facilities, and of the maintenance and operations – and not associated with the property – for example the occupants' behavior, and how and for how long the rooms are used. There is another important external factor, the climatic trend, which cannot be controlled and may involve large variations in annual consumption.

Although the factors associated with property management are predominant in defining energy consumption, the behavior and actually occupation of the buildings are important due to the repercussions they can have and due the relations with plant operation from the perspective of energy service with guaranteed energy performance.

ENEA and CRESME (The Social Economic Market Research Center for the Construction Industry and the Territory) analyzed the state of the art of “executive” and “school” sectors within the scope of the Electrical System Research program, and the results obtained were published in the “Investigation on public-buildings (executive and school) consumption and potential for energy efficiency operations” report, from which the following information was taken and to which the reader is referred for detailed information².

The “Public Executive” sector has been studied hardly at all until now and is one of the least know sectors: there are approximately 15,000 Contracting Authorities in Italy and the “Executive” buildings fully occupied by not residential (public and private) occupancy is equal to about 80,000 units. The number of buildings totally designated for office use amount to approximately 13,600 buildings, for a covered surface area of 23.4 million square meters. The table below shows the breakdown of public buildings by compartment.

² Marco Citterio, Gaetano Fasano, ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development) (2009), “Investigation on public-buildings (executive and school) consumption and potential for energy efficiency operations,” Electrical System Research.

Table 1 - Numerical repartitioning for buildings designated strictly for office use

	Buildings	Surface Area (m²)
PUBLIC ADMINISTRATION	9,550	16,881,119
EDUCATION	2,025	2,594,456
HEALTHCARE	508	2,285,834
RESEARCH AND DEVELOPMENT	247	491,701
ELECTRICAL POWER GAS WATER	129	100,312
REAL ESTATE AND CONSTRUCTION	128	189,469
OTHER	993	955,683
TOTAL	13,581	23,428,573

Source: CRESME-ENEA

As regards the territorial subdivision, the provinces of Rome, Turin, Naples, and Milan hold 14% of entire national property. Rome has the most buildings (735) followed by the provinces of Turin (426), Naples (376), and Milan (371).

As regard schools, an overall number of about 43,000 units broken down as follows can be considered: 17,000 units in the north, 9,500 in the center, and 16,500 in the south. The breakdown in the investigation cited above was made using the territorial subdivision of assigned personnel as a baseline (source: CONSIP).

5 Energy services and directive 2006/32/EC

Directive 2006/32/EC was transposed in the Italian legislative framework through Italian Legislative Decree no. 115 of 2008, who assimilates the definitions provided by European Community directive regarding the key elements of the energy services market (ESCO, EPC, TPF). The directive urged each of the member states to ensure the growth and dissemination of the energy services market in their own countries through legislative transposition acts. The public sector, in particular, as affirmed in art. 5, had the key role of:

"(acting) as a model within the context of this directive. For this purpose (...) they effectively inform citizens and/or enterprises, as the case may be, regarding the model role and actions of the public sector".

Key topics such as energy-efficiency instruments and monitoring, the simplification and removal of regulatory barriers, in addition to the accompanying measures were introduced to the Italian legal system in the cited Legislative Decree. Again to highlight the key role of the public in this sphere, some specific aspects are pointed out, such as for example ENEA's role as the national agency on energy efficiency, to work side-by-side with the Ministry for economic development in monitoring the progress made out with respect to the NEEAPs and in implementing the energy efficiency support schemes. The public sector was also asked to use the best applications to implement the efficiency activities (energy audits, EPC, Green public procurement, TPF, etc,) from a technical, economical and financial perspective. In Schedule II of the Energy Service Contract, which governs the provision of goods and services necessary to best manage and improve the energy transformation and use process and in the Energy Service Plus Contract, the decree also devoted special attention on EPC scheme for Public Authorities with the objective of creating a standardized contract that administrations could use to achieve the energy savings defined by the NEEAP. All of this in the view of facilitating the Public Administration in playing the "exemplary role" entrusted to it by the legislative decree itself.

6 ESCOs and the contractual models

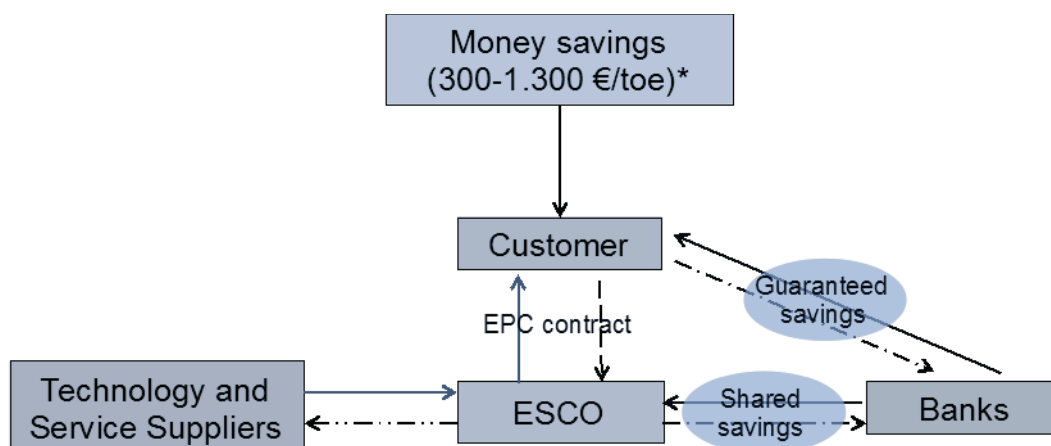
Below the Figure 1 shows two types of contract models used by the ESCOs in proposing their energy services to end customers: one is the shared savings model, the other the guaranteed savings model.

In the first model the economic savings are shared between the ESCO and the end customer as a function of the type of operation and the payback period. The ESCO is responsible for the plants, and maintains and manages the property until the termination of the contract, together with the technical and financial risks associated with the energy-efficiency project. The ESCO and the customer must establish a measurement and verification protocol to be inserted in the contract.

In the second model, the loan is granted to the customer, who nevertheless benefits from the existence of a service contract guaranteed by the ESCO. The service company is also responsible for the plant and its operation until the termination of the contract.

In both cases, it's necessary to have a solid base of consumption data, necessary to correctly assess the flow of funds deriving from energy saving, and to have methods to measure and verify the savings³.

Figure 1. A typical operating scheme of the market: ESCO, EPC and TPF



Source: FIRE's own elaboration

³ For example methodologies such as those proposed by the International performance measurement and verification protocols, available on the website www.evo.org may be used.

7 UNI CEI 11352 standard on ESCOs

The Italian UNI CEI 11352 standard for the certification of ESCOs was published in the 2010 and is in line with the prescriptions of directive 2006/32/EC with regard to the certification of energy service providers. It also anticipates the indications in directive 2012/27/EU related to the qualification and certification of energy efficiency providers.

The standard stipulates the minimum requirements that an energy service provider must fulfil: the organizational aspect, the capability to carry on energy diagnosis and feasibility studies, and to plan, build, and manage energy efficiency projects, the possibility of contracting electricity, natural gas and other fuels for the end-user, and the ability to finance the projects or to help their clients to obtain a dedicated loan and to access incentive schemes. For this purpose a checklist provided by the standard supports the auditors in assessing the provider's capacity.

Following the criteria established by UNI CEI 11352, the ESCO must be able to improve the end customers' energy efficiency while guaranteeing the results and helping the client to access financing, thus transferring to the ESCO certain technical and financial risks (to be indicated in the energy service contract).

