

Overview of Energy Efficiency Policies and Programmes for SMEs in Italy

Claudia Toro^{1}, Enrico Biele¹, Carlos Herce¹, Chiara Martini¹, Marcello Salvio¹, Adrianna Threpsiadi²,
Jack Wilkinson-Dix²*

1) Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), Rome, Italy (Claudia.toro@enea.it)

2) Energy Saving Trust, London, United Kingdom

ABSTRACT

In 2019, Europe's 25 million SMEs represent 99% of European businesses and are the backbone of the EU economy. They employ around 100 million people, account for more than half of Europe's Gross domestic product and provide two out of three jobs. Almost a quarter of SMEs in Europe already enable the energy transition by offering green products or services. Around 65% of employees in Europe are working in SMEs, with some considerable national differences. In Italy SMEs generate around 70% of value added in 'non-financial business economy', above the European Union average of 56.4%.

Despite the significant magnitude of the potential for increasing energy efficiency in SMEs, its full implementation is still held back by numerous technical and economic barriers. The same barriers also often prevent SMEs from easy access to the energy services market.

This paper, developed in the framework of the LEAP4SME EU funded project, aims at understanding the existing SMEs-targeted energy efficiency measures in Italy. Given the lack of up-to-date literature studies and comprehensive policies evaluation reports, a more specific disaggregation of the main policy results in terms of firm size is proposed.

Energy efficiency support to SMEs in Italy usually falls under a variety of policies and regulations targeted to all size enterprises or even wider targets. The most important Energy efficiency schemes in Italy – White certificates, Renewable energy for heating and cooling support scheme, National Energy Efficiency Fund, Energy Intensive Industry programme – cover both SMEs and large companies. Most of the national energy efficiency measures specifically targeted to SMEs fall under Article 8 of the Energy Efficiency Directive. Moreover, specific programmes for encouraging SMEs to undergo energy audits have been promoted by voluntary regional calls through the co-financing of national funds (Ministry of Economic Development) or using European funds.

Learnings and findings from this work are used to provide recommendations for policy makers and implementers relative to the above programmes for SMEs.

Introduction

Despite the fact that energy efficiency is crucial for the energy transition of European countries and for their independence from Russian gas, as demonstrated by the 2022 European Commission REPowerEU plan (European Commission, 2022), its full implementation in small and medium-sized enterprises is still held back by numerous technical and economic barriers. The same barriers also often prevent SMEs from easy access to the energy services market.

Considering the whole European Union in 2019 the share of SMEs in all enterprises is over 98%. Micro enterprises account for more than 80% of all businesses, representing 95% of all enterprises in Italy and 90% in the UK. Referring to the share of employees by size-class, SMEs do not show the same significance. Around 65% of employees in Europe are working in SMEs, with some considerable national differences (European Commission, 2021a; Eurostat, 2021).

The UK and France show a lower share of persons employed by SMEs with just over 50%, while SMEs employ over 80% of all employees in Greece and Cyprus and about 75% in Italy. About 54% of value added in the European Union is generated by SMEs, with a widespread at national levels (almost 40% in Ireland and almost 80% in Malta). In Italy SMEs generate around 70% of value added in 'non-financial business economy', above the European Union average of 56.4%. The SME sector in Italy employs an average of 3.1 people, against a European average of 3.9. In terms of labour productivity (value added per employee), the average is about 42,000 €, in line with the European average (44,600€) (European Commission, 2021b). Micro enterprises in Italy contribute with the 28.4% of value added and 45% of employment in the 'non-financial business economy'.

Regarding SME energy-related data at country level, research conducted under the LEAP4SME project (www.leap4sme.eu) showed that no sufficient information for SMEs is available and accessible in nine European area Countries (including Italy), in contrast to the large amount of economic information available. There is a high uncertainty in the estimation of the energy consumption of SMEs. Depending on the methodology adopted for the estimation (Reuter, Lackner and Brandl, 2021) the overall Italian SMEs energy consumption could reach between one quarter and one third of Gross Inland Consumption, and it could achieve more than the 60% of all industrial domestic consumption (Trianni and Cagno, 2012).

An increasing number of countries is implementing policies to promote energy efficiency in productive sectors and to enhance investments by companies with different size and structure. There are comprehensive reviews of energy efficiency policies focused in industry (Tanaka, 2011) and industrial SMEs (Johansson *et al.*, 2019). However, the impact of energy efficiency programmes devoted to SMEs have been analyzed only in few countries such as Germany (Fleiter, Schleich and Ravivanpong, 2012), Sweden (Paramonova and Thollander, 2016) or Bulgaria (Nigohosyan, Vutsova and Vassileva, 2021).

Recently it has been published a general overview of Italian (and British) energy efficiency policies (Malinauskaite *et al.*, 2019). Additionally, some specific Italian programmes have been extensively analyzed -i.e. White Certificates (Stede, 2017)- and an extensive literature on drivers and barriers for the implementation of energy performance improvement actions (EPIAs) in SMEs is available (Trianni, Cagno and Farné, 2016). However, aggregated information about energy efficiency policies impact in SMEs in Italy is not available.

