Full version - 02/04/2013

CONSTRUCTION21

ENERGY AUDIT OF 50 SMES

I. ABSTRACT

The italian energy system is characterized by relatively low "energy consumption per capita" indicators (2,74 tep/inhabitant, while 3,89 tep/inhabitant for Germany and 3,97 tep/inhabitant for France). Nevertheless CO2 emission intensity per energy consumption is high (2,36 tCO2/tep for Italy as Germany and 1,38 tCO2/tep for France).

These values derive from four fundamentals aspects that characterize italian energy management:

- imports dependence;
- high energy costs;
- neglect of secondary energy sources by process;
- non-rationalization of consumption.

Art.8 of European Directive 2012/27/UE on energy efficiency obliges large enterprises to make the first energy audit within three years of the entry into force and, later, a revision every four years.

Annex VI to this Directive sets out the energy-audit criteria, summarized in the following:

- they must be based on operative data in relation to the energy consumptions which must be updated, measured, traceable and, for electric energy, on load profile;
- they must comprehend a detailed examination of the energy consumption of buildings, activities, industrial plants and transportation.
- when possible they should be based on the life cycle cost analysis.
- they must be proportionate and sufficiently representative to outline the global energy performance and to individuate the best improvement opportunities.

This approach doesn't consider Medium and Small Enterprises which in Italy represent a class of users with a great impact on national energy system. The extension of the energy audit to the

SMEs allows to estimate improvements which justify initial costs (analysis, evaluations, technical intervention on plants and structures). These improvements are in terms of:

- costs reduction;
- environmental impact reduction;
- improvement of the company performance, considering that the total energy consumption of a group of several SMEs is similar to the one of a single Large Enterprise.

The SMEs energy diagnostic process is comparable to the one applied to other cases based on UNI CEI/TR 11428:2011 <Energy Diagnostic, General Requirement of the energy diagnostic service> which establish the following fundamental points in order to carry out the energy audit:

- identification of significant energetic aspects;
- identification of the operating modes, users behaviours and influence on energy consumption;
- identification of areas and process that needs more qualitative data;
- field inspections and validation of collected data;
- elaboration of energetic fluxes subdivided by uses and supplies (contracts analysis);
- elaboration of an energy balance individuating consumption factors in relation to building insulation, thermal and electric plants;
- calculation of real energy performances indicators and comparison with the reference-ones;
- elaboration of temporal diagram of energy demand;
- determination and quantification of potential energy saving compatible with diagnosis objective;
- comparison between different energy saving solutions in terms of costs and consumptions;
- feasibility and interaction analysis of multiple actions for energy saving;
- calculation of economic indicators EROEI (energy return on energy investment) and NPV (net present value).

The procedure above uses data already available or, anyway, easy to find. This allows to define the energy master plan on objective informations and calculations.

We can see also how the industrial energetic diagnostic is complementary to the implementation of environmental management system (ISO 14001), project of life cycle assessment (ISO14040) carbon footprint (ISO 14064) and energy management systems (ISO 50001) aiming at an integrate management E&E (energy and environment) of process and product.

The attention on environmental sustainability and energy saving are shown in a diagram which allows continuous monitoring and a performance improvement, which is self-supplied with the gained savings and which contributes to the achievement of excellent management levels.

II. EUROPEAN NATIONAL LEGISLATION

The European Directive 2012/27/UE in energy efficiency is the natural evolution of Directive 2006/32/CE concerning the final uses and energy services.

A Regulation, that specifically refers to the industrial context and intervenes in process efficiency, derives from the Directive 96/61/CE (prevention and pollution reduction - IPPC).

This Directive is meant to industries with a great environmental impact in terms of waste, emissions, water waste, noise, etc.. and energy. As Member States must exchange informations about BAT (Best Available Techniques), this was realized by writing BREF (Bat Reference Documents). One of these documents deals with energy efficiency in industrial contexts, considering both management and energy saving measures.

The subject of European Directive on Emission Trading 2003/87/CE are the industrial activities. From January 1st 2005 european enterprises that are included in the sectors indicated by EU ETS must limit CO2 emissions as indicated on the national plans of allocation. EU ETS involves about 11000 plants that are responsible for approximately 45% of the total CO2 emission of the European Union.

In Italy the electric and gas Ministerial Decrees 7.20.2004 introduces the energy efficiency titles (“certificati bianchi”). This system improves efficiency measures realized in all fields, including the industrial one.

The industry participation increases in time, particularly for cogeneration plants and thermal recovery.

At the moment the "certificati bianchi" are effective tools to boost energy efficiency. They constitute the main part of the italian strategy to reach the +20% objective of improvement in energy efficiency for 2020.

If we consider local incentives we can see that only some Regions made incentives for energy audit and energy-saving measures specifically for industries (for ex. Lombardia Region), but there isn't an overall report that allows the esteem of all real benefits.

III. METHODOLOGY FOR THE EXECUTION OF THE ENERGY AUDIT

The project CONSTRUCTION21 entails the realization of 50 energy audit for micro, small and medium-sized enterprises (SMEs) .

The energy diagnostic process is currently underway, 35 SMEs have been already analyzed.

In *Table 1* we can find the classification of SMEs according to the Extract of Article 2 of the Annex of Recommendation 2003/361/EC *" The category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 people and which have an annual turnover not exceeding 50 million euros, and/or a total annual balance sheet not exceeding 43 million euros"*.

SME Thresholds	**Staff**	**Turnover**	**Balance sheet**
Micro enterprise	< 10	≤ € 2 million	≤ € 2 million
Small enterprise	< 50	≤ € 10 million	≤ € 2 million
Medium-sized enterprise	< 250	≤ € 50 million	≤ € 43 million

Table 1 – Enterprise classification according to the number of employees

During the first phase of the energy audit we collected enterprise information to better evaluate their actual situation and to understand if the enterprises are environmentally-conscious and genuinely interested in pursuing energy efficiency and renewable strategies.

The questionnaires were done by telephone interview or online and some enterprises requested meeting to perform the audit.

Not all the enterprises we contacted wanted to participate and this had significantly increased the proportion of contacted SMEs which provided the request data.

The number of enterprises which answered the questionnaire compared to the total number of contacted companies is shown in ***Figure 1***.

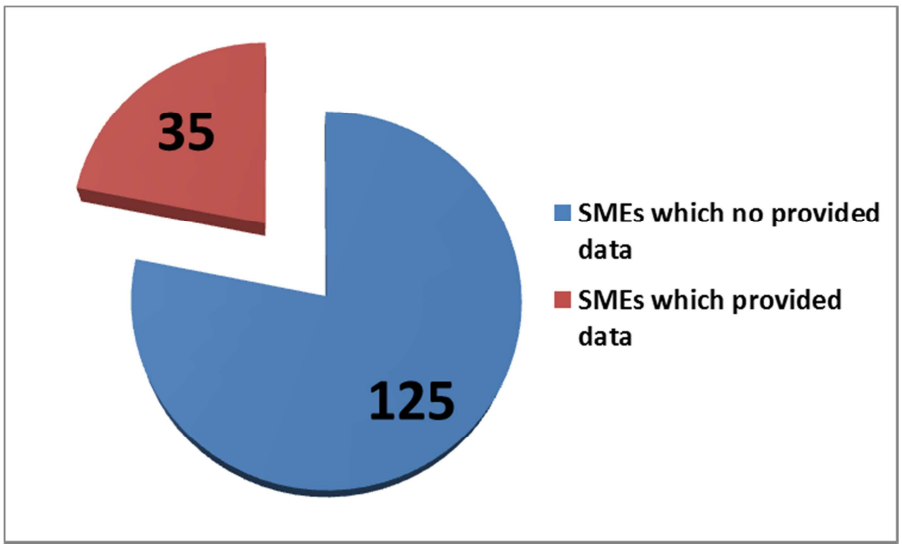


Figure 1 – Contacted SMEs statistic

Table 2 shows the SMEs which provided data. Of all contacted companies only the 22% answered the questionnaire. Many enterprises also asked not to publish their sensitive data for privacy reasons, competition and lack of fiscal transparency.