UNI CEI 11352 was written as a response to demands originating from the energy services market and to the necessity to clarify what an energy service company is, how it must operate, and what its main responsibilities are. The certification process from accredited bodies guarantees the capabilities of the ESCO both for the clients and for the financial institutions that seeks tools and procedures to manage any risk involved in an energy efficiency project in order to be able to grant loans based on project financing and not (only) on the client creditworthiness.

In compliance with UNI CEI 11352, an ESCO must provide an energy-efficiency service based on another technical standard, EN 15900. In short, this standard establishes the minimum energy efficiency service requirements, which must aim to improve efficiency establishing guarantees and responsibilities for both the ESCO and the end customers. The efficient energy service requirements include the quantification of efficiency improvement by the company providing the service, which may or may not be guaranteed. Furthermore, the contract to be signed must clearly express every obligation for the contracting parties.

8 Current incentive schemes in Italy

Current support schemes to promote energy efficiency and renewable sources in Italy are as follows:

1. the white certificates mechanism;
2. the “*conto termico*” subsidy;
3. tax deductions;
4. tariffs for renewable electricity sources.

In synthesis, the tax deductions – distributed over 10 years – cover 65% of the expenses incurred for the energy-renovation interventions in the residential sector up until 2014 (June 2015 for condominiums).

The “*conto termico*” subsidy calls for an average coverage between 30% and 40%, allocated over two or five years, of the expenses incurred for the energy efficiency investment. Although economically less significant than the tax deductions, it is intended for a number of public and private entities that can't access the other scheme – either for a lack of taxable income, or for other reasons – and is especially designed for the Public Administration.

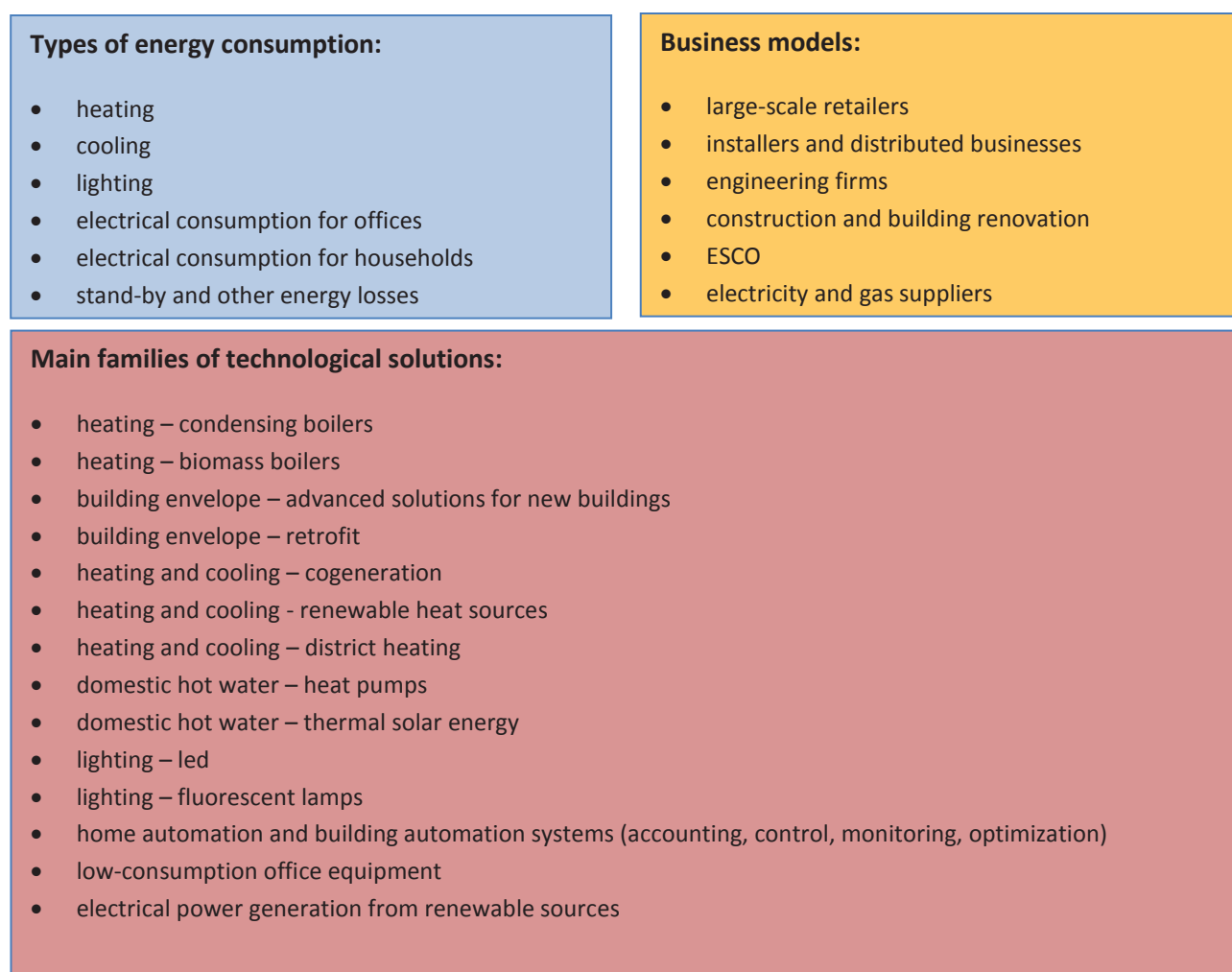
The white certificates are a valid solution whenever the two previous schemes cannot be used, considering the smaller economic contribution on operations of interest for this study. Its value depends on the considered solution and can range from some percentage point of the capital expenditure to more than 50%, depending on the additionality of the technology, on the sector and on its economic performance. In the last years this scheme has been supporting mainly industrial projects and it will cover 60% of the 2020 energy efficiency target according to the notification on 4 December 2013 to the European Commission provided according to the EED directive.

The tariffs for renewable electrical sources offer a contribution to the MWh delivered to the grid, excluding photovoltaic. Their application is currently negligible in the building sector.

9 Energy-efficiency improvement solutions for buildings

The energy-efficiency improvement solutions for buildings respond to common needs with regard to climate control and lighting, whereas they differentiate in electrical uses associated with the services sector and with the residential sector, remaining homogeneous however within the sectors themselves. The repeatability of any operations is therefore a key fundamental characteristic of energy efficiency in buildings. It can be positively exploited both in terms of minimum obligatory requirements and voluntary agreements, and in terms of widely-used retrofit activities.

Figure 2: Overview of operations for buildings



Source: Fire's own elaboration

This is offset by a large variety of solutions available to handle the same need (for example fossil-fuels boilers, biomass boilers, heat pumps, cogeneration for heating) and a limited plant utilization factor⁴. These elements translate into a design and decisional complexity and payback periods often between five and ten years.

Energy efficiency solutions may next be subdivided based on the technological aspect, the complexity of the operation, and the capital cost. The relation between these three aspects has repercussions on any business models that can be used.

For solutions proposed from a perspective of service, evaluating whether or not a certain solution is feasible is accomplished with two main selection criteria:

1. the value of the energy savings must be sufficient to cover the capital, operating, and the commercial costs within a suitable time limit⁵;
2. the technologies identified must allow the ESCO and the contractor to share in the monitoring protocol, which must be defined beforehand and must not be expensive.

Further information requiring consideration derive from these two valuation criteria.

As regards payback periods, for example, the situations may be completely different for public buildings used for a limited number of hours (typically schools), buildings with extended hours of operation (for example gyms used by sports clubs), buildings used permanently (such as barracks), and finally buildings with complex technological facilities (like hospitals). In the civilian sector, the payback period may be less decisive than it is for industry when deciding whether to carry out a project.