Few policies are focused on the development of energy audits (EAs) in SMEs, as stand-alone programmes or as part of mandatory or voluntary energy efficiency policies. EAs are extensively recognized as the first step for an effective implementation of energy efficiency measures in the SMEs. They impact positively in the decision of SMEs to invest in energy efficiency and they help to overcome the information barriers to energy efficiency investments (Kalantzis and Revoltella, 2019). The encouragement to undergo EAs in SMEs should find a compromise with quality standards for energy audits, templates for audit reports or mandatory monitoring of energy audits in order to effectively promote the implementation of Energy Performance Improved Actions (EPIAs) in SMEs (Fleiter, Schleich and Ravivanpong, 2012; Herce *et al.*, 2021).

This paper, developed in the framework of LEAP4SME EU funded project, aims to provide an overview of the existing SMEs-targeted energy efficiency measures in Italy. A detailed analysis of the impact of the national programmes has been developed, with disaggregation of data in terms of firm size when available. Both general energy efficiency programmes/measures and energy audits for SMEs policies have been analysed.

Methodology

Italy has reached 65% and 67% of 2020 objectives set in 2017 Energy Efficiency Action Plan for the industry and the service sector respectively (Iorio and Federici, 2021). Different policies related to energy

efficiency promotion contributed to these results, such as White Certificates and the Renewable energy for heating and cooling support scheme. The National Energy and Climate Plan (NECP) sets an energy saving target for 2030 equal to 1 Mtoe for industry and 2,4 Mtoe for service sectors. These targets contribute to the overall energy saving target equal to 9,3 Mtoe which differentiate the final energy consumption in 2030 between the policy and baseline scenario in Italian NECP. According to the projections here developed, residential and transport sectors contribute respectively with 3,3 and 2,6 Mtoe. The target level for each sector has been obtained using the TIMES model and minimising the system cost, then taking into account the cost and performance of the different technologies applicable in each sector, sectoral potentials and the existing target on renewable energy. NECP also lists several policies as relevant for the energy efficiency dimension and in some cases also for the other four, namely decarbonisation, energy security, internal market and research, innovation and competitiveness.

Relative to industry and service sectors, relevant measures can be divided into four categories as shown in Table 1.

Table 1 – Measures described by type of policy objective

Policy objective	Policy Name	Policy Description	Main Ref.
To promote energy efficiency - not only targeted to SMEs	White Certificates	Managed by Gestore Servizi Energetici (GSE) and obligation scheme under art.7EED, subsidy scheme setting obligation and tradable shares to certify energy saving achievements in final use	GSE, 2021b, 2021a
	Renewable energy for heating and cooling support scheme	Managed by GSE, subsidy for energy efficiency and renewable heating measures, mainly aimed to buildings and not on industrial processes	GSE, 2020
	National Energy Efficiency Fund	Managed by INVITALIA, investment fund providing incentives to public authorities and businesses, granting soft loans and guaranteeing financing operations for energy efficiency measures	Invitalia, 2020
	Italy in Class A	Managed by ENEA, three-year information and training program aimed at promoting and facilitating the efficient use of energy, including several target groups among which large companies and SMEs	ENEA, 2021; MiSE, 2021
	Energy-Intensive Industry programme	Scheme to implement Article 8 of EED, extending its obliged target group to energy-intensive companies and defining the conditions necessary for them to obtain a reduction of the cost of electricity	MiSE, 2015b
Wider scope, often devoted to innovation, not only targeted to SMEs	National Plan for Industry 4.0	Plan providing for a wide array of measures affecting every step of the companies' life cycle to improve their competitiveness, by supporting investments, the digitalization of industrial processes, improvement in workers' productivity, as well as the development of new skills, new products and new processes	
	New National Transition Plan 4.0	Plan promoting private investments for green, digital and technological innovation (by means of credit tax) and ensure stability for investments in all the topics related with energy transition and industry 4.0	
	National Innovation Fund	Venture capital mechanism to support direct and indirect investments in qualified minorities within the capital of innovative companies, aiming at supporting start-ups and innovative SMEs	