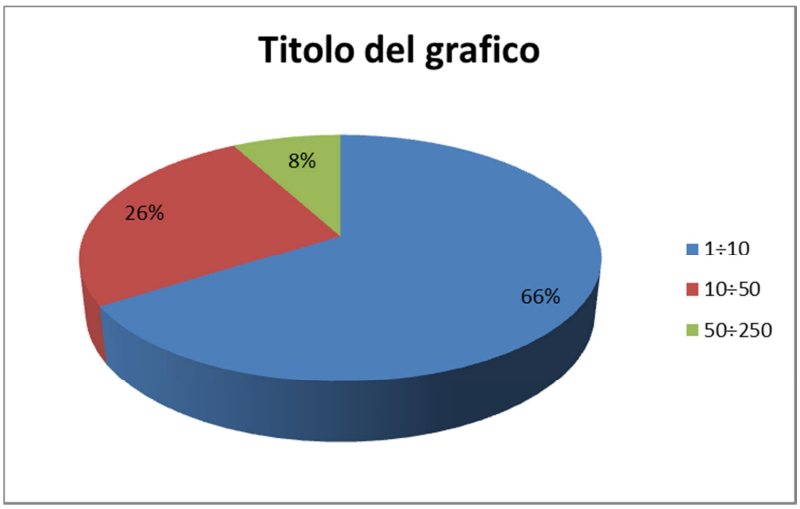
We can see that there is a homogeneous geographical dislocation throughout the national territory and a manifold business typology. For simplicity in next charts the SMEs will be indicated only by reference code SAxx where xx is a progressive number.

Rif.	COMPANY NAME	ADDRESS	PROVINCE	REFERENT	TYPE OF BUSINESS OR SECTOR
SA01	Casasana	S. Fidenzio, 1/a	PD	Maurizio Lazzarotto	Architecture studio and builder merchant
SA02	Pozzetto Impianti	Via Francesco di Manzano,22 33044 Manzano	UD	Chiara Pozzetto	Electrical and PV systems seller
SA03	B.M. Automatismi Elettrici S.R.L.	via noalese 174h	VE	Bragagnolo Mario	Renewable energies
SA04	Polo Tecnologico Per L'Energia	Via Degasperi, 77	TN	Maurizio Fauri	Energy design studio
SA05	San Gregorio Impianti Sportivi Srl	VIA ristori 39	PD	Arisi Mattia	Real estate
SA06	Vassilli S.R.L	via Canada, 9	PD	Berto Vassilli	Devices for disables (wheelchairs)
SA07	Az. Agricola Gallina Claudio	via cavarie 8, Valdobbiadene	TV	Claudio Gallina	Commercial farm
SA08	Verniciatura Lady S.A.S.	via dell'artigianato 12, San Cassiano di Brugnera	PN	Paron Valter	Forniture polishing, laquer and painting
SA09	Mia Infissi S.R.L.	Via Pre' Jacobino Da Miane 5	TV	Luigi Mattiola	Metalworking
SA10	Basilico Automazioni S.R.L.	via San Lorenzo 147, Lazzate	MI	Alessandro	Commercial
SA11	Sartor Renato Impianti S.R.L	via Martinello 9, Montebelluna	TV	Non Comunicato	Electronic systems
SA12	Ecomenergia S.R.L.	via balla 106, Villafranca	PD	Pittarello	Energy and construction
SA13	Centro Elettronico Bassanese	Via S.Pellico, Bassano del Grappa	VI	Bizzotto Maurizio	Electrical systems
SA14	Marchetto E Visentin Impianti Elettrici S.N.C.	via strada gatta 21, Albaredo d'Adige	VR	Marchetto Oscar	Electrical systems
SA15	Solar Bvf Di Boschele Fabio	via Iagon 5, 38050 Roncegno Terme	TN	Boschele Fabio	Electrical and PV systems
SA16	Clivati Impianti Elettrici S.R.L.	via lombardia 1, Azzano S. Paolo	BG	Mauro Clivati	Electrical systems
SA17	3T S.R..L	via v.g. Perina 15/17 Valdaro	MN	Modena Enrico	Metalworking
SA18	Solegest S.R.L.	via G.Bruno	ME	Freni Gaetano	Renewable energies
SA19	Carissoni Gianmarco Impianti Elettrici	via primula, 1 24020 Parre	BG	Carissoni Gianmarco	Electrical systems
SA20	Scainelli Giacomo	via monte secco 2, Parre	BG	Giacomo Scainelli	Installer
SA21	Trl Grop S.R.L.	Via Treno 146, 25020 Capriano del Colle	BS	Ippolito Raffaele	Engineering
SA22	Eurogessi Italia Srl	417/1, v. della Lira - 31053 Pieve Di Soligo	TV	Antonello	Construction company, thermal and acoustic insulation
SA23	A.S.M.I. S.N.C	Via Tagliamento, 56 Mellaredo di Pianiga	VE	Michelon Giuliano	Production of load cells
SA24	Malvestio S.P.A	Via Caltana, 121 35010 Villanova	PD	Giudo Malvestio	Hospitals and clinics forniture
SA25	Meccanica Meneghello Snc	via Francia, 7 35010 Busa di Vigonza	PD	Meneghello Valter	Metal and steel industry
SA26	Mondial S.N.C.	Via Don Zonta,3 35010 - Limena	PD	Cavinato Antonio	Disinfectants production
SA27	Off Carr S.R.L.	Via dell'Artigianato II, 29 35010 Villa del Conte	PD	Ruggero Vilnai	Sport devices for disables
SA28	Rehateam S.R.L.	Vicolo Negrelli, 4 31040 Castagnole di Paese	TV	Gianfranco Pivato	Devices for rehabilitation
SA29	Sarp Snc	Via Colombara, 9 - 35018 S.Martino di Lupari	PD	--	Food and canning machine industry
SA30	Sordina S.P.A.	Via Emilia Romagna, 9 35020 Saonara	PD	--	Medical equipment
SA31	Tecnoplastic S.R.L.	Via Calabria, 3/5 35020 Saonara	PD	--	Thermoplastics molding
SA32	Termoidraulica Gusatto Srl	via Roma 86 Miane	TV	Gusatto Giuseppe	Thermohydraulic
SA33	Cim Mobili Srl	via Roma 82 Miane	TV	Antonio Possamai	Furnishing
SA34	Assodont	Via Pre Jacobino 3 Miane	TV	Marilena De Conto	Manufacture of dental instruments and supplies
SA35	Energie Rinnovabili	VIA Pulte Albano 19, Sasso Marconi	BO	Bendini Giuseppe	Renewable energies
SA36	Falegnameria Zannoni snc	via Nogarazze 34 - 31020 Sernaglia della Battaglia	TV	Amelia Gallina	carpentry
SA37	Corniciaio Trinca ROberto	via Manzoni 4/a, 31010 Moriago della Battaglia	TV	Elsa Colomberotto	picture framer
SA38	Piesse	via Cal Zattera, 62, 31010 Falzè diPiave	TV	De Nardi	MDF panels cutting
SA39	Ribò s.r.l.	via Prà della Flera, 45/a ,31010 Falzè di Piave	TV	Bottega Barbara	veneering
SA40	Bubola & Naibo	via della Lira, 617	TV	Luigi Zamai	frames production
SA41	Bortoletto Peter	via Marco Polo 3, 35100, Cadoneghe	PD	Bortoletto Peter	self-employed
SA42	Quotaverde di Michele Paset	via Flliasi 376	PD	Michele Paset	craft
SA43	geom. Rossetto Enrico	via Cartile n.22	PD	Rossetto Enrico	self-employed
SA44	Cardin Cesare e figli srl	Via Montericco, 2 35032 Arquà Petrarca	PD	Cardin Andrea	Construction company
SA45	Casa Isi Più srl	via Rienza 26/c	PD	Sara Coppola	studio progettazione
SA46	ETRA spa	via Galvani 1/a	PD	Eligio Goffo	Multiutility
SA47	Vettorazzo Costruzioni srl	via del progresso,26	PD	ing. Marco Vettorazzo	Construction company
SA48	Impresa di costruzioni Carlo Basso srl	Riva del Grappa 37/1, Cittadella	PD	Geom. Giovanni Carlo Basso	Construction company
SA49	Galliazzo fratelli costruzioni srl	viale Gran Bretagna 3	PD	Galliazzo Sebastiano	Construction company
SA50	Impresa edile Al Pozzo	via Fanzaghe 68	PD	Ruggero Gò	Construction company

Table 2 – SMEs that answered the questionnaires

In the first phase we also classified the SMEs by geographical location, business type and dimension (number of employees) according to *Table 2*.