In fact, it is not subject to the same logic typical to the manufacturing industry that usually lead to the rejection, *a priori*, of any project with a payback period of more than 3 years⁶. Parameters such as the net present value (NPV) and the internal rate of return (IRR) take on greater importance. For projects carried out from the point of view of an ESCO with third-party financing, however, the project's capacity to generate cash flow having a reasonable payback period – not directly compatible with some more highly structured operations, such as insulation – takes on greater significance. Therefore the funding method becomes an important variable.

As regards monitoring, the situation changes instead depending on whether or not the operations carried out involve users, their actions, or habits. Again on the issue of monitoring, certain parameter changes can be officially acquired from chambers of commerce or from the GME, while for other parameters, such climatic data, the situation is more complex, since to have a official figure it is necessary to refer to data from geographical sites that may be distant

⁴ In most applications, usage is less than 2,000 hours per year.

⁵ The suitability depends on various factors: the end-user's entrepreneurial risk, the possibility of changing the designated use over the years, the duration of the loans, and the cost of money for the project and the proposer considered, etc.

⁶ Certain organizations anticipate shorter payback times, related to or in anticipation of modifications to the production process, or to the crisis situation.

and perhaps not representative, whereas if a local metric is used, no prior history may be available to make a comparison⁷.

Efficiency improving technologies can improve various economic aspects of energy consumption, with more or less significant technological implications. The installation of meters on major consumption sources allows energy waste, which would be difficult to notice reading the monthly consumption reported in the bill, to be identified (for example lighting and climate control systems or information technology devices left on after business hours or in unused spaces) and allows the evaluation of the utility of using local control and management systems designed to render the supply of electricity and heat less costly. The machines present in the heating cabinet can be made more efficient by installing instruments to control combustion and to program the use of the various machines, even as a function of the meteorological parameters, and also by adopting technologies with better performance, such as condensing boilers, heat pumps, or cogeneration. In addition to the classical insulation, windows with active solar radiation control or special painting for terraces can be considered on the building envelope. The building automation technologies currently allow effective control, monitoring and management functions, optimizing consumption and maintenance associated with other of organization requirements (for example occupancy control, fire prevention, and safety). The renewable electricity and heat sources can have broad applications in new buildings and in case of restructuring, in order to supply the part of energy demand than can not be reduced.

The climatic evolution lead to a reduction in winter-time demand for heating and to an increase in the summer demand for air conditioning, and this fact too is a factor ESCOs must consider just like the operations that are mandatory due to energy standards in buildings: one example is the mandatory installation of thermostatic valves on all heating bodies, which will certainly result in a reduction in the average winter consumption with already verified savings of up to 30%⁸. Generally speaking, a more efficient heating cabinet will be connected to a more efficient internal user grid⁹; the latter has longer payback periods and therefore may be chosen only for longer and more demanding future contractual relationship.

ESCOs should also take into account plans to change the use of buildings, for example the centralization of hospital operating rooms or the reorganizations of the main headquarters of central provincial administrations for which unification is proposed. Equally troublesome is the possibility of installing systems to reuse and recovery energy from both liquid and gaseous effluents in large building complexes (shopping centers, hospitals, universities, etc.). These interventions can be very interesting in terms of energy, but at the same time they should confront themselves with the management procedures, the national and regional standards, and the projected evolution in the use of the buildings. Every constraint related to plant engineering becomes a negative factor in the future, and building owners don't want to deal with them.

⁷ With regard to this, Italian Legislative Decree 115/2008, Schedule II, paragraph 4, letter e), indicates the reference to the location's actual degree days.

⁸ Data originating from the TCVV spa, which manages the district heating systems of Tirano, Sondalo, and Santa Caterina Valfurva.

⁹ In addition to the thermostatic valves, which can be adapted to traditional radiators, underfloor heating systems or heat recovery and free cooling solutions can be used in the services sector.

The operations affecting demand are an additional type of activity that forcibly requires greater collaboration between the customer and the proposing ESCO. This step would appear inevitable if energy efficiency is to change from reducing consumption from primary sources to reducing end-use demand, a theme never dealt with until now. This type of operation is grouped in two large families:

1. the first regards operations on building structures such as insulation, coatings, and restructuring;
2. the second falls within in the large theme of home automation: the set of the hardware and software technologies that should allow the room-by-room optimization of the operating conditions of the energy vectors (hot, cold and electricity) provided by the generation system and by the electric substation.

The second group of operations may regard the installation of occupancy and/or ambient luminosity sensors for lighting, CO₂ control, ventilation control, shutting off air conditioning upon the opening windows, etc., in addition to intelligent metering (which can be potentially combined with the timely management of electrical loads for economic purposes), to innovative device-management systems, and to integration with anti-intrusion and security systems. It should be noted that the wireless technologies have made the dissemination of these solutions more economical with regard to sensors, even though the economic problem of regarding the adapting of the actuators governing the supply of the hot and the cold still remains.

As regards the use of the renewable heat sources, three main solutions deal with different issues: thermal solar energy is predominantly confined to new buildings or special applications in which sufficiently vast areas are available (evaluating competition with photovoltaic in their application), heat pumps are facing regulations that hinder their development, and the use of biomass for thermal applications is related to the particular local logistics (for example technical-agrarian institutions) or to the development of logistical raw material procurement and distribution networks.

10 Integration of technologies with energy services

The following major groups of active subjects can be identified:

- large-scale retailers - referred to those technologies that can be purchased at shopping centers or on the internet, typically plug and play (for example household appliances, office equipment, anti-stand-by systems, residential lamps, etc.);
- installers and small restructuring businesses - suited for solutions that require state-of-the-art assembly, but not a complex and integrated design (for example, autonomous boilers, replacement of ceiling lights with other higher-performing lights, simple home automation systems, window frames and insulation, etc.);
- engineering firm and large companies for restructuring - useful where integrated operations are anticipated, in general intended for the upgrading of the entire building or the construction of new buildings;
- ESCOs and service providers - fundamental where the supply of products in terms of service is what counts, generally associated with financial packages through third parties (for example upgrading heating and cooling systems, lighting, building automation, cogeneration and renewable sources of electricity, etc.).

For the purpose of this work, the first two groups, whose potential for success are essentially associated with suitable communication and education activities – in part public and in part private – are not as interesting as the other two, where the barriers are more complex and divided, and require policy efforts and a larger market.

The third group in particular shows the need for adequate skills and the capacity to work with high degree of complexity (the integration of different solutions, relations between the envelope, plants, networks and occupants, large amounts of capital, etc.). The true evolution with respect to the past, from a perspective of buildings with very low or no consumption, lies in extending a *modus operandi* that was typical in the realization of works of excellence (archistars for example) and large works. Combining this complexity with distributed operations of relatively modest entity is the challenge in this field.

As regards services, the most widely-used model associated with buildings is energy management contracts ("*gestione energia*"), the prerogative of facility management companies and, in the northern Italy, of the municipal utilities, who developed district heating systems (integrated both with the valorization of energy of urban wastes and the management of the groundwater table to feed heat pumps in the center of Milan), and the operation of the gas and electricity grids.

Over time, the facility management companies have generated energy services including EPC, in most cases concentrated on the easiest and most remunerative operations related to the

public sector, with low entrepreneurial risk and with opportunities for higher margins¹⁰. Energy services have however remained predominantly limited to specific actions, favored both by the complexity of our climate, and by the complexity of the financial and organizational conditions that end up rewarding the less structural operations and those less associated with the general efficiency of the market.