	R&D projects of circular economy	Financing mechanism devoted to R&D projects for reconverting economic activities by realizing new products, processes or services or consistently improving existing ones by means of Key Enabling Technologies (KETs) in different areas	
To promote energy efficiency in SMEs	Regional actions to support the implementation of energy audits for SMEs	Regional calls/tenders to promote energy efficiency in enterprises including energy audits	European Commission, 2014
Wider scope, often devoted to innovation, in SMEs	Italy's National Strategy for innovative start-ups and SMEs	Several financial support mechanisms, such as fiscal incentives for capital investment, free of charge and simplified access to the Guarantee Fund for SME and possibility of equity crowdfunding	MiSE, 2015c
	Guarantee Fund for SMEs	Investment fund initiative, granting a public guarantee, covering up to a maximum of 80% of the loan, for short, medium and long-term loans	MiSE, 2021
	Capital goods support scheme (Nuova Sabatin)i	Financing scheme designed to facilitate access to credit and support investments in the purchase or leasing of equipment, capital assets and digital technology.	
	Sustainable Investments 4.0	Sustainable Investments 4.0 is an aid scheme for the support, throughout the country, of new innovative and sustainable business investments. The objective is to encourage the technological and digital transformation of enterprises, in order to overcome the contraction induced by the Covid emergency and to direct the recovery of investments towards strategic areas for the competitiveness and sustainable growth of the economic system.	

As shown in the list above, energy efficiency support to SMEs in Italy usually falls under a variety of programmes targeted to enterprises (large and small) or even wider programmes, related to Article 7 and 8 of the European Energy Efficiency Directive 2021/27/EU (EED). These policies are usually under obligation schemes for large companies and under voluntary agreements for SMEs. The most important supporting schemes in Italy -White certificates, Renewable energy for heating and cooling support scheme, National Energy Efficiency Fund- also cover SMEs. In terms of informative and training programmes, the National Campaign "Italy in Class A" is also addressed to SMEs to overcome non-technical information barrier.

The few energy efficiency programmes fully targeted to SMEs fall under Article 8 of EED (Energy audits and energy management systems). These programmes are under the regional actions to support the implementation of EAs in SMEs policy framework. Another important programme where energy intensive SMEs are involved is the Energy-Intensive companies programme. In the monitoring of this last measure, there is no breakdown of outcomes in terms of enterprise size or in general by characteristics that could help to separate large enterprises from non-large enterprises and evaluate the effects of that specific measure in a disaggregated manner.

This work will focus on the measures reported in Table 1, describing more in detail how they function and elaborating new figures to monitor their results in SMEs. In particular, the analysis is concentrated on measures targeted to SMEs (energy efficiency or innovation) or on energy efficiency in general (including SMEs) measures.

National Energy Efficiency schemes and programmes targeted also to SMEs

This section analyses the main energy efficiency measures in Italy that also involved SMEs including incentives, obligation measures and information campaigns.

White Certificates

White Certificates (WhC) constitute the most relevant scheme for promoting energy efficiency in Italy. WhC obligation scheme is based on the obligation, placed on electricity and natural gas distributors with more than 50,000 domestic and non-domestic customers, to achieve a quantified target of energy savings yearly. These savings can be achieved through energy efficiency actions among end-users and are assessed using tons of oil equivalent (toe) as measurement unit. WhCs are tradable shares which certify energy saving achievement in final use, through activities and projects to improve the energy efficiency. Energy savings are to be additional, meaning that for each project measured consumption baselines are compared with legislative requirements and market averages and supply. The recognized high efficiency cogeneration units, together with other benefits, can also access the White Certificates mechanism.

Since the launch of the WhC scheme, from 2005 to 2019, the total cumulative end-use savings achieved is equal to 6.02 Mtoe (ENEA, 2021a). In the same period, over 54 million White Certificates were issued, with around 1/3 of the certificates generated by non-obligated parties. The total volume of projects submitted in 2019 was down on the previous period, with 1744 projects (60% in the industrial sector) as against 2211 in 2018. The number of WhCs granted in 2019 was 2.9 million, a decrease of about 24% compared to 2018 (3.8 million) (GSE, 2021b, 2021a). The scheme underwent important changes in 2012 and 2017, both for the targets and the operating guidelines. These modifications, the actual achievement of saving targets and the evolution of Italian energy efficiency market, resulted in dramatic reduction on the generation of WhC (Di Santo, Biele and De Chicchis, 2018).

Most savings of the scheme are referred to the industrial sector, but there is no public availability of data to identify SMEs (employees and turnovers/balance sheets) throughout the whole scheme implementation. It is possible to identify a disaggregation on SMEs in terms of employees (1-49 Small, 50-249 Medium) on a sample of 850 energy proposals evaluated (see Figure 2). A total of 497 energy efficiency measures are referred to SMEs split in half between medium and small enterprises. Many of those interventions are referred to the Industrial sector: 30% of the measures is on process control and optimization, 26% on heat recovery through heat exchangers, 7% energy efficiency improvements on the furnaces, also cross-cutting measures such as variable speed drives which account for 4% in number (EU-Merci Project, 2017).

