innoveas
The power of energy audits

Assessment of Non-technical barriers

AUTHORS : ANDREA DECLICH, GABRIELE M. QUINTI, PAOLO SIGNORE
DATE : 23.03.2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

Technical References

Project Acronym	innoveas
Project Title	**INNOV**ating the uptake of **E**nergy **A**uditing **S**chemes for SMEs
Project Coordinator	Luisa Sileni Istituto per l'Istruzione Professionale dei Lavoratori Edili della Provincia di Bologna (IIPLE) Email: luisasileni@edili.com
Project Duration	June 2019 – Mai 2022 (36 month)

Deliverable No.	D2.2 - "Assessment of non-technical barriers"
Dissemination level [1]	PU
Work Package	WP2
Task	T2.1 and T2.2
Lead beneficiary	K&I
Contributing beneficiary(ies)	IIPLE, A3E, NAPE, LEAG, JER, UTBW, CKA
Due date of deliverable	29.02.2020 (extended until 31.03.2020)
Actual submission date	23.03.2020

[1] PU = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

Document history

V	Date	Beneficiary	Author
1	05.03.2020	Project partners	G. Quinti, A. Declich, P. Signore
2	17.03.2020	Project partners	G. Quinti, A. Declich, P. Signore
3	20.03.2020	Public	G. Quinti, A. Declich, P. Signore

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

Project summary

The INNOVEAS project is an initiative promoted by 10 partners from 6 EU countries, to build and deliver a capacity building programme, aiming at addressing the major non-technical barriers that most often hamper the adoption the energy auditing practice, in particular among those actors, such as SMEs where such audits are not required by law.

The ultimate goal is to consolidate a structured, permanent and expandable offer to help develop continuous self-sustainable services to raise awareness and build capacity in the field of energy auditing and related energy saving measures in SMEs.

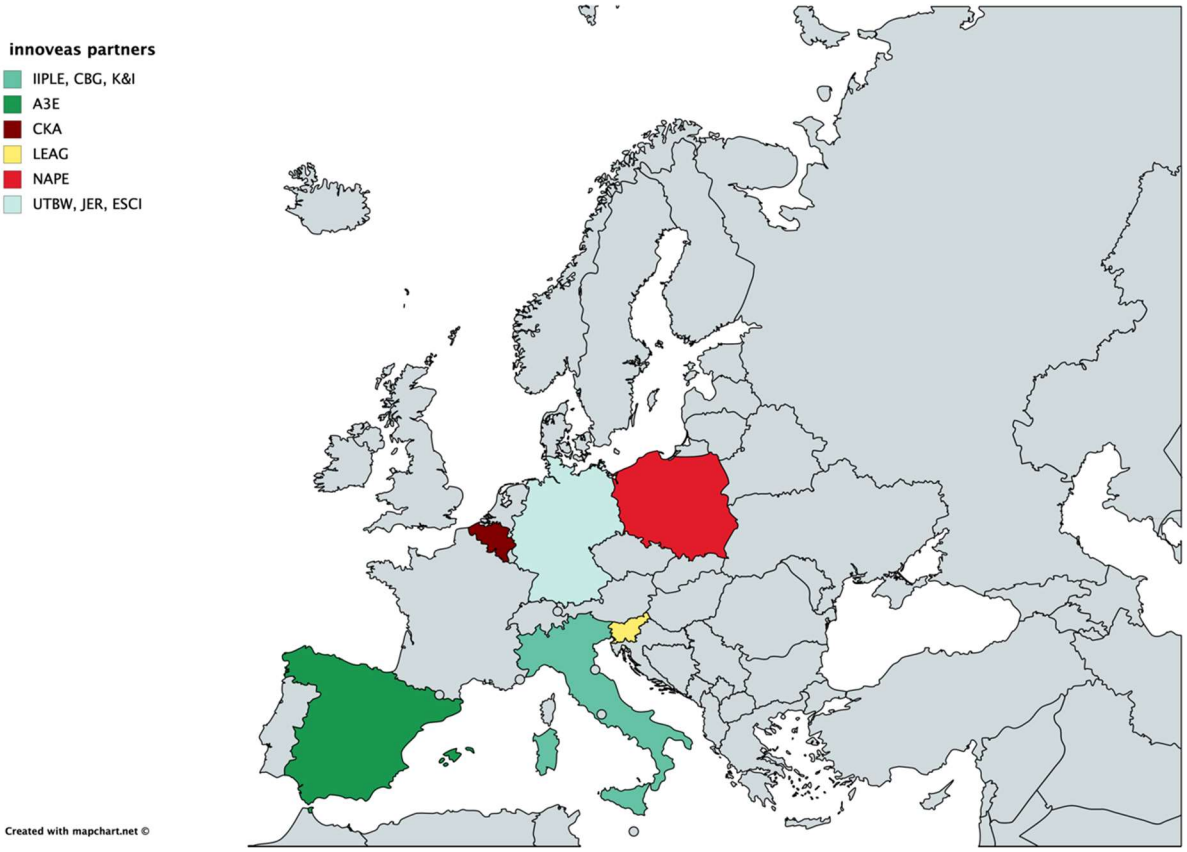
The project therefore aims at designing and deploying staff trainings and capacity building programmes to enhance corporate policy towards energy efficiency, energy culture (motivations, behaviour change, mitigation of perceived risks and barriers) and sustainable supply-chain initiatives. It therefore intends to:

