Emerging business models for energy efficiency in buildings

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Abstract

The European energy efficiency and the EPBD directives emphasize the role of buildings within the climate and energy strategy. Given the high energy consumption of the building sector the European approach provides a mix of mandatory targets, minimum requirements, labeling, and supporting tools to help member states in delivering the requested energy efficiency improvements. A strong action on the building stock represents also a unique opportunity in terms of market development, employment, and contrast of fuel poverty, with many related benefits.

Despite the commitment from the European Commission and the available benefits, the renovation of the public real estate clashes with the financial condition of many public bodies, the lack of economic and human resources, and the inadequate development of the energy efficiency market.

The authors carried on in 2013–2014 a comprehensive study in Italy on the skills, business models and policies available in order to overcome the existing barriers and support both the public and private sectors in the energy renovation of their building stock. In particular the study shows that many new approaches are emerging to facilitate and permit the required market transformation.

Based on the results of the study mentioned above, the paper will illustrate the most interesting case study about the analyzed business models and illustrate how different approaches can adapt to different situations, involving both public and private parties. Some case studies took advantage from the involvement of different financing sources, others profited from synergies between local parties and local policies, others – like electricity and gas supply – were able to change their business model, others showed how companies that understand the concept of green economy can play a role in improving their territory.

Buildings and energy: also a question of business models

The European Commission recognized since the beginning the importance of buildings within the energy efficiency action plan ("COM/2011/0109"). Buildings account for more than 40 % of the total final energy consumption and succeeding in improving their energy efficiency would have a fundamental impact on environmental emissions, energy security, economy, and living quality. Both the EPBD directives (2002/91/EC and 2010/31/EU), the energy services directive (2006/32/EC), and the energy efficiency directive (EED – 2012/27/EU) create a consistent legislative framework that aims at promoting a decisive improvement in the building stock energy and environmental performance.

Even if important results have been achieved over the years, the path towards the achievement of the targets of the EU action is still a rough one. Many years of communication and dissemination initiatives has definitely improved the awareness of the stakeholder, but economic and financial barriers, an insufficient availability of skilled and qualified companies and professionals, split incentives, and negative attitudes (such as litigiousness in condominiums) has hampered till now the desired development.

Both the EPBD directive recast and the EED directive place a lot of attention to planning, information and dissemination, qualification and certification, energy audits and measurement, ESCOs[1] and energy performance contracts (EPC). These are all tools that are required or can be very useful to implement energy efficiency actions.

Among the measures that are aimed at promoting energy efficiency in buildings it is worth mentioning:

- Minimum requirements for building performance (new constructions and deep renovations) and technologies used in buildings facilities;
- Energy Performance Certification of buildings;
- Mandatory nearly zero energy buildings from 2021 on (2019 for public buildings);
- Inspection schemes for heating and air conditioning systems;
- Mandatory energy efficient renovations of at least 3 % of buildings owned and occupied by central public administrations;
- Implementation of a public building cadastre and of long-term national building renovation strategy.

These measures should deeply impact the global performance of the building sector in the next years, and some effects are already visible by checking the national NEEAPs (national energy efficiency action plans, written under 2006/32/EC directive and 2012/27/EU directive).

Nevertheless, the long crisis cycle that is characterizing this time emphasizes the importance of finding new business models capable of overcoming the existing barriers, in particular by giving access to third party financing.

With the aim of finding solutions or suggestions on these issues, ENEL Foundation commissioned the study "Energy efficiency in the building sector: skills, business models and public private partnerships" to FIRE [1][2]. The document has been written between 2013 and 2014. The project aimed to analyse 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, which concentrated on the Italian situation, in particular examined:

- 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.
- 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.
- The actual implementation of innovative and successful business models to improve energy efficiency in the public building sector (ESCO, utilities, "green banks", etc.).

Based on experiences and analyses acquired from the above activities, the study proposed 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 illustrated some of the best experiences and best practices with the public and private parties concerned.

This paper synthetizes some parts of the document and some of the most interesting findings. In particular a brief summary of the building stock is given, followed by some considerations on energy efficiency solutions for buildings, the integration of energy efficiency technologies with energy services, the analysed case studies, and the main conclusions.

The Italian public building stock

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' behaviour, 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 behaviour 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 (the Italian Agency on energy, environment, and the sustainable economic development) and CRESME (the Social economic market research center for the construction industry and the territory) analysed the state of the art of "office" and "school" sectors within the scope of the Electrical System Research program, and the results obtained were published in some reports [17, 18, 19], from which the following information was taken.