Energy efficiency measures for Medium sized enterprises

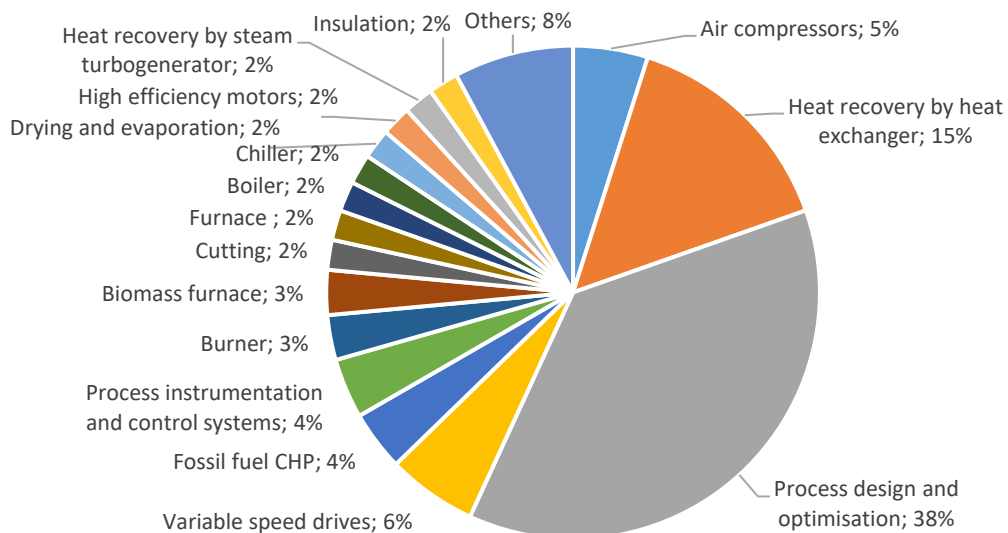


Figure 1 - Energy efficiency measures under White Certificate mechanism for medium-sized enterprises. Elaborated from EU-Merci Project database

Energy efficiency measures for Small sized enterprises

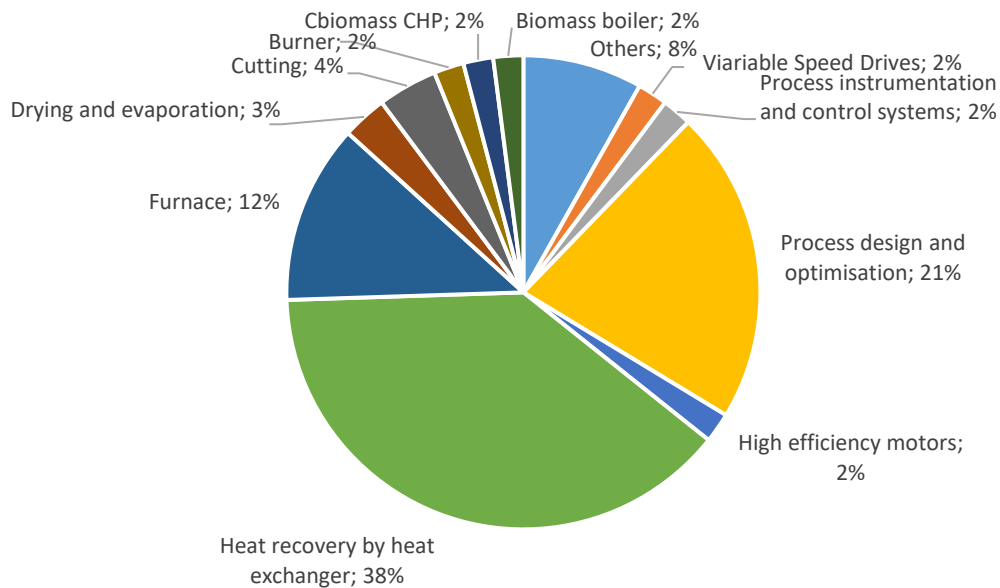


Figure 2 - Energy efficiency measures under White Certificate mechanism for small-sized enterprises. Elaborated from EU-Merci Project database

Renewable energy for heating and cooling support scheme

This financial support scheme aims at supporting the production of thermal energy from renewables, as well as small-scale interventions of energy efficiency. The incentive can be accessed both by public administration and private parties, including businesses and enterprises (most likely small-medium sized ones). Private parties may apply for incentives only for small-scale projects concerning systems for producing thermal energy from renewables and high-efficiency systems.

The yearly cumulative disbursement allowed is up to € 700 million for projects implemented by private parties. The incentives may be granted only for projects which do not benefit from other forms of government support, except for guarantee funds, revolving funds and loans.

In 2019 314,000 proposals were collected, corresponding to 433 million Euros of incentives (+29% relative to 2018) and to 89 ktoe of saving. Considering also the previous years in which the measure has been in force, total saving equals 0.19 Mtoe.

Costs for energy auditing and energy certification are also covered for some of the interventions, but only when associated with the above projects and subject to specific requirements. The audit must comply with the standard UNI CEI EN 16247 and for the private sector (including private residential sector and SMEs).

In 2019 an overall number of 562 audits and certificates have been emitted, for an overall incentive of 1.29 M€. This number is nevertheless referred to the whole residential, part of the Public administration and SMEs, with no further disaggregation (GSE, 2020).