- Advanced analysis of behavioural barriers to energy audits, to identify and analyse the enabling conditions and non-technical barriers hindering the adoption of energy auditing practice;
- Delivery of self-sustainable capacity building programmes, in order to systematise awareness raising procedures to overcome the psychological and organisational barriers to energy audits in SMEs, deliver a training offer to SMEs and formulate a capacity building programme targeting stakeholders such as intermediaries, policy makers and financing institutes;
- Create an institutional structure to sustain the project's objectives and results and lay the basis for the creation and consolidation of a pan-European network of enablers likely to support in the coming years the growth and expansion of the training offer to on energy efficiency for European business.

Disclaimer

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

Partners



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

Description of work package

WP2 intends to carry out an analysis of the current state of the art of energy culture in SMEs in the participating countries. This entails: - Analysis of the current attitude towards energy efficiency and the perception of energy audits as an instrument to abate costs - Existing non-technical barriers that hinder the diffusion of energy audits as a common praxis in SMEs in the participating countries - Analysis of existing regulatory and financial conditions that influence the use of energy audits and the uptake of energy saving measures.

Description of task

Task 2.2 **(**Assessment of non-technical barriers**)** will entail an analysis of the state of the art in EU countries (taking specifically into account the partners countries, i.e. Germany, Italy, Poland, Belgium and Slovenia) regarding the existing non-technical barriers, that hinder the use of energy audit to uptake energy saving measures. Non-technical barriers are mainly societal (e.g. social, behavioural, organisational and psychological) and economic.
This task will be implemented in two stages:
• First through a documentary analysis (using also the documents already consulted in T2.1) aimed at preparing a first inventory of the documented non-technical barriers.
• Second through a consultation in the partners countries of key informants, such as SMEs leaders, energy auditors, policy makers, financial institutions representatives, consumer association leaders dealing with energy issues, scientific experts and academics, aimed at extending the first inventory and at assessing the identified non-technical barriers.

Description of deliverable

The deliverable 2.2 (Assessment of non-technical barriers) consists in a report structuring the results of the assessment of the non-technical (behavioural, organisational and psychological) barriers, that hinder the use of energy audit to uptake energy saving measures.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