Figure 2 shows the number of enterprises according to the number of employees:



- 33 micro enterprise;
- 13 Small enterprise;
- 4 medium-sized enterprise.

Figure 2 – Number of SMEs classified by number of employees

Table 3 shows electric and thermal consumption per year.

Rif.	Thermal Energy Consumption [kWh/year]	Thermal Energy % Consumptions for production cycle	Therma Energy % Consumptions for ambience heating	Thermal Energy system	Electric Energy Consumption [kWh/year]	Electric Energy % Consumption for production cycle	Has the enterprise ever payed penalties in the consuption of reactive energy?
SA01	**2.350**	0%	100%	traditional boiler	4.000	0%	No
SA02	**3.500**	0%	100%	traditional boiler	35.000	80%	No
SA03	27.000	80%	20%	convector heather	40.000	60%	No
SA04	32.000	0%	100%	traditional boiler	14.000	0%	No
SA05	30.000	80%	20%	traditional boiler	24.000	45%	Yes
SA06	**7.200**	0%	100%	traditional boiler	49.000	60%	No
SA07	**22.000**	0%	100%	traditional boiler	8.000	0%	No
SA08	44.000	90%	10%	diesel boiler	185.000	95%	No
SA09	**32.000**	90%	10%	gpl boiler	**3.000**	0%	No
SA10	26.500	0%	100%	condensing boiler	10.000	0%	No
SA11	18.000	0%	100%	heat pump	14.400	0%	No
SA12	25.000	0%	100%	traditional boiler	36.000	10%	No
SA13	**4.700**	0%	100%	traditional boiler	**3.800**	0%	No
SA14	5.000	0%	100%	traditional boiler	4.100	0%	No
SA15	18.000	0%	100%	diesel boiler	5.000	0%	No
SA16	**7.700**	0%	100%	traditional boiler	21.000	60%	No
SA17	**22.000**	20%	80%	traditional boiler	13.500	0%	No
SA18	**4.200**	0%	100%	traditional boiler	7.000	0%	No
SA19	**3.900**	0%	100%	traditional boiler	**3.000**	0%	No
SA20	11.000	0%	100%	traditional boiler	4.200	0%	No
SA21	**3.500**	0%	100%	traditional boiler	8.000	0%	No
SA22	**5.200**	0%	100%	traditional boiler	2.500	0%	No
SA23	**1.500**	0%	100%	traditional boiler	3.900	0%	No
SA24	**3.900**	0%	100%	traditional boiler	1.000.000	95%	No
SA25	**11.000**	0%	100%	traditional boiler	**10.000**	0%	No
SA26	**1.500**	0%	100%	traditional boiler	**3.000**	0%	No
SA27	27.000	0%	100%	traditional boiler	9.000	0%	No
SA28	**3.550**	0%	100%	traditional boiler	16.200	0%	No
SA29	**4.350**	0%	100%	traditional boiler	47.000	95%	No
SA30	**4.300**	0%	100%	traditional boiler	44.000	90%	No
SA31	**15.000**	0%	100%	traditional boiler	**10.500**	0%	No
SA32	2.800	0%	100%	gpl boiler	3.000	0%	No
SA33	5.000	0%	100%	gpl boiler	3.200	0%	No
SA34	32.000	0%	100%	diesel boiler	12.000	50%	No
SA35	24.500	0%	100%	traditional boiler	4.000	0%	Yes
SA36	25.500	20 %	80%	convector heather	32.727	0%	No
SA37	5.000	0%	100%	lignocellulosic biomass	18.700	0%	No
SA38	4.200	0%	100%	heat pump	55.000	80%	No
SA39	2.100	0%	100%	gasolio	30.000	80%	No
SA40	2.000	0%	100%	traditional boiler	154.000	95%	No
SA41	7.000	0 %	100%	traditional boiler	9.000	0%	No
SA42	7.000	0%	100%	convector heather	1.200	0%	No
SA43	7.500	0%	100%	traditional boiler	3.000	0%	No
SA44	5.000	0%	100%	condensing boiler	1.818	0%	No
SA45	8.000	0 %	100%	heat pump geotermico	11.000	0%	No
SA46	35.000	0%	100%	traditional boiler	30.000	0%	Yes
SA47	20.000	0%	100%	heat pump	9.000	0%	No
SA48	20.000	0%	100%	heat pump	9.500	0%	No
SA49	15.000	0 %	100%	condensing boiler	8.000	0%	No
SA50	3.500	0%	100%	traditional boiler	2.900	0%	No

Table 3 – Energy consumptions data

In ***Table 3*** energy consumptions were divided into production cycle and non-production cycle consumptions.

Table 3 shows the energy consumption highlighting the production cycle of the SMEs. The implant typology for the production of thermal energy is also indicated.

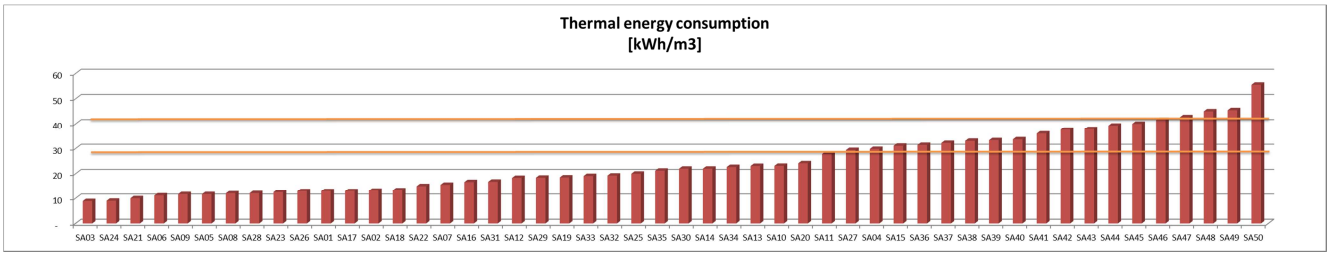


Figure 3 – Thermal energy consumption

Errore. L'origine riferimento non è stata trovata. shows thermal energy consumption arranged by increasing consumptions. The higher consumption are them of a polishing, painting and lacquering enterprise.

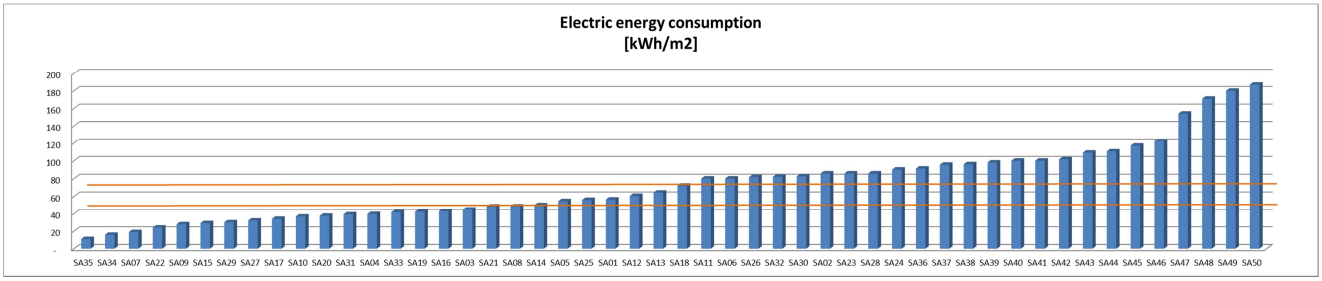


Figure 4 – Electric energy consumption

In Errore. L'origine riferimento non è stata trovata. the electric energy consumption are shown in increasing order. A remarkably high consumption is observed for the SMEs that produces building construction supplies made of recycled plastic material.