National Energy Efficiency Fund

The Energy efficiency fund is a financial support measure, and it is funded by the national government. The main policy objective of this investment fund (revolving fund) is providing grants and loans, as well as guarantees, to sustain investments in energy efficiency. It can be accessed by public authorities and businesses, both by large enterprises and SMEs. The fund has been created in 2014, when transposing EED, and it has become operational in 2019: the delivery organization is Invitalia and the total budget is 310 million €, of which 185 already committed and 125 representing an additional financing for the period 2019-2020 (Invitalia, 2020; MiSE, 2020).

The first batches of projects to be financed by the Fund were approved in February 2020 (10 projects) and April 2020 (7 projects). Among those, only one is referred to industry sector, in particular to a large enterprise active in the textile sector which will invest in improving the energy efficiency in the production process. Businesses and particularly SMEs have not yet benefitted of this policy tool: reasonably this could be due to the complexity of administrative rules and because its potential benefits have not yet properly reached the interested stakeholders (MiSE, 2021b).

According to the National Energy and Climate Plan (NECP) this measure is included in the policy mix to reach the 2030 energy efficiency objective, with a contribution of 0.76 Mtoe in 2030 to the overall 9,3 Mtep target. Investments needed to achieve this objective are estimated to be around €4.4 billion in the period 2021-2030, with a commitment from the State to increase the fund allocation to 80 million € per year in the same period (Italian Government, 2019).

Energy Intensive Industry programme

All the energy-intensive companies (Large or SMEs) subjected to partial tax relief in the purchased electricity (registered in the list of the Environmental Energy Services Fund - CSEA, a government agency on

electricity) are obliged to carry out energy audits. They are characterized by high electricity consumption (relatively to their internal costs and higher than 1GWh/y) and belongs to specific industrial sectors (mainly Annexes 3 and 5 of EU Guidelines 2014/C 200/01 (European Commission, 2014).

Moreover, according to the Legislative Decree 73/2020 they are obliged to implement at least one of the energy efficiency measures identified in the energy audit. Energy audits of Energy Intensive SMEs are submitted to ENEA as per D.Lgs. 102/14.

At the end of July 2020 an overall number of 2845 energy audits regarding 2546 SMEs (reference year 2018) had been submitted to ENEA. The 94% of those are manufacturing SMEs, with an overall consumption of about 8.8 Mtoe. Such consumption, according to the data reported in the 2017 Italian National Energy Balance, represents about 32% of the total energy consumption of Italian industry. The energy consumption of energy-intensive SMEs is made up of 52% electricity (about 24.5 TWh), 23% natural gas, 18% diesel oil and 6.6% LPG (see Fig. 3).

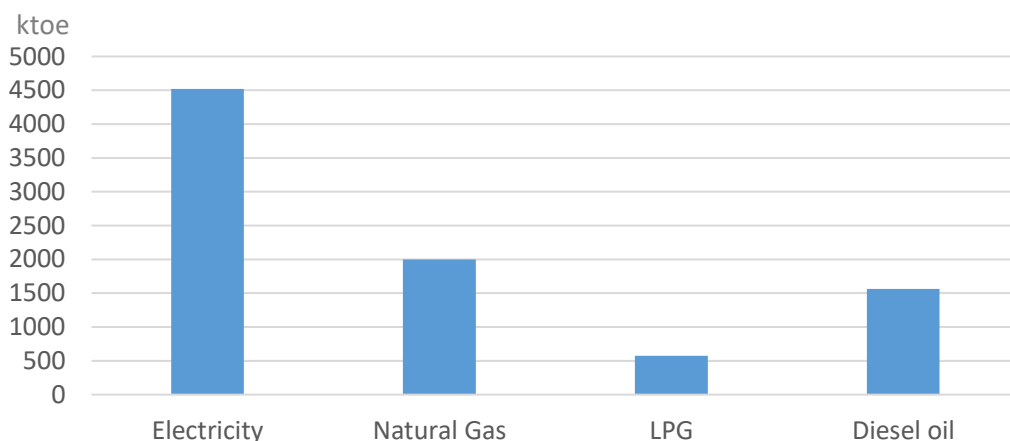


Figure 3 - Distribution of energy sources in Energy Intensive SMEs

The audits also show global savings of 102 ktoe/year related to energy efficiency interventions carried out and declared in the audit report. This figure corresponds about to 1.1% of the total consumption of SMEs and is equal to 14% of the total savings from interventions made by large companies and Energy-intensive Companies. Almost 60% of the interventions carried out ranks in three areas: lighting (26%), production lines (17%) and general interventions (15%) which include the installation of monitoring systems, ISO 50001 etc.