In the third and fourth group, one can sense the need to develop new approaches, more or less complex, through the integration of different skills and capacities, in order to create a system and be able to carry out operations that deal with consumption and the distributed production of thermal and electrical energy at the same time. An uncommon transformation, considering that the typical size of the individual activity – that is for the single building – is limited, and therefore there is the need to aggregate a certain number of buildings to reach a desirable economic threshold.

¹⁰ A choice that has recently shown its limits, when the continuing practice of public administrations to pay late has put these companies in serious economic difficulty.

11 The evolution of monitoring

The issue of monitoring is central for the development of business models centered on third-party financing, the only type capable of producing consistent results in the short-medium-term in these years of economic crisis. The growth in the ability to evaluate and measure the buildings presents three nodes:

1. to fully exploit the energy efficiency opportunities, especially in the area of EPC contracts and with TPF, the customer must expand its ability to make precise request, based on a series of historical data and not just on current data;
2. the ESCOs and the other types of contractors must be increasingly able to quantify their operations and to evaluate and enumerate the variables that influence the final results, to protect themselves against possible incorrect conduct by customers, in addition to reducing risks and costs for the guarantees.
3. a national data bank in which the various experiences can converge, so that contractual procedures adopted can be compared and to gain access to climate, consumption, and cost references to derive useful indicators would be useful for the public administration.

12 Stakeholders

The building energy efficiency market is a potentially vast market of general interest, that is taking the first steps towards a consistent development. The European Union has set substantial limits for 2020 and for several years now, the IEA noted in its annual report the importance role this sector plays.

The stakeholders' role will be decisive to take advantage of the opportunities. The main potentially important categories are mentioned here.

12.1 Technology producers

In general, this category makes the main effort to develop a new market. Some distinctions should be made as regards energy efficiency, however. The technologies in this sector may in fact be divided into two groups:

- those that represent a more evolved or a more efficient model of already established technologies (for example, a condensing boiler is an evolution of a traditional boiler, just like a high-efficiency motor is an evolution of a traditional motor);
- those that appear as market innovations with respect to traditional solutions (for example, heat-pump technology is different that boiler technology, just like a led lamp or a gas-discharge lamp is different than an incandescent lamp).

Whereas in the latter case it is in the manufacturer interest to try to affirm its technology, this stimulus is less obvious in the former case¹¹. It is no coincidence that the lobbies most active area are those associated with cogeneration, heat pumps, building automation solutions, insulation, new construction materials, and with renewable sources of electricity.

They are flanked by the copper association (transversally interested in the electrical technologies field). Boilers and household-appliances manufactures, to provide some examples of the former group, are instead less active, since what change for them is not the number of products sold, but the type.

It should be mentioned however that this attitude will tend to change, since in many cases the competition brought on by alternative technologies will also end up increasing the attention given to the theme of energy efficiency in these areas.

¹¹ This may hold true only for those manufacturers who lead the market, who may have an interest in gaining new market share or strengthening themselves in relation to the competition quickly introducing more advanced models potentially required by the market, but this would hard to achieve on the trade-association level.

12.2 Operating and maintenance companies

Energy efficiency, as mentioned in the first part of the study, has an important operations and maintenance component if the best results are desired. It is no coincidence that until now, a large portion of ESCOs' revenues is based on O&M. Along with the need for plant maintenance in fact is the need to operate them as best as possible, as a function of their application. This means that companies that operate in this field must consider the development of this market to be interesting, both due to the possibility of working directly as an ESCO for the less complex projects, and to provide support and manpower to organizations active in the area of advanced building renovation, to ESCOs and to the energy suppliers seeking to offer energy efficiency bundled with electricity and gas.

Despite this, only recently have the representatives of these categories, faced with the economic-financial crisis, began to direct their attention to this issue. Similar reasoning applies for other categories, such as engineering studies and designers.

12.3 Energy suppliers and utilities

Many believe this category would have no interest in seeing energy efficiency gain ground, considering that a reduction in quantities sold could only cause economic harm. In reality, numerous business models can be developed in this case. As far back as thirty years ago, in the domain of demand side policies, management began affirming that ways could be found to maintain high profitability while renouncing the philosophy of selling as much as possible. More recently, the transformations triggered by directive 96/92/EC changed the picture.

If everything goes well, the first stage of market liberalization will lead to price competition, therefore vendors tend to compete with each other guaranteeing a portfolio of offers that can allow them to offer the best prices. After a few years, once profitability has eroded, this approach will no longer be sustainable, therefore other commercial options are being sought.

From this perspective, the electricity market is essentially following the events that occurred in the mobile phone market: suppliers are attempting to associate electricity sales with bundled monitoring and efficiency improving operations. The idea is to obtain two results: cultivating customer loyalty for a period long enough to repay the efficiency improvement investments in the bill, and to obtain additional profitability associated with the new services¹².

Unlike the mobile phone sector, the hardware offer is more complex to manage in this case, since it does not entail providing the end user with a ready-made directly useable object, but it requires identifying custom-fit solutions. It is also necessary to implement a preliminary diagnosis and a fine tuning after installation for many solutions. Therefore it will take more time to define the winning model.

¹² The sale of smartphones whose price is included in the monthly telephone traffic fee is the equivalent in the mobile phone market.

Involving suppliers is very interesting also due to the potential impact on SMEs, buildings and residential customers, where the limited size of the investments render actions with traditional models hardly feasible.

12.4 Thermoelectric power producers and fuel suppliers

It has been known for decades that the energy sector would undergo a momentous transformation, passing from fossil fuels to a mix of increasing energy efficiency and renewable sources. Long term transformation, but one that began to show tangible signs, especially in the Old Continent.

In the last century the fundamental change has been the gradual shift from carbon to hydrogen (from coal to hydrocarbons and natural gas). Despite the obvious differences, switch from one carrier to another did not involve disruptions of business models.

In recent times the focus was instead the transition to the energy from the Sun, in its various renewable forms. In this case, the business model has undergone major changes, as it passed from the schema of centralized power to that of distributed generation, with equipment often in the hands of the end users.

The challenge for large companies active in this area is how to manage the transition to the new model without being excluded, trying to survive in a market that is increasingly centered on renewable energy sources.

The two options closer to the traditional scheme are those of district heating, high efficiency cogeneration and biomass powered thermal generation or cogeneration.

In the first case the average size of the plant is reduced, but it is possible to exploit the network with the users to create a stable business. In the second case the production moves to the user, and most of the business passes to the O&M service, the supply of traditional fuels, and the management of any surplus electricity generation. In the third case the fuel is no more a traditional one, but plants similar to the other cases are operated, with the possibility to offer the same services of case two, with the addition of the disposal of biomass ashes.

Other options include the development of alternative fuels (e.g. algae) and the creation of centralized electricity generation sources (wind, photovoltaic great, etc.).

By dedicating resources to these new options it becomes possible to approach the market with new perspectives, continuing to play a leadership role.

12.5 Other industry operators

The local actors play an important role in terms of energy efficiency in buildings (and in SMEs):

- installers and maintenance personnel;
- consultants, engineering firms or similar;
- small local enterprises involved in building renovation;
- enterprises active in the installation and operation of distributed generation plants.

These players can operate in a distributed manner across the territory and can make profits even with operations on small buildings and chalets. Company size does however limit their activity in the simpler solutions for improving energy efficiency (for example, furnaces, boilers, frames, etc.) or in specializing in particular solutions (for example renewable sources or microgeneration). To expand their effectiveness and capacity to respond, action is needed on intense and structured training programs, combined with incentive schemes, or to promote the creation of synergies with larger players (ESCOs, electricity and gas suppliers, construction companies, etc.). The combination would also facilitate the provision of the financial services required concomitantly with the energy efficiency improving operations.