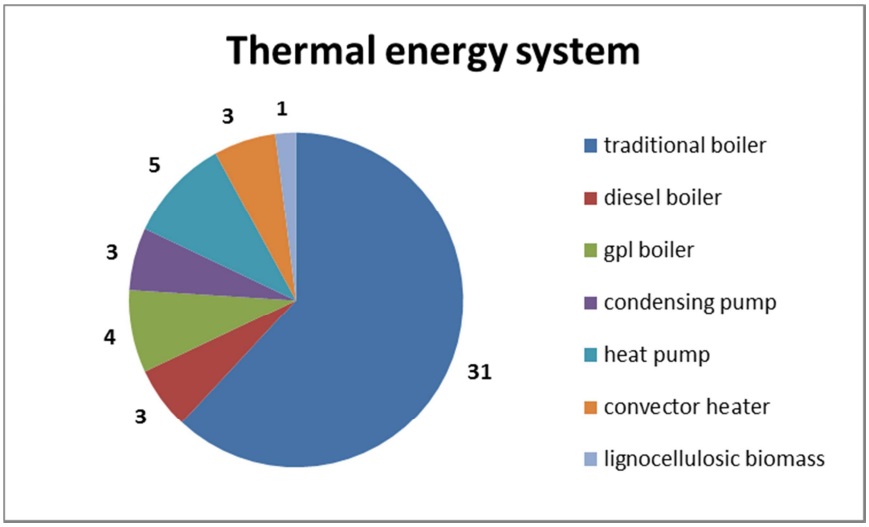


Figure 3 – Type of plants

From ***Figure 3*** we can see that most enterprises have a traditional thermal plant (31)

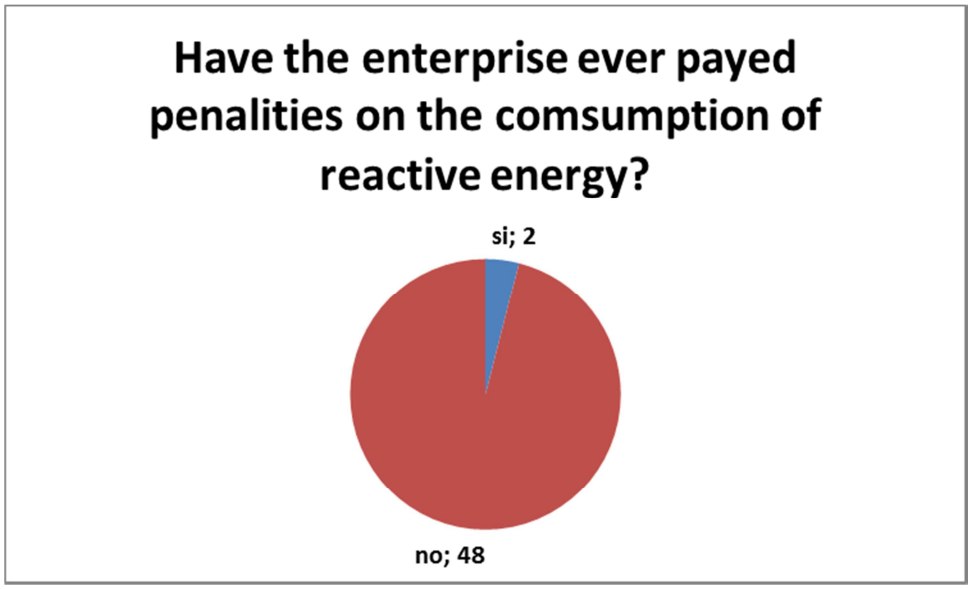


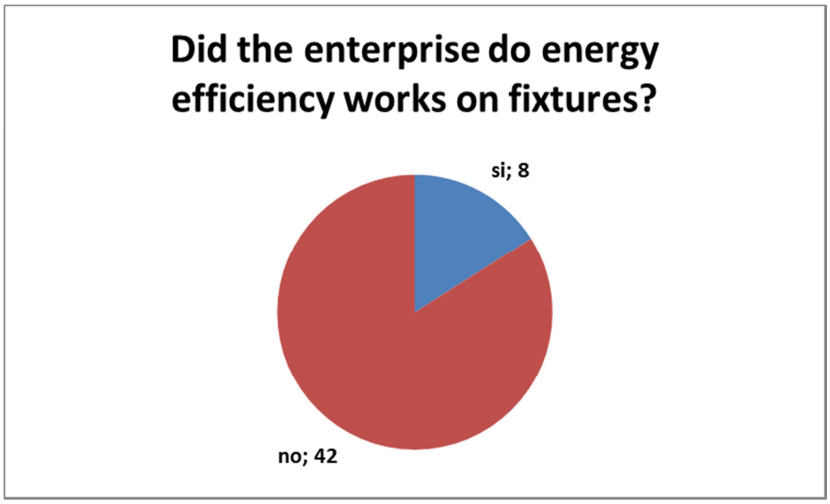
Figure 4 – Reactive energy penalties

Figure 4 reports the number of fined SMEs for the consumption of reactive energy due to not balanced spikes of power demand. Presumably many of these SMEs are not aware of the existence of such a fine.

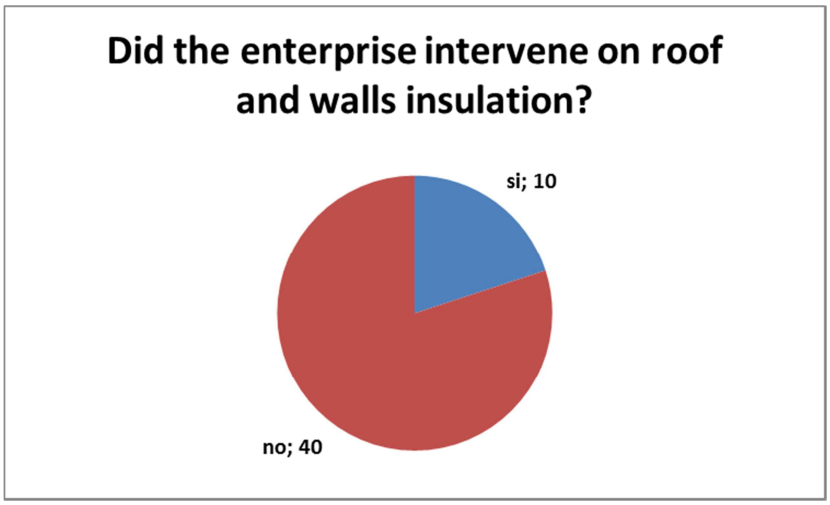
Rif.	TYPE OF BUSINESS OR SECTOR	Year of building construction	Did the enetrprise do energy efficiency works on fixture?	Did the enterprise intervene on roof and walls insulation?	Did the enterprise calculate the average transmittance of opaque walls?	Walkable area [m2]	Office walkable area [m2]	Heated volume [m3]
SA01	Architecture studio and builder merchant	1960	No	Yes	No	450	47	**140**
SA02	Electrical and PV systems seller	1940	Yes	Yes	No	500	63	**190**
SA03	Renewable energies	1996	No	No	No	1.250	200	600
SA04	Energy design studio	1980	No	No	No	250	250	750
SA05	Real estate	2006	No	Yes	No	750	160	480
SA06	Devices for disables (wheelchairs)	1960	No	No	No	8.000	200	**600**
SA07	Commercial farm	1992	No	No	No	400	333	1.000
SA08	Forniture polishing, laquer and painting	1996	No	No	No	1.370	113	340
SA09	Metalworking	1998	No	No	No	1.515	88	265
SA10	Commercial	2003	No	No	No	500	233	700
SA11	Electronic systems	1999	Yes	No	No	300	150	450
SA12	Energy and construction	1995	No	No	No	360	360	1.080
SA13	Electrical systems	2000	No	No	No	**300**	42	**125**
SA14	Electrical systems	1950	Yes	Yes	No	**430**	50	**150**
SA15	Electrical and PV systems	2001	No	No	No	500	133	400
SA16	Electrical systems	1992	No	No	No	18.000	117	350
SA17	Metalworking	2005	No	No	No	1.250	320	960
SA18	Renewable energies	2000	Yes	No	No	**400**	73	**220**
SA19	Electrical systems	2002	No	No	No	**330**	47	**140**
SA20	Installer	1980	Yes	No	No	100	93	280
SA21	Engineering	2001	No	No	No	**250**	100	**300**
SA22	Construction company, thermal and acoustic insulation	2000	No	No	No	500	90	270
SA23	Production of load cells	1999	No	No	No	**150**	33	**100**
SA24	Hospitals and clinics forniture	2002	No	No	No	**3.000**	117	**350**
SA25	Metal and steel industry	2003	No	No	No	**600**	117	**350**
SA26	Disinfectants production	1996	No	No	No	**200**	30	**90**
SA27	Sport devices for disables	2001	No	No	No	**3.200**	217	**650**
SA28	Devices for rehabilitation	1999	No	No	No	**2.950**	90	**270**
SA29	Food and canning machine industry	2000	No	No	No	**1.000**	60	**180**
SA30	Medical equipment	2003	No	No	No	**900**	43	**130**
SA31	Thermoplastics molding	2001	No	No	No	**400**	217	**650**
SA32	Thermohydraulic	1998	No	Yes	No	500	30	90
SA33	Furnishing	1998	No	No	No	800	57	170
SA34	Manufacture of dental instruments and supplies	1960	Yes	Yes	No	900	317	950
SA35	Renewable energies	1982	No	No	No	290	253	760
SA36	carpentry	1975	No	No	No	840	300	900
SA37	picture framer	1981	Yes	No	No	550	100	270
SA38	MDF panels cutting	1997	No	No	No	2.560	90	270
SA39	veneering	1980	No	No	No	2.950	70	210
SA40	frames production	1995	No	No	No	400	50	150
SA41	self-employed	1990	No	No	No	180	180	540
SA42	craft	1950	No	Yes	No	110	110	330
SA43	self-employed	2003	No	No	No	55	55	165
SA44	Construction company	1990	Yes	Yes	No	30	30	90
SA45	studio progettazione	2010	No	No	Yes	300	300	900
SA46	Multiutility	1994	No	No	No	1.000	1.000	3.000
SA47	Construction company	1980	No	No	No	185	185	555
SA48	Construction company	1995	No	No	No	240	240	670
SA49	Construction company	1995	No	Yes	No	250	250	750
SA50	Construction company	2012	No	No	No	100	100	270