Table of contents

Table of contents

TECHNICAL REFERENCES 2
DOCUMENT HISTORY 2
PROJECT SUMMARY 3
DISCLAIMER 3
PARTNERS 4
DESCRIPTION OF WORK PACKAGE 5
DESCRIPTION OF TASK 5
DESCRIPTION OF DELIVERABLE 5
TABLE OF CONTENTS 6
1. EXECUTIVE SUMMARY 8
2. CHAPTER ONE INTRODUCTION 10
2.1. INSTITUTIONAL FRAMEWORK 10
2.1.1. The INNOVEAS project 10
2.1.2. Work Package 2 12
2.1.3. This deliverable 12
2.2. THEORETICAL "CORE": FROM BARRIERS AND DRIVES TO THE SYSTEM OF ACTORS 13
2.3. METHODOLOGICAL FRAMEWORK 14
2.3.1. The literature review 15
2.3.2. Key-informants 16
3. CHAPTER TWO BARRIERS THAT HINDER THE USE OF ENERGY AUDIT TO UPTAKE ENERGY-SAVING MEASURES IN SMES 19
3.1. THE GREAT HETEROGENEITY OF EUROPEAN SMES 19
3.2. ENERGY AUDITS AND EUROPEAN SMES 21
3.3. WELL-FOUNDED ISSUES ON BARRIERS HINDERING ENERGY AUDITS 22
3.4. SMES AND EEMS 25
3.5. CONTROVERSIAL ISSUES 27
4. CHAPTER THREE BARRIERS THAT HINDER THE "ACTORS OF THE CONTEXT" 31
4.1. OBSTACLES CONCERNING AUDITORS AND CONSULTANTS 31
4.2. OBSTACLES CONCERNING FURTHER ACTORS NOT ENTERING IN THE SME'S DYNAMICS BUT RELEVANT 34
5. CHAPTER FOUR TOWARDS AN INNOVATIVE INTERPRETATION FRAME 40
5.1. A HOLISTIC SCHEME FOR THE INTERPRETATION OF INFORMATION 40

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

5.1.1. Energy Culture of “actors of the context” 42
5.1.2. Orientation to change 43
5.1.3. Action 44
5.1.4. The strength of the actors 46
5.2. SOME CONCLUSIONS 46
6. CHAPTER FIVE RECOMMENDATIONS 50
7. BIBLIOGRAPHY 53

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N°847095

1. Executive summary

This deliverable was prepared after the completion of the interviews to 42 key-informants held in the 6 countries of the partners of the INNOVEAS consortium (Belgium, Germany, Italy, Poland, Slovenia and Spain) and at the European level, completing the review of the relevant scientific literature and documentation implemented before, which main results are reported in D2.1 "Energy culture and energy transition" (submitted at the end of November 2019). Chapter One represents an introduction, describing the approach, the methodology, and the activities implemented. Chapter Two is dedicated to the description of the barriers that hinder SMEs in the implementation of the Energy Audits (EAs). It considers, first, the wide heterogeneity of SMEs in Europe and then their different approach towards the relevance of an energy culture. The core of the chapter is represented by a map of barriers met by the SMEs ranging from a strong reluctance towards considering energy issues to the lack of qualified human resources; from economic issues to the lack of information; from problematic relations (sometimes) with Energy Auditors to concerns in the practical implementation of Energy Audits. There are also many controversial issues. Among others, the non-mandatory nature of Energy Audits for most SMEs, the need (or not) of a tailored approach and their (lack of) efficiency. Chapter Three deals with the barriers that hinder the other actors (the so-called "actors of the context") in the implementation or in the assistance to the implementation of the Energy Audits with a specific focus on Energy Auditors and other SME's consultants, as well as SMEs associations, policymakers, financial actors, etc. Seven categories of barriers were identified: (i) EEMs and EAs costs; (ii) Energy culture-related barriers; (iii) Lack of personnel with appropriate skills; (iv) Lack of awareness about the benefits of EEMs and EAs; (v) Ineffective action for involving SMEs; (vi) A scarce focus on SMEs specificity; (vii) Policies' fragmentation. In Chapter Four, considering altogether the barriers that hinder the implementation of the Energy Audits (met on the one hand by SMEs and on the other by the "actors of the context", we propose a model classifying the barriers according to four wide categories: two categories belonging to the cognitive realm, the actors' culture and their orientation to change; and two belonging to the operational realm – the strength of the actors and the operation of the Energy Audits –, as shown in the table below (that is not exhaustive, but includes most of the main important barriers).