Italy in Class A information campaign

The Energy efficiency information and training programme is a three-year national campaign (2016-2019), promoted by the Italian Ministry of Economic Development and carried out by ENEA, according to the national transposition of the EED. It can be classified as an information/advice measure and it is funded by national government, with an overall budget equal to 1 million Euro per year for the period 2014-2020; the program has been recently re-financed for another three-year period. It identifies specific objectives to be achieved for each target group, represented by large companies and SMEs, but also by public administration, households, students and fragile people (ENEA, 2021b).

The program has been implemented through the information campaign "Italy in Class A", prepared by ENEA with trade and consumer associations and the Regions. Relative to the business sector, covering both large enterprises and SMEs in industrial and service sectors, the campaign is aimed at raising awareness in the execution of energy audits, the implementation of the actions suggested in the audits themselves and/or the adoption of an energy management system compliant with the ISO 50001 standard.

In the context of the campaign, a survey has been implemented among those companies that provided a communication to ENEA of energy efficiency actions implemented and not incentivized through any existing energy efficiency support measure (Preziosi, Federici and Merli, 2022). The survey made it possible to assess the percentage of companies that believe that the training/information activities carried out within the campaign have positively influenced the decision to carry out energy efficiency interventions. According to this method it was possible to evaluate the energy savings due to the information campaign: an annual saving of 4,5 ktoe/year was estimated for 2019 and a cumulated saving of 56 ktoe/year for 2014-2019 period (MiSE, 2021b).

In the industry sector, a main barrier for SMEs could have been that the information and training programme was not specifically tailored for them and thus their specific features would need to be better assessed.

Regional actions to support the implementation of energy audits for SMEs

Unlike previous measures that were aimed at all sizes of enterprise, the promotion and support for energy audits in SMEs in Italy was mainly entrusted to the regions. Italian regions, since 2016, have promoted and supported the carrying out of energy audits in SMEs through the co-financing of national funds or using European funds (POR, FESR etc).

The Decree of the Ministry of Economic Development and the Ministry of the Environment of 12 May 2015 (MiSE, 2015b), following art. 8 EED, started a program aimed at stimulating small and medium-sized enterprises towards a more efficient and conscious energy consumption. According to the Decree, the regions and autonomous provinces could present programmes aimed at supporting the implementation of energy audits in small and medium-sized companies. The Ministerial Call for co-financing consisted of an incentive divided at 50% between individual Region and Ministry of Economic Development, to finance the implementation of energy audits in SMEs (with a maximum contribution of € 5,000 per audit) or the adoption of an ISO 50001 certified energy management system (with a maximum contribution of 10,000 €).

In 2015, EUR 15 million was made available for the co-financing of regional incentive programmes for energy audits of SMEs or the adoption of energy management systems in accordance with ISO 50001. A further EUR 15 million was provided by the Regions. Altogether the funding covered 50 % of the energy audit costs.

Table 2 lists Regions that have issued calls for applications for the co-financing of regional programmes. Regarding the call for 2015, seven Regions have set aside almost EUR 11 million for the co-financing of energy audits of SMEs and for the adoption of energy management systems in accordance with ISO 50001. The initiative was repeated in 2016 and 2017 (2,4 and 2,2 million Euro respectively).

The analysis of the impact achieved by the various regional calls for proposals for the promotion of energy efficiency in SMEs, pursuant to art. 8 of Legislative Decree no. 102/2014, highlighted some critical issues. The regional calls did not have the expected effect in terms of results achieved. Not all Italian regions have joined the calls (as shown in Table 2) and among those that have implemented a regional call only Lombardy (234 companies), Sardinia (58 companies, 29 of which also reported energy efficiency interventions) and Campania (56 companies audits and funded interventions) have achieved concrete and satisfactory results. As good results obtained in few regions are mainly due to the fact that the regional calls also included the financing of the energy efficiency intervention implemented after the audits.

The call of the Emilia Romagna region has also obtained good results (156 financed companies) thanks to the extension to 100% of the contribution for the costs for the realization of the audits or for the adoption of ISO 50001 certification and the establishment of a Subsidized Finance Fund aimed at supporting companies and in particular for the realization of interventions aimed at reducing energy consumption and the production of energy from renewable sources.

Table 2 - Support programmes for energy audits in SMEs and the adoption of energy management systems in accordance with ISO 50001, following the calls of 12 May 2015 and 8 November 2017.