Table 4 – building information and data

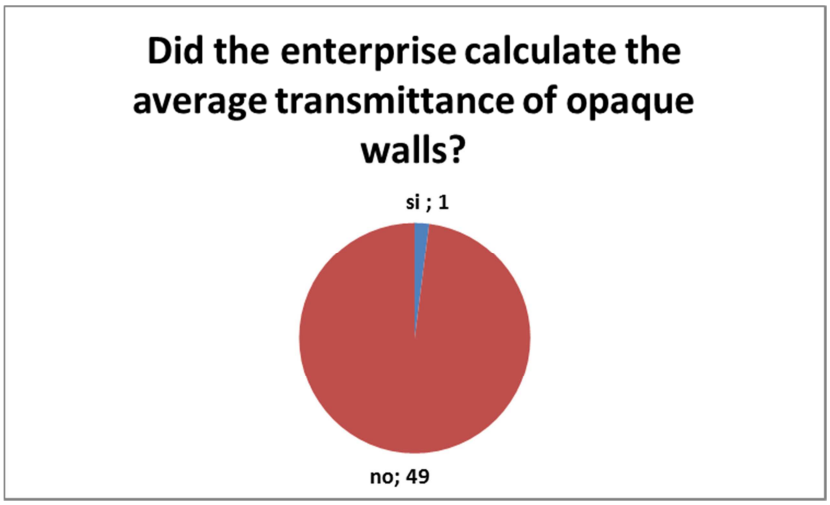
Buildings are almost all built from 1980 to 2000, nevertheless not enough have been done to improve the buildings' energy efficiency.



Only a few energy retrofits of the buildings on doors and windows were made



The insulation of opaque structures was made by about the 20% of the total enterprises.

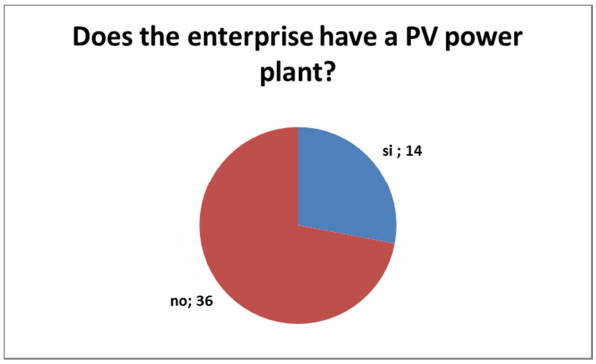


Only one enterprise has calculated opaque walls' energy performances.

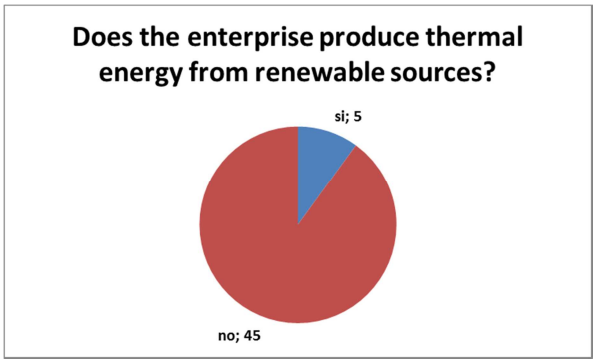
Table 5 reports the enterprises' attention in matter of FER, domotic and energy recovery systems.

Rif.	TYPE OF BUSINESS OR SECTOR	Photovoltaic System?	Does the enterprise produce thermal energy from renewable sources?	Does the enterprise use domotic systems to manage energy?	Does the enterprise have heat recovery systems?
SA01	Architecture studio and builder merchant	No	No	No	No
SA02	Electrical and PV systems seller	Yes	No	No	No
SA03	Renewable energies	Yes	No	No	No
SA04	Energy design studio	No	No	No	No
SA05	Real estate	No	No	Yes	No
SA06	Devices for disables (wheelchairs)	No	No	Yes	Yes
SA07	Commercial farm	No	No	No	No
SA08	Forniture polishing, laquer and painting	No	No	No	No
SA09	Metalworking	No	No	No	No
SA10	Commercial	Yes	No	No	No
SA11	Electronic systems	Yes	No	Yes	No
SA12	Energy and construction	Yes	No	No	No
SA13	Electrical systems	No	No	No	No
SA14	Electrical systems	Yes	No	Yes	No
SA15	Electrical and PV systems	Yes	Yes	No	Yes
SA16	Electrical systems	Yes	No	Yes	No
SA17	Metalworking	Yes	No	No	No
SA18	Renewable energies	Yes	No	No	No
SA19	Electrical systems	No	No	No	No
SA20	Installer	Yes	No	Yes	No
SA21	Engineering	No	No	No	No
SA22	Construction company, thermal and acoustic insulation	No	No	No	No
SA23	Production of load cells	No	No	No	No
SA24	Hospitals and clinics forniture	No	No	No	No
SA25	Metal and steel industry	No	No	No	No
SA26	Disinfectants production	No	No	No	No
SA27	Sport devices for disables	No	No	No	No
SA28	Devices for rehabilitation	No	No	No	No
SA29	Food and canning machine industry	No	No	No	No
SA30	Medical equipment	No	No	No	No
SA31	Thermoplastics molding	No	No	No	No
SA32	Thermohydraulic	No	No	No	No
SA33	Furnishing	No	No	No	No
SA34	Manufacture of dental instruments and supplies	No	No	No	No
SA35	Renewable energies	No	No	No	No

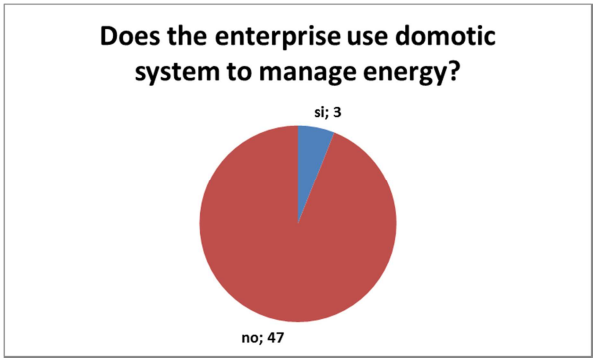
Table 5 – Renewable Energy use



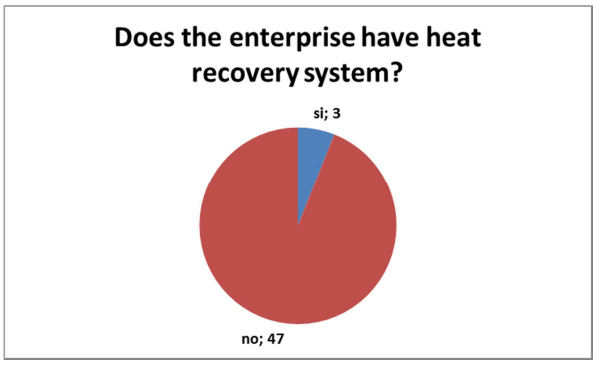
Only 14 SMEs uses photovoltaic to produce electric energy