12.6 End users

Theoretically, end users should be the first to propose energy efficiency, being the main beneficiaries, directly and indirectly. We know in reality however that only in recent years have we seen a minimal amount of attention, beginning with the increase of petroleum cost between 2004 and 2005. And it was the crisis alone that truly brought the issue into the limelight, more out of necessity that anything else (in fact, the effect is more of a collapse in consumption forcing energy saving than a reduction associated with a more intelligent use of resources).

In the building sector, efficiency becomes a weapon against fuel poverty in the residential sector, but the following aspects must be dealt with:

- investment decisions in the more interesting buildings, i.e. condominiums, must be shared, and the crisis risks blocking investment decisions due to a lack of funds;
- it is still difficult to find ESCOs active in this sector capable of providing upgrade packages that include third-party financing.

Government aid tends to be necessary. Tax deductions have been of great help these years, but it is now time to pass on to more decisive policy instruments with integrated operations suitable for those with weak income statements also.

In the services sector, the basic need is instead related to the sensitization of decision makers and to further expansion of commercial proposals by the ESCOs and other industry players.

12.7 Banks and investment funds

Cash rich investors are very interested in energy efficiency, due to its potential, to the medium or short-term payback periods and the limited employment of capital necessary per project. The complexity and technical nature of energy efficiency, on the other hand, makes it difficult to evaluate risks and this barrier will require time to be effectively overcome.

The primary impediment in Italy, in any case, consists of the recent history related to photovoltaic systems. In recent years, in fact, all the banks jumped into the photovoltaic power plant funding, with debt/equity ratios and spreads unthinkable for other investments. The fact that the energy subsidy would by itself cover the cost of capital and would even allow it to be remunerated, in addition to representing a clear indicator of the folly of this policy instrument, made money lending very easy, practically 100% guaranteed by the State. For the purpose of this study, it is interesting that for the banks and investment funds, accustomed to easy business in this sector due to the energy subsidy, dedicating themselves to energy efficiency requires a truly considerable effort (many diverse technologies to be understood, completely different risk structures, the flow of funds generated by investments strictly dependent upon the end use and climate, etc.).

Therefore it is not surprising if, notwithstanding the interest from the banks, we are still witnessing the first steps on this business. Those further ahead have begun to grant the first loans to the ESCOs who operate with EPCs based on the design analysis and not on collateral or corporate guarantees. The market is nevertheless in movement and the rate of the transformation will depend on the rate at which standard schemes and model contracts to manage the most replicable initiatives can disseminate. From this perspective, the building sector offers several suitable solutions.

State aid would nevertheless be useful, especially in the form of guarantee funds for solutions with medium and medium-long term payback periods. For the latter – for example, building insulation – a dedicated incentive (like 55%-65% tax deductions available in recent years) is also necessary if significant results are to be obtained.

12.8 Institutions

Support on the part of institutions is decisive in deciding upon the rate of market development, both because efficiency is complex, and because when a some awareness on the issue is beginning to spread, the economic resources to transform desires into actions are wanting.

The main players involved are:

- The European Council, Parliament, and Commission: during recent decades they created a solid framework to develop energy efficiency and renewable energy sources. Having wagered on the latter rather than the former has translated into greater costs for the Community and fewer results, but the process of change has begun. In recent years, a great deal of attention has focused on the buildings sector, to which the directive 2010/31/EU, and several financial support packages are dedicated (for example 7 PF, IEE, EIB programs, etc.).
- The Italian Parliament and Government: greater attention has been dedicated to energy efficiency this past decade, acknowledged in the National Energy Strategy approved with Italian Ministerial Decree dated 8 March 2013 with energy efficiency as a top priority. The communication and promotion of energy diagnosis and monitoring systems, necessary to kick off the market, have however been neglected until now. It is no coincidence that the incentives, such as white certificates, have run into difficulty as soon as the saving targets have really started to expand. The lack of a medium-long term perspective did the rest, failing to offer stability to the system on one hand and triggering changes that were too rapid on the other hand (for example, uncontrolled growth of incentivized photovoltaic technology).
- The Ministry of Economic Development and the Ministry of the Environment: various measures defined by the ministries have achieved good results and, in recent years, some attention to the accompanying measures (communication, education, training, monitoring, control, etc.) was observed. The aspects needing improvement include the shifting of priority to efficiency (until now considered secondary to renewable sources with a series of negative consequences in terms of stability and harmony of the energy system and system costs) and a greater observance of the time limitations (certain promulgated measures suffer from the haste with which they were written, a later source of problems with enactment).
- The Italian Electricity and Gas Authority: this regulatory body had been directly engaged in energy efficiency within the management of the white certificates scheme, which passed over to GSE in 2013. On the regulatory front, two measures would be fundamental, the first regarding the price structure for the residential sector, which currently penalizes the use of electrical heat pumps and induction cookers, the second regards efficient consumption systems (SEU), necessary to develop distributed generation from the service perspective. The decisions regarding the prices of grid access and use of the grid, the price structure of which is no longer suitable for managing an electrical system with a high penetration of renewable sources (above 40% in 2014) will therefore be important.
- Regions and local authorities: a large portion of the responsibility in terms of planning and control linked to energy efficiency has been decentralized with the reorganization of Title V of the Constitution. The inadequacy of the regional system in managing this broader task led to contrasting results. On one hand there are Regions such as Lombardy and Emilia-Romagna, or Autonomous Provinces such as Trento and Bolzano,

which have implemented several positive activities that are worthy of mention, on the other hand administrations that only exercised the right to veto in the Italian State-Region Conference. Outstanding results could be achieved, in particular in the building sector, if it were possible to propagate the best practices in terms of planning and control (territorial, urban, and local).

- Regional Administrative Courts and the Council of State: these are often involved in large tenders promoted by the Public Administration to award energy services, such as deliberating on problems that have arising up in the operation of local district-heating systems, in the formation of public-private ESCOs, and in the implementation of AEEGSI provisions. For the purposes of this study, it needs to be said that regulatory complexity is a constraint and cost especially for Public Administration, making initiatives focused on a serious upgrading for real estate assets more difficult to carry on.

13 Market segmentation by building type

It is impossible to incorporate the vast variety of forms and intended uses of buildings into a single scheme. This is also true for the relation between owners and occupants. In the tables below, all buildings have been segmented into 14 types of different intended uses. Table 2 analyzes the types of consumption, the complexity of the plants, and the importance of energy expenses in percentage and absolute terms in the annual profit and loss report. Table 3 analyzes the decision-making ability and the technical and operational capability of the owner. Tables 4 and 5 present the major energy-efficiency technologies, indicating the suitability for the various market segments.