Programme	Executive Decree	Regional Call publishing data	Region	State Resources allocated [€]	Regional [source,€]	Co-financing	Total resources available
Decree of the Ministry of Economic Development (MiSE) and the Ministry of the Environment (MATTM) of 12 May 2015 (MiSE, 2015b)	Executive Decree of 21 December 2015 (MiSE, 2015a)	09/09/2016	Lombardy	1,135,566	ERDF Regional Operational Programme 2014-2020 (MiSE, 2016b)	1,135,566	2,271,132
		29/09/2016	Piedmont	1,194,000	ERDF POR 2014-2020 (MiSE, 2016b)	1,194,000	2,388,000
		28/10/2016	Sardinia ¹	269,250	ERDF POR 2014-2020 (MiSE, 2016b)	269,250	538,500
		12/12/2016	Friuli Venezia Giulia	298,500	Regional funds	300,000	598,500
		10/10/2017	Emilia Romagna ²	1,194,000	ERDF POR 2014-2020 (MiSE, 2016b)	1,194,000	2,388,000
		10/11/2017	Sicily	895,500	Regional funds	900,000	1,795,500
		25/01/2018	Marche ³	437,500	ERDF POR 2014-2020 (MiSE, 2016b)	437,500 ³	874,000
Decree of the MiSE and the MATTM of 4 August 2016 (MiSE, 2016a)	Executive Decree of 21 December 2016 (MiSE, 2016c)	29/05/2017	Campania ⁴	1,194,000	ERDF Regional Operational Programme 2014-2020	1,194,000	2,388,000
Decree of the MiSE and the MATTM of 8 November 2017 (MiSE, 2017)	Executive Decree of 23 November 2018	30/01/2020	Lombardy	1,567,125	Regional Funds	671,625	2,238,750

¹The call also included € 1,920,000 (ERDF funds) for energy efficiency interventions identified by energy audits up to a maximum of 65% of eligible costs.

² The contribution has been intended to cover 100% of eligible expenditure for the implementation of an energy audit or for the adoption of an energy management system.

³ The ministerial contribution was included in a wider call for proposals on ERDF funds (for a total of 9,836,644euros) which provided for the financing of energy audits and energy efficiency interventions identified from energy audits. All interventions had to lead to an improvement in energy efficiency, in terms of annual primary energy savings, equal to or greater than 1 kWh per euro invested for electricity consumption and 2.5 kWh per euro invested for fuels, compared to the pre-existing production capacity.

⁴The call also included € 5,000,000 (ERDF funds) for energy efficiency interventions identified by energy audits up to a maximum of 50% of eligible costs.

Innovation policies devoted to SMEs

Although no information is available on the share of financing with direct or indirect impacts on energy efficiency, it is worth briefly describing the two policies devoted to SMEs with a wider scope, related to innovation: guarantee fund for SMEs, Capital goods support scheme “Nuova Sabatini” and National Strategy for innovative start-ups and SMEs.

Literature (Honohan, 2010; Holton *et al.*, 2013) suggests that guarantee funds reduce the risks of beneficiaries and enhance credit access, implying both economic and financial additionality. The first additionality creates benefits for the economy as a whole, such as increases in employment and firm productivity, whereas the second at firm level, increasing available resources and reducing the level of collateral required. When such funds are used to support energy efficiency, additional benefits are created both at firm and national level, for example reducing energy dependence and contributing to long term energy targets.

The guarantee fund for SMEs, created by the Budget Law 1997 in Mediocredito Centrale and operational since 2000 provides public guarantees to SMEs in manufacturing, construction and services and, in case of default, the financing institution can immediately call on the fund to meet its obligation. This measure is the most important financial support measure for SMEs in Italy: it was able to counterbalance the effect of the 2008 credit crisis, particularly severe for SMEs that experienced a more significant drop in credit flows and a stronger rise in interest rates with respect to larger firms (MiSE, 2015c). In 2020, due to pandemic, the fund registered its peak in operations, overcoming the cumulated results in twenty previous years (MiSE, 2021c).

In order to access the fund, the bank has to verify the eligibility of the firm through a scoring system designed to minimize the default likelihood, ensuring the financial sustainability of the fund itself. The Italian fund was reformed in December 2017, in order to consider the actual financial constraints of the SME and to increase support to firms that are more likely to be credit constrained. The reform was in line with the results of (Andini *et al.*, 2019), who studied the effects of improving the screening of creditworthy firms by adopting a machine learning approach.

The fund works in two main ways: direct guarantee and counter-security, associated to financing already guaranteed by mutual guarantee institutions or regional funds. Relative to the second one, reserves existed in specific regions to limit the access to the fund to counter-securities, but all regions were obliged to abolish these reserves by December 2020. The existence of these reserves for counter-securities was aimed to reduce transaction costs and thus enhance SMEs in accessing credit, but it could create a rent for financial intermediaries. (Lavecchia, Leva and Loschiavo, 2020) compare the access to the guarantee fund in several Italian regions and found out that removing limitations in the fund functioning, such as reserves for counter-securities, improves SMEs access and reduces the corresponding costs.

Looking at the 2014-2020 period, the fund authorised 2.262.878 operations, granting guarantees for 175 billion Euro (106 billion Euro in 2020 only) that were associated to guaranteed financings equal to 225 billion Euro (124 in 2020). The granting is for the vast majority in terms of direct guarantees: counter-security operations represented more than 80% of the total in 2005, 50% in 2010 and 14% on average in the period 2014-2020 (MiSE, 2021c).