Only 5 SMEs produces thermal energy for self-use



Only 3 enterprise uses automatic energy management systems



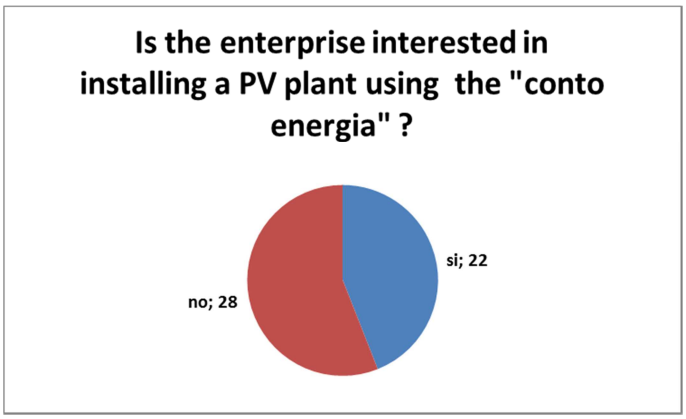
Number of enterprises that use waste heat recovery systems

Rif.	TYPE OF BUSINESS OR SECTOR	Is the enterprise interested in installing a pv system uYesng feed-in tarif (conto energia) ?	Is the enterprise interested in incentives on energy upgrading (tax allowance of 55%)	Is the enterprise interested in incentives on building renovation (tax allowance of 50%, ex 36%)	Did the enterprise applied for "Titoli di Efficienza Energetica" (TEE) ?	Has the enterprise ever used tax credit to research on its building's energy efficiency?	Is the enterprise in the EU ETS system?
SA01	Architecture studio and builder merchant	Yes	Yes	Yes	No	No	No
SA02	Electrical and PV systems seller	No	Yes	Yes	No	No	No
SA03	Renewable energies	No	Yes	Yes	No	No	No
SA04	Energy design studio	No	No	No	No	No	No
SA05	Real estate	No	Yes	Yes	No	No	No
SA06	Devices for disables (wheelchairs)	Yes	Yes	No	No	No	No
SA07	Commercial farm	Yes	Yes	Yes	No	No	No
SA08	Forniture polishing, laquer and painting	No	No	No	No	No	No
SA09	Metalworking	Yes	Yes	No	No	No	No
SA10	Commercial	No	Yes	Yes	No	No	No
SA11	Electronic systems	Yes	Yes	No	No	No	No
SA12	Energy and construction	Yes	Yes	Yes	No	No	No
SA13	Electrical systems	Yes	Yes	No	No	No	No
SA14	Electrical systems	No	Yes	No	No	No	No
SA15	Electrical and PV systems	Yes	Yes	No	No	No	No
SA16	Electrical systems	No	No	No	No	No	No
SA17	Metalworking	Yes	Yes	No	No	No	No
SA18	Renewable energies	Yes	Yes	Yes	No	No	No
SA19	Electrical systems	No	No	No	No	No	No
SA20	Installer	Yes	Yes	Yes	No	No	No
SA21	Engineering	No	No	No	No	No	No
SA22	Construction company, thermal and acoustic insulation	No	No	No	No	No	No
SA23	Production of load cells	No	No	No	No	No	No
SA24	Hospitals and clinics forniture	Yes	Yes	No	No	No	No
SA25	Metal and steel industry	No	No	No	No	No	No
SA26	Disinfectants production	No	No	No	No	No	No
SA27	Sport devices for disables	Yes	No	No	No	No	No
SA28	Devices for rehabilitation	Yes	No	No	No	No	No
SA29	Food and canning machine industry	Yes	Yes	No	No	No	No
SA30	Medical equipment	Yes	Yes	No	No	No	No
SA31	Thermoplastics molding	No	Yes	No	No	No	No
SA32	Thermohydraulic	No	No	No	No	No	No
SA33	Furnishing	No	No	No	No	No	No
SA34	Manufacture of dental instruments and supplies	No	No	No	No	No	No
SA35	Renewable energies	No	No	No	No	No	No
SA36	carpentry	Yes	Yes	Yes	No	No	No
SA37	picture framer	No	No	No	No	No	No
SA38	MDF panels cutting	No	No	No	No	No	No
SA39	veneering	No	No	No	No	No	No
SA40	frames production	No	No	No	No	No	No
SA41	self-employed	No	No	No	No	No	No
SA42	craft	Yes	Yes	No	No	No	No
SA43	self-employed	No	No	No	No	No	No
SA44	Construction company	Yes	Yes	No	No	No	No
SA45	studio progettazione	No	No	No	No	No	No
SA46	Multiutility	Yes	Yes	Yes	Yes	No	No
SA47	Construction company	No	Yes	Yes	No	No	No
SA48	Construction company	No	No	No	No	No	No
SA49	Construction company	Yes	Yes	Yes	No	No	No
SA50	Construction company	Yes	Yes	Yes	No	No	No

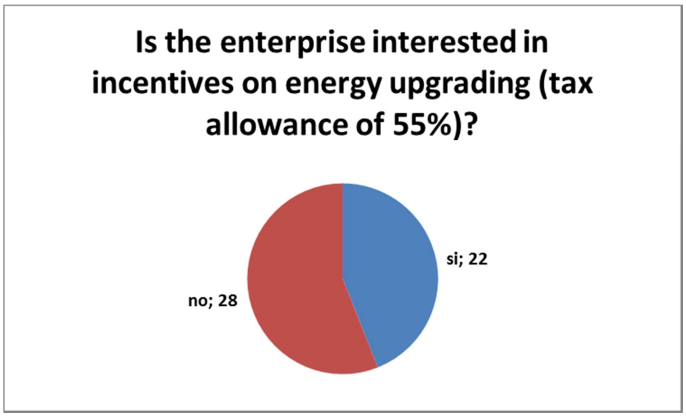
Table 6 - Interest in tax-relief

Table 6 shows SMEs' answers to some questions about the use of financial and fiscal tools to improve plants and building's energy efficiency.

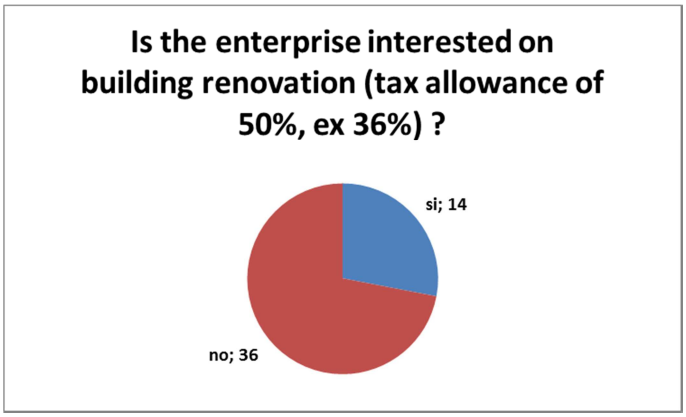
The answers are shown in the following charts.



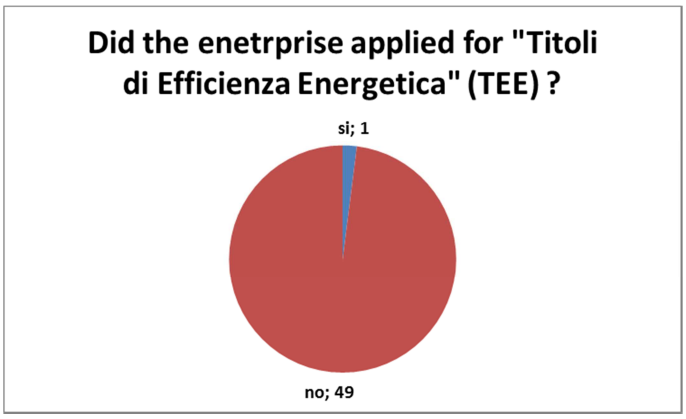
About half of the total number of enterprises are interested in photovoltaic systems. One of the obstacle to the photovoltaic installation is the difficulty to find funds to do it.