The Italian "Public Office" sector has hardly been studied at all until now and is one of the least known sectors: there are approximately 15,000 Contracting Authorities in Italy and the buildings entirely intended for office use – both public and private – is equal to about 80,000 units[3]. The number of public buildings totally designated for office use amount to approximately 13,600 buildings, for a covered surface area of 23.4 million square meters. Table 1 shows the breakdown of public buildings by compartment.

As regards the territorial subdivision, the provinces of Rome, Turin, Naples, and Milan hold 14 % of entire national property.

1. An energy service company (ESCO) is a company (or even a person) able to offer – where the conditions allow it – energy services characterized by the implementation of energy efficiency projects under EPC or a guaranteed saving contracts and third party financing. In Italy ESCOs can be certified since 2010 under the UNI CEI 11352 national standard.

2. The study can be downloaded at: www.enel.com/it-IT/doc/enel_foundation/library/papers/workingpaper13_energy_efficiency_building_sector_disanto_enel_foundation.pdf.

3. There are also many buildings combining offices and other uses (residential, commercial, etc.).

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).

Available policies in Italy

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

- White certificates;
- "Heat account" subsidy;
- Tax deductions;
- 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 31st December 2015 (a decree in 2015 will set a reduced deduction rate for the following years).

The heat account 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 cannot 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 paper. 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.

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.

Apart from these schemes, starting from 2015 other funding options will be available for buildings (e.g. a new energy efficiency guarantee fund and a subsidy for deep renovation of central public administration's buildings). According to the Italian NEEAP 2014 minimum requirements and other measures linked to the EPBD directive will also cover 43 % and 16 % of the 2020 target respectively for residential and tertiary sectors.

Besides these national measures, regional and local funding can be available, usually covering only facilities' renovations (e.g. boilers, heat pumps, thermostatic valves, domestic hot water heaters, etc.).

Energy efficiency improvement solutions for buildings: implications for energy services

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 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.

Table 1. Numerical repartitioning for buildings designated strictly for office use (source: CRESME-ENEA).

End user	Number of buildings	Surface area (1,000 m^2)
Public administration	9,550	16,881
Education	2,025	2,594
Healthcare	508	2,286
Research and development	247	492
Electrical power gas water	129	100
Real estate and construction	128	189
Other	993	956
Total	13,581	23,429

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 factor.[4] These elements translate into a design and decisional complexity and payback periods often between five and ten years.

Energy efficiency solutions may 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 limit;[5]
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 derives from these two valuation criteria. Some of the main aspects to be considered are the following ones.

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

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.