An analysis of the approved requests by NACE code shows that SMEs in trade sector represent 39% of the total in the period 2014-2020, followed those in industry with a share equal to 33%. In the same period, the positioning of the two sectors is the opposite when looking at the financing granted (48% of cumulated values in industry and 33% in trade) and guarantees (45% of cumulated values in industry and 34% in trade). The geographical distribution of both financings and guarantees granted shows a higher importance of Northern Italy (57% of the cumulated values for both variables), followed by Southern Italy (23 and 24% respectively for the two variables) and then Central Italy (20% and 19%).

The National Strategy for innovative start-ups and SMEs is a comprehensive framework aimed at facilitating the creation and the growth of new innovative companies. To do this, the Strategy provides a set of different support mechanisms to accompany new companies in different phases of their life, namely incubators,

start-ups and SMEs; among these incentives, the simplified access to the guarantee fund. The Strategy was launched in 2015 and each year the Ministry of Economic Development provides a monitoring report to the Italian Parliament. According to this report (MISE, 2021a) , in the three-year period 2017-2019, the number of start-ups and innovative SMEs receiving investment increased considerably. Incentives such as the 50% de minimis tax incentives and the National Innovation Fund were well received. At 31 December 2020 the Guarantee Fund for SMEs managed a total of over 14,000 operations devoted to 6,000 between start-ups and innovative SMEs, with some of them receiving more than one loan.

In September 2021 innovative start-ups equalled 13,999 and Innovative SMEs reached 2,066, both figures increasing by more than 15% compared to the previous year. At sectoral level, around 38% of innovative start-ups and 31% of the total number of innovative SMEs operate in the production of software, IT consultancy and related activities. In addition, a significant proportion of innovative start-ups (14%) and innovative SMEs (13%), are involved in scientific research and development. In both cases, there could be implications on the technologies available for energy efficiency improvements, for example in terms of systems for monitoring energy consumption or building energy management systems but the available data do not allow a combined analysis of the measure with indirect effects on the energy efficiency of companies.

The Capital goods support scheme “Nuova Sabatini” has been operational since 2014, and in December 2016 was aligned to the Plan Industria 4.0, allowing an increased contributions for SMEs investing in the material and immaterial goods included in a specific list (Investimenti 4.0). At the same time, the initial plafond, managed by Cassa Depositi e Prestiti, equal to *2.5 billion Euro was increased up to 5 billion*. Nuova Sabatini is devoted to SMEs in all sectors and regions and the involvement of financial intermediaries is aimed to further enhance a widespread use. Beneficiaries can access the measure only with bank financing or financial leasing, with a maximum duration of 5 years and a coverage until 100% of the investment. Nuova Sabatini can be also cumulated with other existing incentives, in particular with the Guarantee Fund.

With more than 25,000 requests in 2020, the measure Nuova Sabatini granted incentives for 382 million Euro, 240 of which were distributed. Looking at the 2015-2020 period, the measure granted incentives for 1,7 billion Euro and distributed 537 million Euro. An evaluation on the period 2014-2018 show that 60.029 have been received, 87% of which corresponded to distributed incentives. In Northern Italy are concentrated 78% of the distributed incentive, with Central and Southern Italy showing an increasing trend (in 2018, 15% and 9% respectively). The measure is relatively well known and used, thanks to the clearness in the access requirements and speed in the process schedule. By contrast, the additionality of activated resources is relatively low, and it could be increased targeting the measures towards specific firms (MISE, 2021) .

The last measure shown in the table Sustainable Investments 4.0 only opened in May 2022, and thus it is not yet possible to examine its results.

Conclusions

The SMEs are the backbone of Italian economy. Energy efficiency and innovation in the SMEs have been recently recognized as crucial as demonstrated by the development of several policies, that have been reviewed in this work. Most of the policies are voluntary agreements focused on economic aspects (mainly grants, loans and tax deductions), with a scarcity of informative programmes. In some cases, the economic incentives are granted only if specific mandatory requirements are implemented.

Further effort in monitoring and harmonizing the information on the impact of national and regional policies (general of SME-specific programmes) on SMEs could help policy makers to evaluate their effectiveness and weakness. This comprehensive evaluation can give policy makers a basis for decisions while helping companies to evaluate and take actions to improving their energy efficiency. Monitoring of supporting instruments, in an impartial and scientific-based way, is very important to be able to analyse the uptake of the instruments, the barriers and the success factors.

In the case of policies not only targeted to SMEs, the comparison of results and cost effectiveness between SMEs and large enterprises could provide insights for better tailoring existing measures and removing barriers.

Innovation in SMEs can also be considered as a driver for energy efficiency while increasing competitiveness in SMEs towards the energy transition. A further work in developing a monitoring system for innovation policies aimed at identifying the direct and indirect energy efficiency impacts linked to innovation would help in reinforcing this interaction and quantify the associated multiple benefits.

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