Table 3 - Typologies of consumption

Market segmentation/Description of consumption	Prevalence of heat or electrical consumption	Load factor	Complexity of plants	Impact of energy expenses on operating expenses	Absolute value of expenses to justify internal management	Knowledge of consumption and of performance
Dispersed buildings	Thermal	Low	Low	Low	No	Yes/ no
Single-family residences	Thermal	Low	Low	Low	No	No
Multi-family residences	Thermal	Low	Low	Low	No	No
Timesharing condominiums	Thermal	Low	Low	Low	Yes/no	No
Private housings	Thermal	Low	Low	Medium	Yes	No
Public housing	Thermal	Low	Low	Medium	No	No
Dispersed services sector	Electrical	Medium	Medium	Medium	No	Yes
Large services-sector buildings	Electrical	High	High	High/medium	Yes	Yes
Territorial infrastructures	Electrical	High	Medium	Low	Yes	Yes
Buildings occupied by local P.A.	Thermal	Medium	Low	Low	No	No/yes
Buildings occupied by the central P.A.	Thermal	Medium	Low	Low	No	No/yes
Primary and secondary schools	Thermal	Low	Low	Low	No	No/yes
Health	Thermal	High	High	High	Yes	Yes
University	Thermal	Medium	High	High	Yes	Yes

Source: Fire's own elaboration

Table 4 - Characteristics of different building typologies

Market segmentation/Decision-making capacity	Congruence between the interests of the users and the owners	Presence of skilled energy managers	Decision taken considering energy efficiency	Who can provide technical and organisational support?	Access to tax credit	Use of energy global service for operation and maintenance	Possibility to stipulate an EPC contract for the energy supply
Dispersed buildings	Yes	No	Yes (fiscal deductions)	Craftsman	Yes	No	No
Single-family residences	Yes	No	Yes (fiscal deductions)	Craftsman	Yes	No	No
Multi-family residences	Yes	No	Yes (fiscal deductions)	Professional	Yes	No	No
Condominiums	No/Yes	Yes/No	No	Professional, ESCO	Yes/No	Yes	No/Yes
Private housings	Yes/No	No/Yes	Yes/No	Professional, ESCO	Yes	Yes	No
Public housing	Yes/No	Yes	Yes/No	ESCO	No	Yes	No
Dispersed services sector	No/Yes	Yes		Professional	Yes	Yes/No	No/Yes
Large services sector buildings	Yes	Yes	Yes	Engineering company, ESCO	No	Yes	No/Yes
Territorial infrastructures	Yes	Yes	Yes	Engineering company, ESCO	No	Yes	No/Yes
Buildings occupied by local P.A.	No	Yes	No	Engineering company, ESCO	No	Yes	No/Yes
Buildings occupied by the central P.A.	No	No	No	Engineering company, ESCO	No	Yes	No/Yes
Primary and secondary schools	No	Yes	Yes/No	ESCO	No	Yes	No/Yes
Health	Yes/No	Yes	Yes	Engineering company, ESCO	No	Yes	No/Yes
University	No/Yes	Yes	Yes	ESCO	No	Yes	No/Yes

Source: own elaboration

Table 5 - Technologies used in different buildings typologies

Market segmentation/Technologies	Biomass	Geothermal heat pump	Insulation	Condensing boilers	Shading glazed walls
Dispersed buildings	Yes	Yes	Yes	Yes	Yes
Single-family residences	Yes	Yes	Yes	Yes	Yes
Multi-family residences	Yes	Yes	Yes	Yes	Yes
Condominiums	No	No	No	Yes	Yes
Private housings	Yes	Yes	Yes	Yes	Yes
Public housing	Yes	No	Yes	No	Yes
Dispersed services sector	Yes	Yes	Yes	Yes	Yes
Large services-sector buildings	No	Yes	No	Yes	Yes
Territorial infrastructures	No	Yes	No	Yes	Yes
Buildings occupied by local P.A.	No	No	No	Yes	Yes
Buildings occupied by the central P.A.	No	No	No	Yes	Yes
Primary and secondary schools	Yes/No	No	No	Yes/No	Yes
Health	No	Yes/No	Yes	Yes	Yes
University	No	Yes/No	No	Yes	Yes

Source: own elaboration

14 Analysed case studies










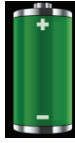








The analysed case studies are as follows:



















- ACER Reggio Emilia;
- ARE Liguria;
- European Investment Bank (EIB);
- Cassa depositi e prestiti (CDP);
- ENEA;
- ENEL Distribuzione;
- ENEL Energia;
- Greenutility;
- Habitec - Trentino technological District;
- Keep Point Udine;
- Loccioni;
- Mediocredito Italiano;
- The Province of Milan;
- The Province of Treviso;
- Win-Win Project.













The parties were selected in an attempt to cover the various stakeholders and the various innovative or successful approaches that are being achieved in Italy¹³. The cases presented are not necessarily the best, nor in some cases it can be guaranteed that they are successful, but they were chosen to illustrate various facets of how the market is attempting to circumvent barriers to the energy renovation in buildings. This review includes banks and the EIB, energy suppliers and distributors, ESCOs, some prominent central and local public institutions, some private players acting as intermediaries between funds and end users. The table below summarized the results.

¹³ Although F.I.R.E. has done everything in its power, other experiences may also be noteworthy.

Table 6 - Summary of case studies analyzed

SUMMARY OF CASE STUDIES AND INTERVIEWS	BARRIERS ENCOUNTERED	IMPLEMENTATION, REPEATABILITY AND IMPACT		
<p><i>Implementation: the level of progress of the considered case study with respect to the targets.</i> <i>Repeatability: the possibility that other players will implement similar actions.</i> <i>Impact: benefit that this type of action will bring in terms of global results.</i></p>				
<p>Progetto Fresh, Acer Emilia Romagna. Energy upgrading of residential public buildings thanks to European loans, to the use of EPC contracts stipulated by Acer Emilia Romagna with the ESCOs, and to municipal guarantees.</p>	<ul style="list-style-type: none"> ▪ decision-making capacity of the condominiums ▪ financial 			
<p>Condomini Intelligenti, Are Liguria. Energy upgrading of private residential buildings in the province for Genoa, subject to energy diagnosis in collaboration with condominium tenants and administrators and subsequent comparison with the energy certifications present in the Liguria region's data bank.</p>	<ul style="list-style-type: none"> ▪ knowledge of energy-consumption ▪ informational 			
<p>European Investment Bank programs (EIB). Programs supporting energy upgrading of the public administration via loans facilities at subsidized rates and technical assistance funds (the ELENA and JESSICA programs). The minimum thresholds and guarantees required until now have limited recourse to these instruments to a few successful cases.</p>	<ul style="list-style-type: none"> ▪ knowledge of energy-consumption ▪ contracts ▪ financial 			
<p>Cassa Depositi e Prestiti. Cassa Depositi e Prestiti grants loans for energy-efficiency projects with minimum thresholds of around 5 million euro, more accessible than the EIB thresholds. The poor attitude regarding complex projects and the difficulty identifying structured ESCOs until now have limited recourse to these instruments to a few successful cases.</p>	<ul style="list-style-type: none"> ▪ economic ▪ financial 			
<p>Enea proposals on the energy upgrading of P.A. buildings. The lack of data on energy consumption and on buildings is one of the key factors holding back initiatives in this field. If a suitable cognitive and later programmatic process were to be initiated, consumption could be reduced by 60%. The implementation of the building cadaster contemplated by directive 2012/27/EU is very late.</p>	<ul style="list-style-type: none"> ▪ knowledge of energy consumption ▪ informational ▪ decision-making process 			
<p>Enel Distribuzione. Electricity and natural gas distributors can play an important active role within the white certificates mechanism. Enel Distribuzione, in particular, initiated an activity to collect and incentivize in a single solution operations publicized through a dedicated portal and provides support in presenting complex projects, even making resources available to fund the initiatives.</p>	<ul style="list-style-type: none"> ▪ access to incentives ▪ financial ▪ informational 			