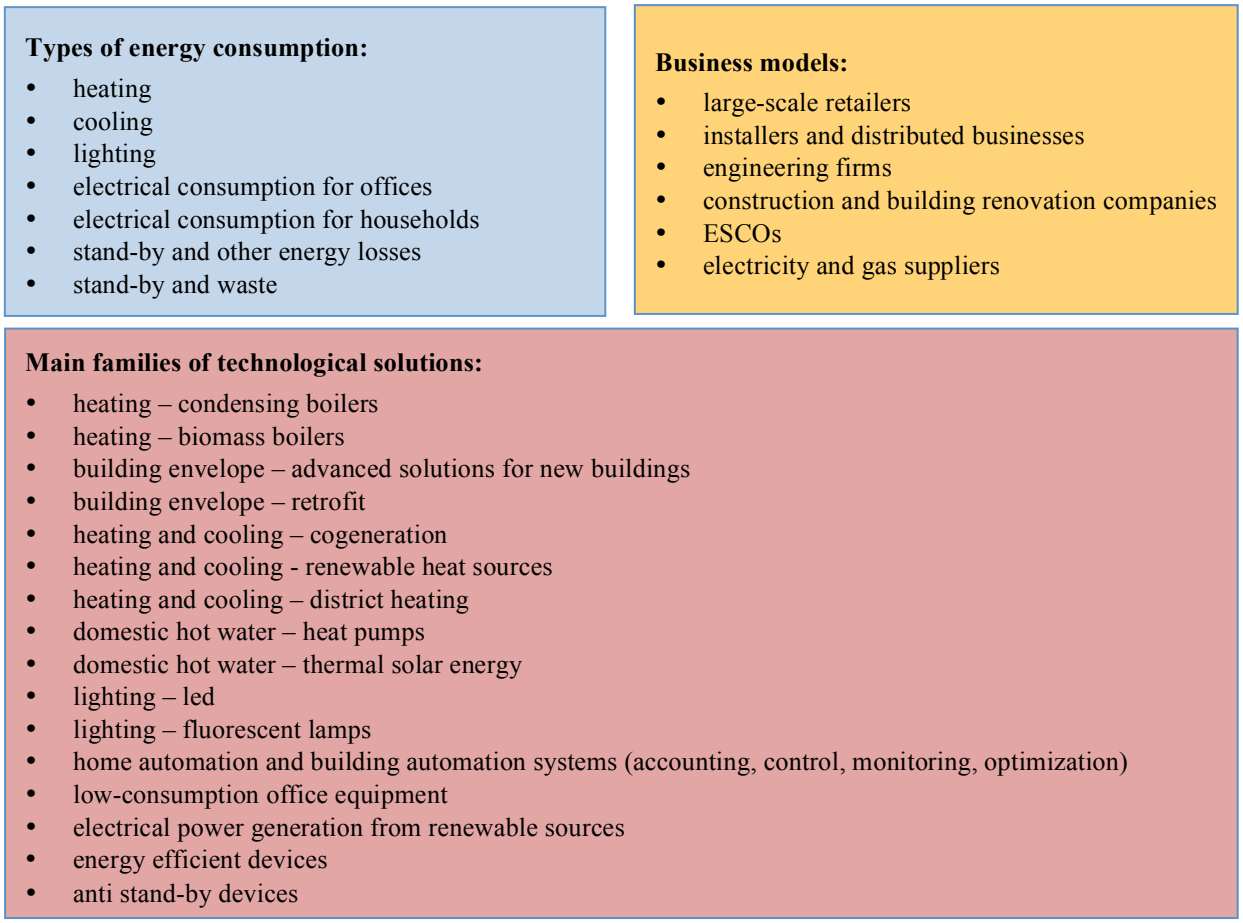


Figure 1. Overview of operations for buildings. Source: FIRE.

buildings with complex technological facilities (like hospitals). In the civil 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 years.[6] 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.

About 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 other public bodies (e.g. price series of different fuels, electricity cost, cost of technologies, etc.), while for other parameters, such climatic data, the situation is more complex, since to have an official figure it is necessary to refer to data from geographical sites that may be distant and perhaps not representative, whereas if a local metric is used, no prior history may be available to make a comparison[7].

Energy efficiency 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[8] and – in a smart city vision – allows the DSO (distribution system operator) the choice to evaluate if using local control and management systems designed to make the supply of electricity and heat less costly. Heating services can be made more efficient by installing instruments to control combustion and to program the use of the various heating devices, both as a function internal demand and 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

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

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. For example lighting and climate control systems or information technology devices left on after business hours or in unused spaces.

maintenance associated with other organization requirements (for example occupancy control, fire prevention, and safety).

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. As regards the use of the renewable heat sources, the 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 rural buildings) or to the development of logistical raw material procurement and distribution networks.

The climatic evolution lead in the last years to a reduction in winter-time demand for heating and to an increase in the summer demand for air conditioning, and this 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 %.[9] Generally speaking, a more efficient heating system will be connected to a more efficient internal user grid;[10] 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.

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 the large theme of building automation.

The second group of operations may regard room-by-room optimization of ambient conditions by controlling heat and cooling systems, installation of occupancy and/or ambient luminosity sensors for lighting, CO_2 control, ventilation control, electric devices switching, intelligent metering, innovative devices capable of communicating and being controlled by the electric grid, and integration with anti-intrusion and security systems. These systems are much more economical thanks to the diffusion of new technologies and of wireless communication.

The technological evolution in the field of measuring, monitoring, and building automation can support the installation of energy efficiency equipment by allowing more reliable feasibility studies and cash flow prediction, facilitating the implementation of EPC contracts and thus of third party financing. This is a mean to link technical aspects to economic and financial issues, and is fundamental even if considering business models that don't involve ESCOs.