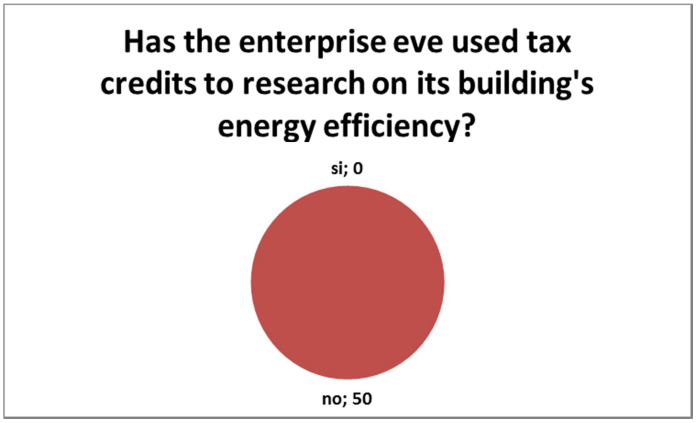
We can notice that many enterprises are interested in fiscal incentives on energy upgrading.



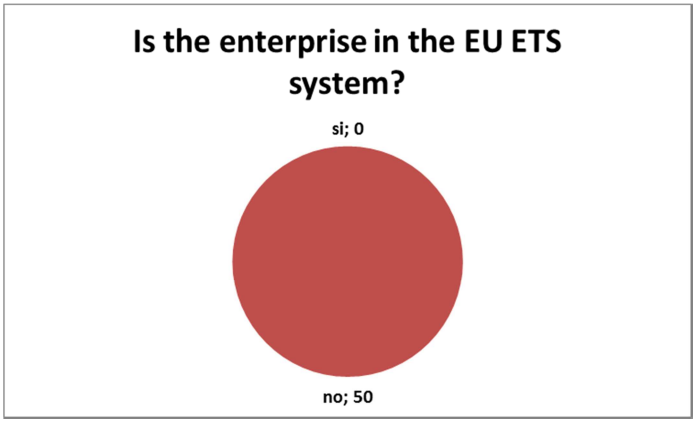
There's a lower interest in fiscal incentives on buildings' energy retrofits especially for the lack of financial resources.



None of the SMEs applied for TEE because they don't' know the existence of them or because they have never paid attention to energy efficiency.



No enterprises used tax credit to do research on buildings' energy efficiency.



The contacted SMEs aren't obliged to participate to EU ETS system because of their average small dimension.

Rif.	TYPE OF BUSINESS OR SECTOR	Is the ennterprise interested in publicizing its products in the CONSTRUCTION21 Yeste?
SA01	Architecture studio and builder merchant	Yes
SA02	Electrical and PV systems seller	Yes
SA03	Renewable energies	Yes
SA04	Energy design studio	Yes
SA05	Real estate	Yes
SA06	Devices for disables (wheelchairs)	No
SA07	Commercial farm	No
SA08	Forniture polishing, laquer and painting	No
SA09	Metalworking	Yes
SA10	Commercial	Yes
SA11	Electronic systems	No
SA12	Energy and construction	Yes
SA13	Electrical systems	No
SA14	Electrical systems	No
SA15	Electrical and PV systems	Yes
SA16	Electrical systems	Yes
SA17	Metalworking	No
SA18	Renewable energies	Yes
SA19	Electrical systems	No
SA20	Installer	No
SA21	Engineering	No
SA22	Construction company, thermal and acoustic insulation	Yes
SA23	Production of load cells	No
SA24	Hospitals and clinics forniture	No
SA25	Metal and steel industry	No
SA26	Disinfectants production	No
SA27	Sport devices for disables	No
SA28	Devices for rehabilitation	No
SA29	Food and canning machine industry	No
SA30	Medical equipment	No
SA31	Thermoplastics molding	No
SA32	Thermohydraulic	No
SA33	Furnishing	No
SA34	Manufacture of dental instruments and supplies	No
SA35	Renewable energies	Yes
SA36	carpentry	Yes
SA37	picture framer	No
SA38	MDF panels cutting	No
SA39	veneering	No
SA40	frames production	No
SA41	self-employed	No
SA42	craft	No
SA43	self-employed	No
SA44	Construction company	No
SA45	studio progettazione	Yes
SA46	Multiutility	No
SA47	Construction company	Yes
SA48	Construction company	No
SA49	Construction company	Yes
SA50	Construction company	Yes

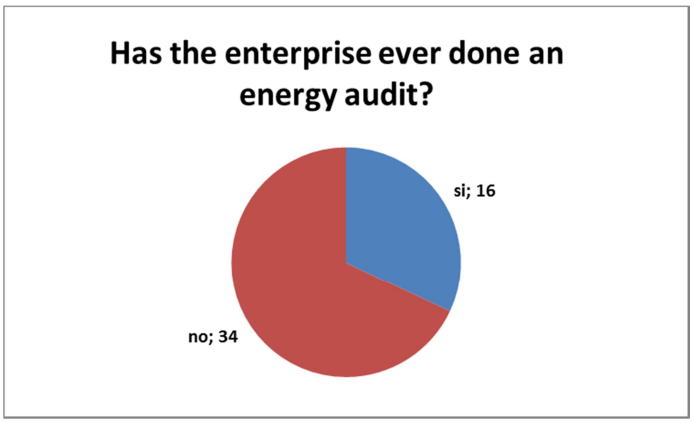
Table 7 reports the SMEs' answers to the possibility to publish their products or services on CONSTRUCTION21 website. 18 enterprises answered positively but maybe the number will increase if we show them the advantages that the site could bring.

Rif.	TYPE OF BUSINESS OR SECTOR	Is the ennterprise interested in publicizing its products in the CONSTRUCTION21 Yeste?
SA01	Architecture studio and builder merchant	Yes
SA02	Electrical and PV systems seller	Yes
SA03	Renewable energies	Yes
SA04	Energy design studio	Yes
SA05	Real estate	Yes
SA06	Devices for disables (wheelchairs)	No
SA07	Commercial farm	No
SA08	Forniture polishing, laquer and painting	No
SA09	Metalworking	Yes
SA10	Commercial	Yes
SA11	Electronic systems	No
SA12	Energy and construction	Yes
SA13	Electrical systems	No
SA14	Electrical systems	No
SA15	Electrical and PV systems	Yes
SA16	Electrical systems	Yes
SA17	Metalworking	No
SA18	Renewable energies	Yes
SA19	Electrical systems	No
SA20	Installer	No
SA21	Engineering	No
SA22	Construction company, thermal and acoustic insulation	Yes
SA23	Production of load cells	No
SA24	Hospitals and clinics forniture	No
SA25	Metal and steel industry	No
SA26	Disinfectants production	No
SA27	Sport devices for disables	No
SA28	Devices for rehabilitation	No
SA29	Food and canning machine industry	No
SA30	Medical equipment	No
SA31	Thermoplastics molding	No
SA32	Thermohydraulic	No
SA33	Furnishing	No
SA34	Manufacture of dental instruments and supplies	No
SA35	Renewable energies	Yes
SA36	carpentry	Yes
SA37	picture framer	No
SA38	MDF panels cutting	No
SA39	veneering	No
SA40	frames production	No
SA41	self-employed	No
SA42	craft	No
SA43	self-employed	No
SA44	Construction company	No
SA45	studio progettazione	Yes
SA46	Multiutility	No
SA47	Construction company	Yes
SA48	Construction company	No
SA49	Construction company	Yes
SA50	Construction company	Yes

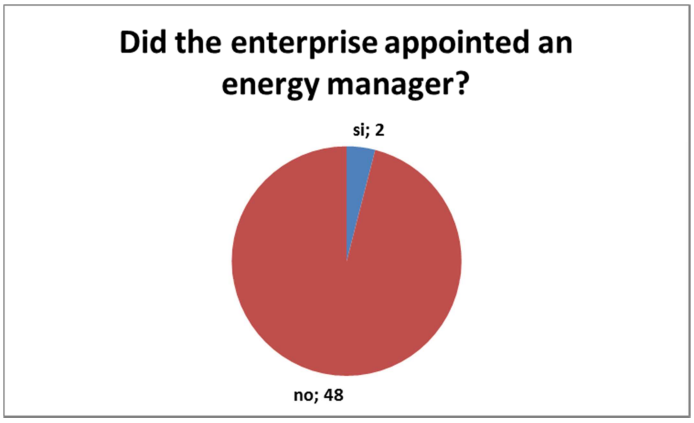
Table 7 – interested in business opportunities