SUMMARY OF CASE STUDIES AND INTERVIEWS	BARRIERS ENCOUNTERED	IMPLEMENTATION, REPEATABILITY AND IMPACT		
<p>Enel Energia. Energy suppliers are attempting to develop business models that seek to provide energy-efficiency services together with energy sales. Enel Energia initiated a vigorous activity targeting all the sectors. In the residential sector in particular, turnkey solutions are proposed with third-party financing.</p>	<ul style="list-style-type: none"> ▪ informational ▪ economic ▪ financial ▪ qualification of operators 			
<p>Green Utility, ESCOs active in the renewables sector. They build photovoltaic power plants in grid parity, stipulate win-win contracts with end customers, and deliver “turnkey” systems. The model is at risk in the short term due to recent regulatory decisions.</p>	<ul style="list-style-type: none"> ▪ economic ▪ financial 			
<p>Habitech, Technological District of Trentino. Habitech, the technological district for energy and the environment, was founded in 2006 in the Autonomous Province of Trento, with the objective of developing a network of companies and a supply chain specialized in sustainable buildings, in the production from renewable energy sources, and in energy efficiency. The district had implemented various initiatives both in the public and in the private sector.</p>	<ul style="list-style-type: none"> ▪ supply chain ▪ financial ▪ economic ▪ informational 			
<p>Keep Point Udine. An example of a public-private ESCO instituted by the Municipality of Udine in the form of a Public-private Partnership (PPP) to perform energy efficiency operations for the Public Administration. Local businesses specialized in energy efficiency and building construction will participate in the ESCO.</p>	<ul style="list-style-type: none"> ▪ financial ▪ economic 			
<p>The Loccioni Group and LEAF Community. An example of an eco-sustainable community created by a private enterprise that considered the green economy to be a fundamental objective for growth. The community integrates manufacturing facilities, built with energy efficiency criteria, with renewable sources, an intelligent home where all employees and company guests lodge, a local home-work transportation system, and the recovery of the biomass for energy purposes from the reclamation of the riverbed that crosses the installation. Measurement, allowing the best possible decisions to be made, is the underlying principle.</p>	<ul style="list-style-type: none"> ▪ informational ▪ core business ▪ attitudes ▪ supply chain ▪ integration 			
<p>Mediocredito Italiano - Intesa Sanpaolo Group. Through its Energy Desk Mediocredito Italiano in recent years began a journey aimed at financing large energy efficiency improving initiatives (above euro 500,000) based on their ability to produce cash flow capable of paying back the debt. The assessment of investments with logic not strictly associated with the applicant’s creditworthiness, is fundamental for developing a blooming market. The process is still at the beginning stages and</p>	<ul style="list-style-type: none"> ▪ financial ▪ economic 			

SUMMARY OF CASE STUDIES AND INTERVIEWS	BARRIERS ENCOUNTERED	IMPLEMENTATION, REPEATABILITY AND IMPACT		
the problem of participating in smaller initiatives still remains.				
<p>The Province of Milan. Within the scope of the EIB's ELENA program, the Province of Milan obtained a 2.1 million Euro loan after adopting the Covenant of Mayors. The loan covers the technical-administrative costs for an energy renovation project for the municipalities adhering to the agreement. The project regards initiatives to be realized amounting to about 90 million euro, of which 65 million euro will be covered by EIB loan facilities. A first batch of works with investments amounting to Euro 13 million was awarded in 2013. A fundamental reason funds were obtained was the 700 energy diagnoses performed on public buildings in previous years thanks to contributions from the Fondazione Cariplo.</p>	<ul style="list-style-type: none"> ▪ knowledge of consumption ▪ informational ▪ decision-making process ▪ integration ▪ economic ▪ financial ▪ supply chain 			
<p>Province of Treviso. An example of how a specific division of duties and responsibilities allowed the Province of Treviso to obtain optimal results in the energy field. The basic points are: switching from "global service" contracts with energy diagnoses to "servizio energia plus" contracts¹⁴ with a reduction in consumptions, education and sensitization of the end-user (for example money bonuses for the most efficient schools with the implementation of policies oriented to the building occupants).</p>	<ul style="list-style-type: none"> ▪ decision-making process ▪ informational ▪ economic ▪ financial 			
<p>Win-win project, ESCOs active in financial services. An example of a party facilitating and enabling the encounter between a network of investors interested in putting resources into projects on the order of 1-5 million euro and private players with opportunities for successful operations. A special purpose vehicle is formed to manage the project and an EPC contract is prepared with the customer for each initiative. Natural gas or biomass cogeneration systems are typical projects.</p>	<ul style="list-style-type: none"> ▪ economic ▪ financial 			
<p>Change leadership. The Australian experience suggests a different approach to energy efficiency. The traditional method begins with energy diagnosis and the corresponding feasibility study produced by a third party that are submitted to company management. The innovative method consists in integrating energy efficiency with the company's core business. The energy expert starts from stakeholder analysis, involves and motivates personnel to achieve energy efficiency objectives, and carries out activities that entail a high-degree of integration between the core business and energy efficiency.</p>	<ul style="list-style-type: none"> ▪ core business ▪ informational ▪ integration ▪ attitudes 			

Source: own elaboration

¹⁴ These contracts are defined within the legislative decree 115/2008. They request a minimum energy saving of at least 10% to be achieved during the contract lifetime together with other prescriptions.

15 Energy efficiency: fundamental elements and proposals

The main barrier to efficiency, that entails the entire supply chain from operators to end users, right up to the investors, is an education/training barrier. Being complex (multiple solutions, with savings not always easy to evaluate and measure and with strong integration with the final usages) energy efficiency demand investments in:

- educational campaigns to increase awareness and knowledge of opportunities;
- energy audits and energy management systems, that favor the incorporation of energy performance indicators (EnPI) and the realization of projects, and are the basis for the EPC contracts and therefore for TPF;
- data gathering and monitoring activities, which favor the work of all players in the supply chain and simplify access to incentive programs;
- operators training, fundamental especially for obtaining results in families and in small and medium enterprises;
- an effective system of control and verification aimed at ensuring the compliance and regularity of energy performance certificates for buildings, projects that benefited from incentives, construction sites subjected to EPBD design specifications, etc.

The complexity of energy efficiency, together with the small average project size, makes access to financing difficult, whether from banks, investment funds, or EIB programs. In essence, it is not the economic resources that are lacking as much as the channels that make capital flow from those who own it to those who offer energy efficiency investments. Likewise, there is no shortage in the technologies necessary to drastically improve the end consumption in this field, yet there are still few supply-side operators that know how to best incorporate and use them and end users who know how to request them.

It is the market that must bridge this gap, but the policy makers may help accelerate the process with the following actions:

- to maintain a stable regulatory framework, aimed at energy renovation for buildings;
- the provision of incentives and loans for the renovation of real estate that remain associated with the building and not with the owner, to overcome the landlord-tenant issue¹⁵;
- a mandate to ENEA or to other agencies and bodies to publish baseline market studies for the various groups of buildings and for the typical performance of the usable

¹⁵ A typical problem in the real estate sector, that not only regards renter, but public buildings also such as schools, numerous offices, and commercial spaces. The PACE program in many States of the USA, for example, provides for the repayment installment for the loan by with which the renovation was funded to be associated with the taxes on the real property and not with the resident who first decided to invest.

technologies, to offer banks supporting literature helping them to develop EPC loan contracts and energy efficiency contacts in general;

- to promote the knowledge and divulge best practices in collaboration with Regions and Local institutions;
- to promote the divulgation and the role of the energy managers and ISO Certification 50001 for institutions, realtors, and large services sector companies;
- to launch supporting or mandatory programs to train people capable of performing due diligences for energy-efficiency improvement projects;
- to stimulate programs to combine projects to achieve the best possible dimensions for gaining access to investment funds or EIB programs (from a few million to tens of millions of Euros);
- to promote the start-up of cooperatives capable of operating with loans distributed over small-scale projects.