Finally, it is important to pay attention to the end-users behaviours and to develop programmes apt to support the right attitude towards the internal use of the building. This form of information should improve together with the information and dissemination campaign aimed at raising the awareness on energy efficiency and with the training activities aimed at qualifying the professionals and the company involved in offering energy services. The qualification process can end up in a certification process. In Italy two standards were developed on this point: UNI CEI 11339 for energy management experts (EMEs) and UNI CEI 11352 for ESCOs. The results have been positive, both in terms of legislation implication (since 2016 the standards will become mandatory to access the white certificate scheme and to carry on the mandatory audits on large companies as provided for by art. 8 of the EED directive) and of market answer (many administrations have started requiring the certifications within public tenders and the certified EMEs have seen a substantial rise in their turnover).

THE MAIN STAKEHOLDERS

When considering the possible business actors apt to develop new business models, 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, boilers, replacement of ceiling lights with other higher-performing lights, simple home automation systems, window frames and insulation, etc.);
- engineering firms 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

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

10. 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.

example upgrading heating and cooling systems, lighting, building automation, cogeneration and renewable sources of electricity, etc.);

- electricity and gas suppliers – the most recent player involved in offering energy services, it is related to the attempt of energy suppliers to recover part of the reducing profits connected to the supply of the commodities by selling energy efficiency technologies (e.g. led lamps, solar thermal, boilers, etc.) and energy services (even with EPC and TPF).

For the purpose of this work, the first two groups, whose potential for success is 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 a 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. Presently most companies in this group, at least when dealing with normal projects, just offer some technological upgrade for existing buildings or make class B or C new buildings without using a territory-building-facility holistic approach.

As regards services, the most widely-used model associated with buildings is supply contract a discount is offered on the consumed energy, usually connected with limited energy efficiency investments, the prerogative of facility management companies and, in the northern Italy, of the municipal utilities, who developed district heating systems (integrated both with the valorisation 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 margins[11]. Energy services have however remained predominantly limited to specific actions, favoured both by the complexity of the Italian 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. Generally speaking energy service contracts for public buildings are even nowadays based on a simple discount on the energy service fee, and not on an energy performance contract designed to gain a deep renovation. This happens even if national best practices exist and show the advantages of such an approach.

Suppliers of electricity and gas are trying to develop models to offer energy efficiency bundled with electricity and gas[12]. Their main strengths are the number of clients, the knowledge of their energy consumptions, the huge financial resources that facilitate third party financing (both directly or through banks or funds). Their main weakness is the lack of knowledge of energy efficiency, the difficulty to train their commercial network as energy efficiency consultants, and the inertia of many people used to think of their business only in terms of selling more energy. Presently some offers of energy efficiency technologies payable with instalments bundled in the energy bill (e.g. boilers, solar thermal, heat pumps, etc.) are being advertised by the main traders, but their development is still at the beginning.

In the third, fourth, and fifth 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.

The case studies

The analysed case studies are the following ones:

- 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 Italy[13]. The cases presented are not necessarily the best, nor in some cases it can

11. 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.

12. Theoretically this can apply also to GPL, diesel oil, and LNG suppliers, especially bundled with cogeneration, condensing boilers, thermostatic valves, gas heat pumps, and biomass application.

13. Although FIRE has worked to include all the available best practices, other experiences may also be noteworthy.

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. Table 2 summarizes the results.[14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30]

Policies that can support the development of new business models

According to many studies (e.g. [7, 14]), the main barrier to efficiency – which entails the entire supply chain from operators to end users, right up to the investors – is education/training[31]. Being complex (multiple solutions, with savings not always easy to evaluate and measure and with strong integration with the final usages) energy efficiency requires investments in:

- educational campaigns to increase awareness and knowledge of opportunities;
- energy audits and energy management systems, that favour 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 favour 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 significantly 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 need to 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 issue[32];
- 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 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.

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 brining energy upgrading in buildings into the limelight.

14. Progetto Fresh, Acer Emilia Romagna: http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/files/documents/events/03_corradi_13.03.14.pdf.