Rif.	TYPE OF BUSINESS OR SECTOR	Has th enterprise ever done an energy audit?	Did the enterprise appointed an energy manager?	Does the enterpise have environmental certifications?
SA01	Architecture studio and builder merchant	No	Yes	No
SA02	Electrical and PV systems seller	No	No	No
SA03	Renewable energies	No	No	No
SA04	Energy design studio	Yes	No	No
SA05	Real estate	No	No	No
SA06	Devices for disables (wheelchairs)	Yes	No	No
SA07	Commercial farm	No	No	No
SA08	Forniture polishing, laquer and painting	Yes	No	No
SA09	Metalworking	No	No	No
SA10	Commercial	No	No	No
SA11	Electronic systems	Yes	No	No
SA12	Energy and construction	No	No	No
SA13	Electrical systems	No	No	No
SA14	Electrical systems	No	No	No
SA15	Electrical and PV systems	No	No	No
SA16	Electrical systems	No	No	No
SA17	Metalworking	No	No	No
SA18	Renewable energies	Yes	No	No
SA19	Electrical systems	No	No	No
SA20	Installer	No	No	No
SA21	Engineering	No	No	No
SA22	Construction company, thermal and acoustic insulation	No	No	No
SA23	Production of load cells	Yes	No	No
SA24	Hospitals and clinics forniture	Yes	No	Yes
SA25	Metal and steel industry	Yes	No	No
SA26	Disinfectants production	Yes	No	No
SA27	Sport devices for disables	Yes	No	No
SA28	Devices for rehabilitation	Yes	No	No
SA29	Food and canning machine industry	Yes	No	No
SA30	Medical equipment	Yes	No	Yes
SA31	Thermoplastics molding	Yes	No	No
SA32	Thermohydraulic	No	No	No
SA33	Furnishing	No	No	No
SA34	Manufacture of dental instruments and supplies	No	No	No
SA35	Renewable energies	No	No	No
SA36	carpentry	No	No	No
SA37	picture framer	No	No	No
SA38	MDF panels cutting	No	No	No
SA39	veneering	No	No	No
SA40	frames production	No	No	No
SA41	self-employed	No	No	No
SA42	craft	No	No	No
SA43	self-employed	No	No	No
SA44	Construction company	No	No	No
SA45	studio progettazione	Yes	No	Yes
SA46	Multiutility	Yes	Si	Yes
SA47	Construction company	No	No	Yes
SA48	Construction company	No	No	Yes
SA49	Construction company	No	No	Yes
SA50	Construction company	No	No	No

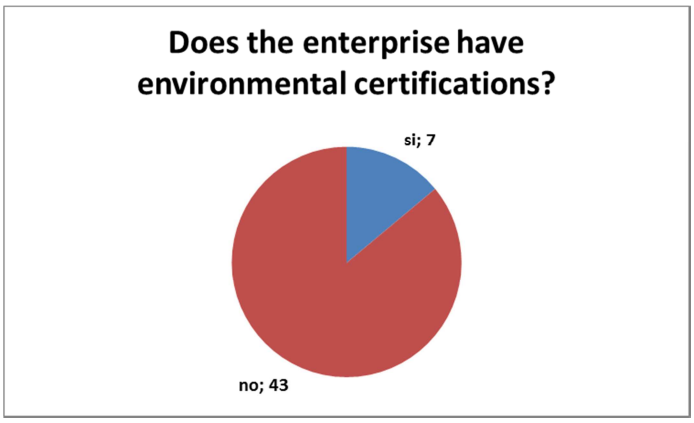
Table 8 – Actual situation



16 SMEs have already done an energy audit.



Only 2 SME have an energy manager.



7 SMEs have environmental certifications.

IV. DATA PROCESSING

After collecting data we have evaluated which are the worst situations and where there are possibilities to an energy efficiency improvement.

The evaluation of thermal efficiency for every SME need the calculation of the thermal specific consumption, which is the annual consumption of primary energy used for room heating and domestic hot water per unit volume heated or unit area heated.

The operating procedure is to calculate the "operational" specific consumption starting from the real fuel consumption which depends on uncertain variables such as climatic conditions and users behaviour.

The choice of expressing the specific thermal consumption in this terms follow the national and regional current legislation which express the limits of energy performance index for winter heating of residential buildings in kWh/m^2 and in kWh/m^3 for the rest of buildings.

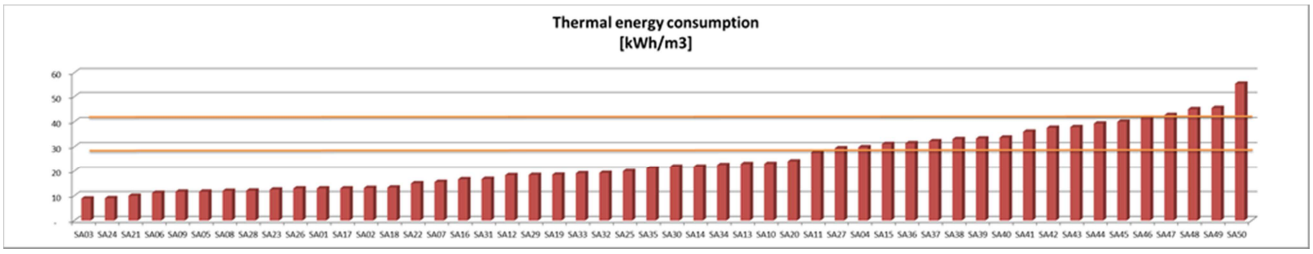


Figure 5 – Specific thermal consumption for winter heating

Figure 5 shows the thermal specific heating consumption The range, which is indicated by the red lines, from 20 to 30 kW/m^3 indicates the standard consumption for these uses. Overall the thermal efficiency is acceptable, only a few cases consume too much energy.

To calculate the electric energy efficiency for every SME, we calculated the specific electric consumption, which is the annual electric consumption per unit area. The specific consumption must be compared with the performance requirements identified on statistical bases. We can say that a lower than 20.0 kWh/m^2 consumption indicates good energy efficiency and no-wastes. The calculation of the specific electric consumption can only be based on the real consumption which is written on the bill.

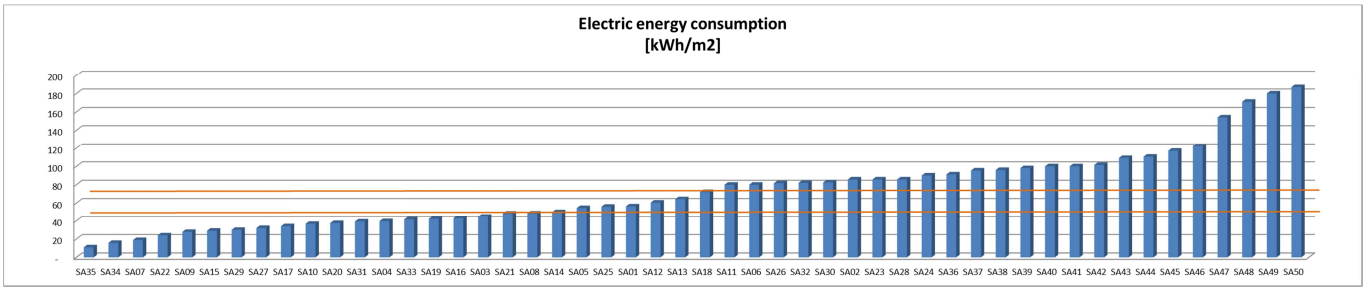


***Figure 6 - Electric* specific consumption**

Figure 6 reports electric specific consumption due to illumination and, in some cases also to the production of hot domestic water. The range, which is indicated by the red lines, from 40 to 60 kwh/m^2 stands for a standard consumption for these uses. The thermal efficiency is overall positive except for a few cases.

Here we can notice that the energy consumption of the analysed SMEs is significantly above average, this indicates the possibility to increase energy efficiency.

V. CONCLUSIONS

The situation that the self-audit activity reveals isn't too positive.

Italian SMEs feel the effect of the market stagnation which carries to a drastic decrease in production.

The attention is focused on the enterprise's budget and on short terms activities. They aren't interested in sustainable development because of the impossibility of earning money from it in the short term.

Almost all the enterprises pay attention to all activities that can increase their visibility and business.

From the consumption analysis we see many opportunity to increase energy efficiency.

We'd like to stress that many enterprises were critical in the possibility to publish their sensitive data both for privacy reasons and advantages against competitors.