On the regulatory front, there are two fundamental issues: the development of the efficient consumption systems (SEU), the basis for the dissemination of renewable sources and cogeneration for self consumption, and the review of the electricity tariff structure for the residential sector.

Resolution 578/2013/R/EEL, which defines the regulatory framework for SEU, was issued in 2013, but political uncertainties still persist regarding how system charges will be handled (*"oneri di sistema"*, the tariff component to pay renewable energy and energy efficiency incentives, nuclear decommissioning, tariff discounts for energy intensive industries, etc., are currently exempt) and regarding the fiscal regime. Energy storage systems are also related to the development of SEU. End users can use these systems to concomitantly maximize the on-site consumption, power quality, and voltage continuity issues.

As regards the second item, it is important to remove the extra tariffs for domestic contracts above 3 kW, immediately adopting a very large scale pilot project regarding residential sector experimentation decided with the AEEGSI resolution 607/2013/R/EEL.

16 Conclusions

Market evolution, the progressive expansion of interest in energy and environmental themes, the growing price of energy, and difficulties associated with the crisis are bringing energy upgrading in buildings into the limelight. They are therefore forming the basis of a continuous and substantial demand for operations in this domain, focused on the building envelope and the technological solutions (needed for warming, cooling, lighting, office or residential equipment, building automation, etc.). Sensitivity and know how are inadequate however and the actual rhythm of real-estate upgrading is far off from the performance necessary to achieve the 2020 objectives imposed by the Climate and Energy Package, or, more pragmatically in reference to the short-term, from what is needed to support institutions, service enterprises, and citizens in this time of crisis.

Table 7 - Summary on the status of supply in the energy efficiency market

Large-scale retailers	This line of business grew the most. Good results in terms of lighting and the labelling of household appliances. The theme of stand-by and of induction cookers still hardly covered.
Installers and micro companies distributed over the territory	Although the 55% and 65% tax deductions stimulated knowledge of the basic technologies and a minimum level of training, but the low average skill level of these operators is the main handicap of this line of business. A line of business that is furthermore essential for residential users.
Engineering firms	Incentives have stimulated growth in this area also. the growth however is still insufficient when considering that it is necessary to know how to plan operations for new buildings and to retrofit existing buildings in an holistic manner, integrating envelopes and systems. Inadequate skill levels and remuneration regulations that favor traditional professional over innovative professionals are the main restraint for growth in this category.
Construction companies and building renovation firms	Building legislation and regulations increasingly steer traditional building sector operators towards energy efficiency, also taking advantage of available incentives. The skill level is not however adequate, nor is the mentality of many manufacturers who cling to the schemes used a few decades ago.
ESCOs	They are implicated by several players, but they are in general a long way from meeting market needs, mainly due to the lack of capital and their very recent foundation, aspects that limit recourse to third-party financing, the most sought after characteristics in this current market.
Electricity and gas suppliers	These parties were the last to move, therefore their fundamental limit is the lack of know-how, together with the difficulty in training networks of commercial accounts used to sell much simpler products ¹⁶ . Wagering on simple sales agreements with technical partners has not always turned out to be a successful proposal. The first structured development plans, which could be effective for SMEs also, are just beginning in this sphere.
Banks and funds	The limited size of energy efficiency investments, their complexity and the characteristics of the supply operators render the development of easily accessible financial packages complicated. Although several players had perceived the potential of this market by intuition, the focus on photovoltaic-plant driven by the incentives in the last years has diverted the interest in energy efficiency, determining a delay in the development of the know-how required to participate in this business.

Source: own elaboration

¹⁶ It should be pointed out that selling energy efficiency is also complicated because not all potential customers seek it. This means that the vendor must first of all know how to instil the potential buyer with the desire to invest in this field.

As concerns supply, instead, the situation is far from mature and far from meeting demand needs. See table 4 for the various operators in this sector.

Although the European and the national legislation strongly induce ESCOs, due to the ability to offer guaranteed-performance contracts and third-party financing, in practice all business channels must be developed to obtain valid results. This would not only allow a greater rate of market development, but also the ability to gain access to the various segments of demand.

The case studies illustrated in this report show how the market is attempting to activate the various channels, even with innovative methods. These best practices show that the desired results can be achieved, but it is worthy highlighting the following factors:

- many cases are in the initial stages, and therefore it will take time to verify the true success and the weak points;
- all experiences regarding innovative contracts translated into practical terms are based on the presence of farsighted managers (investments energy diagnosis) and competent and willing officials (the ability to continue on in the face of difficulties) in the institutions considered;
- the relationship between ESCOs, banks, and users still needs to be formed, due to delays in proficiency and structuring afflicting the three players;
- the building sector in general, and public buildings in particular, is a black hole from which very little information regarding assets, buildings characteristics and consumptions escapes¹⁷.

All of this translates into longer times to exploit opportunities related to the energy renovation of buildings. Times that do not adapt well to the problems and needs that the crisis is dictating to real-estate owners, let alone the objectives of the EU climate and energy package.

On the technology front, the greater awareness of energy and environmental issues, together with incentives such as 55-65% tax deduction and certain initiatives on the territorial level, is leading towards an increasing use of energy efficient solutions and an improved capability from energy operators to use them efficiently.

Action by the State and Regions is therefore essential to accelerate the process. In Italy, the fact that energy efficiency is a concurrent matter does not help to implement the provisions quickly, nor to have clear rules. From this perspective the first policy proposal should regard the review of the governance model, identifying a system that allows the best Regions to express their potential with measures suited to the territory, but which allows to the State to act uniformly, stronger, and more effectively.

¹⁷ It is no coincidence that Italy is late in publishing the plant cadastre envisaged by Directive 2012/27/EU.

The other provisions that are deemed fundamental to accelerate the energy renovation process for buildings are:

- invest in education, being the main barrier and common to all the stakeholders, through precise mandates to the national concerned agencies and providing an appropriate budget;
- utilize a guarantee fund as an instrument to favor the recourse to the third-party financing at least in the Public Administration, where the primary risk for ESCOs is late payment and not the reduction of the cash flow in the projects carried out;
- invest to qualify operators in the sector, both through existing training funds, with the right mix of the obligations and inspections, and with skill-certification schemes;
- launch programs that help realtors conduct energy diagnosis among buildings and SMEs, either providing for the opportunity for a partial or total reimbursement through an incentive scheme when the energy efficiency project is implemented, as is provided by the “conto termico” subsidy, or partially funding the audits, as Fondazione Cariplo has done in Lombardy in recent years;
- exploit the data collected through the diagnosis and service agreements to establish public energy performance indicators (EnPI), that allow sectorial and regional comparisons;
- promote territorial initiatives that accelerate the encounter between stakeholders (demand, supply, finance) and exploit the Regions' and Provinces' capacity to aggregate the demand of Municipalities by access to EIB funds or in any case to exploit economies of scale in conducting energy diagnosis and in the preparing tenders;
- for private buildings, act to both promote the aggregation and therefore access to bank loans and to investment funds, and to support the business models that can be competitive with small businesses (cooperatives, energy suppliers, etc.);
- review the rules that hinder the introduction of effective solutions, taking action on tariffs (for example heat pumps and induction cookers), on technical regulations (skill certification for example), on legislation (real simplification of procedures, respect of deadlines for transposing ministerial decrees) and on the policy guidelines (consistent policies in favor of energy efficiency, long term objectives, synergy between the State and the Regions).

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