15. Condomini Intelligenti, Are Liguria: www.condominiintelligenti.it.

16. European Investment Bank programs (EIB): www.eib.org.

17. Cassa Depositi e Prestiti: www.cdp.it.

18. Enea proposals on the energy upgrading of P.A. buildings: www.enea.it.

19. Enel Distribuzione: http://eneldistribuzione.enel.it.

20. Enel Energia: www.enelenergia.it.

21. Green Utility, ESCOs active in the renewables sector: www.greenutility.it.

22. Habitech, Technological District of Trentino: www.habitech.it.

23. Keep Point Udine: www.eib.org/epec/ee/documents/epec---cdp-conferenza-26-novembre-2013.zip.

24. The Loccioni Group and LEAF Community: www.loccioni.com.

25. Mediocredito Italiano – Intesa Sanpaolo Group: www.mediocreditoitaliano.com.

26. The Province of Milan: www.slideshare.net/atomino/i-contratti-di-prestazione-energetica-nella-provincia-di-milano.

27. Province of Treviso: www.manergyproject.eu.

28. Province of Treviso contracts: 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.

29. Win-win project, ESCOs active in financial services: www.win-win-project.it.

30. Change leadership: www.baruch.cuny.edu/realestate/pdf/Change_Leadership_Whitepaper.pdf.

31. Other important barriers, deeply covered by many national and international studies, are also analysed in the study behind this paper. Focus here is on the informative ones due to its broad effect on the development of new business models. When the different stakeholders have a good knowledge of energy efficiency issues and opportunities, it is more probable that new ideas arise on how to put together the building owner/occupant, the technology supplier, the ESCO, and the financial institution.

32. 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 instalment 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.

Table 2. Summary of the analysed case studies. Source: FIRE.

SUMMARY OF CASE STUDIES AND INTERVIEWS	BARRIERS ENCOUNTERED	IMPLEMENTATION, REPEATABILITY AND IMPACT		
Implementation: the level of progress of the considered case study with respect to the targets. *Repeatability: the possibility that other players will implement similar actions.* *Impact: benefit that this type of action will bring in terms of global results.*				
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.	▪ decision-making capacity of the condominiums ▪ financial			
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.	▪ knowledge of energy-consumption ▪ informational			
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.	▪ knowledge of energy-consumption ▪ contracts ▪ financial			
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.	▪ economic ▪ financial			
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.	▪ knowledge of energy consumption ▪ informational ▪ decision-making process			
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.	▪ access to incentives ▪ financial ▪ informational			
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.	▪ informational ▪ economic ▪ financial ▪ qualification of operators			
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 “turn key” systems. The model is at risk in the short term due to recent regulatory decisions.	▪ economic ▪ financial			
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.	▪ supply chain ▪ financial ▪ economic ▪ informational			
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.	▪ financial ▪ economic			

Table 2. Continuation.

SUMMARY OF CASE STUDIES AND INTERVIEWS	BARRIERS ENCOUNTERED	IMPLEMENTATION, REPEATABILITY AND IMPACT		
Implementation: the level of progress of the considered case study with respect to the targets. *Repeatability: the possibility that other players will implement similar actions.* *Impact: benefit that this type of action will bring in terms of global results.*				
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.	▪ informational ▪ core business ▪ attitudes ▪ supply chain ▪ integration			
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 500,000 euro) 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 the problem of participating in smaller initiatives still remains.	▪ financial ▪ economic			
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 13 million euro 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.	▪ knowledge of consumption ▪ informational ▪ decision-making process ▪ integration ▪ economic ▪ financial ▪ supply chain			
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" contracts 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).	▪ decision-making process ▪ informational ▪ economic ▪ financial			
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. A typical example of facilitator between ESCOs and end-users.	▪ economic ▪ financial			
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.	▪ core business ▪ informational ▪ integration ▪ attitudes			

This transformation is 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[33], 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. About supply, instead, the situation is far from mature and far from meeting demand needs. See Table 3[34] 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 the study 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 Italian building sector in general, and public buildings in particular, is a black hole from which very little information regarding assets, buildings characteristics and consumptions escapes.[35]

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.

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 favour 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 heat account 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

33. The Italian NEEAP 2014 shows that approximately 26 % of the 2020 target has been achieved in 2011–2012 in the residential sector, and some 4 % in the tertiary sector. Most of this result (around 90 %) is linked to the renovation of the facilities and not of the building envelope (approximately 10 %), whereas at 2020 the NEEAP indicates a contribution from the second group from two to three times higher than the savings related to the renovation of facilities. Besides, even if the achievements in the residential sector are good, public and private non-residential buildings are far from the objectives and the crisis had determined a reduction in the deep renovation of buildings of more than 70 % with respect to pre-crisis conditions.

34. Electricity and gas suppliers: 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.

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

Table 3. Summary on the status of supply in the energy efficiency market. Source: FIRE.

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 favour 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. 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.

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 favour of energy efficiency, long term objectives, synergy between the State and the Regions).

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