Barriers related to energy culture	**Barriers related to the strength of the actors**
Lack of a strong generalized energy culture among SMEs and the "actors of the context", for example: • Lack of a widespread awareness of the relevance of EE, including of EAs • Specialized/engineering culture among Auditors and Consultants that create difficulties in communication • Energy issues are not a priority among many actors, including those of the context	SMEs and "actors of the context" are, generally not well equipped for the effective practice of EAs and EEMs. SMEs, in general, have little or no expertise concerning EE and EAs issues or people dedicated to them; especially in micro and small firms, the entrepreneurs have to cover several roles, no specific attention is put on these issues and oftentimes the time to devote is very limited. As for the "actors of the context", it can be said that they:

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

	• Are not able to interact properly all the various types of SMEs; • Oftentimes are weak from several points of view relevant for dealing with SME because of inadequate knowledge of the funding systems for the promotion of EAs and EEMs, scarcity of human resources to dedicate to the promotion and implementation of EEMs and EAs • Have difficulties in adopting correct communication approaches.
Barriers related to orientation to change	**Barriers related to action**
Scarce orientation to change among the actors, for example: • Reluctance of SMEs to undertake EEMs and EA because of the possible economic and operational burden • Reluctance of Auditors to support SMEs • Low level of mutual trust among different "actors of the context" • Just a minority of actors has taken on a proactive orientation towards EEMs and EAs.	Type of barriers to action are: • SMEs' resources to dedicate to EEM and EAs are, normally quite limited • Regulations aimed at favouring the practice of EAs and EEMs, in general, is very complex • Lack of clear information concerning the procedures for practising EAs and EEMs • The practice of EA is different for different types of firms. The need for protocols that fit the specificities of SMEs is not addressed • Difficulties in communicating among the diverse actors involved in the promotion and practice of EAs and EEMs • Lack of coordination among the actors in the promotion, implementation and evaluation of policies.

In Chapter Five, some recommendations for the implementation of the further steps of the INNOVEAS project are suggested. The overall list of the documents analysed in the Literature Review is reported in the annex.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

2. CHAPTER ONE: INTRODUCTION

2.1. Institutional framework

This document is the second deliverable of the WP2 "State of the art, needs and barriers assessment" of the INNOVEAS project and it is devoted to the analysis of the barriers that hinder the implementation of Energy Audits (EAs) in European SMEs (to uptake energy- saving measures), taking in to account the various actors dealing with this practice directly or indirectly. Among the first, we consider SMEs – or SMEs managers – and Energy Auditors and other professionals assisting SMEs. Among the second, we refer to actors such as SMEs associations (and analogous entities; e.g., Chambers), dedicated projects/programs and development agencies, financial actors devoted to SMEs and energy issues, policymakers designing the regulation and incentive schemes for Energy Audits, and consumers' associations dealing with energy issues.

The analysis is based on a literature review and on 42 qualitative interviews to key- informants from six European countries selected among the kind of actors just mentioned above. Literature review was implemented between June and November 2019 and entails many issues, such as energy culture and energy transition issues in the SMEs, EEMs in the SMEs and related barriers; driving and facilitating factors supporting SMEs in the improvement of the Energy Efficiency; and, of course, Energy Audits in SMEs and the related barriers. Interviews, implemented in December 2019 and January 2020, were centred on this last issue, which is the core one of this Deliverable, "merging" the finds of the literature review with the ones of the interviews.

2.1.1. The INNOVEAS project

The INNOVEAS project intends to build and deliver a capacity building programme, aiming at addressing the major non-technical barriers[1] that most often hamper the adoption of the Energy Auditing practice, in particular among those actors, such as SMEs, where such audits are not required by law. The ultimate goal is to consolidate a structured, permanent and expandable offer to help develop continuous self-sustainable services to raise awareness and build capacity in the field of Energy Auditing and related energy-saving measures in SMEs.

[1] The term "non-technical" is meant here, broadly speaking, as "societal (e.g., social, behavioural, organisational and psychological) and economic".

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

The Energy Audit should represent the first step to trigger an Energy Efficiency process in SMEs. The audit allows to know own consumptions and allow the identification of single factors influencing consumption highlighting the main important ones, both in the production process (if any) and in the "logistic" (e.g., temperature, lighting, etc.). Consumption rates can then be benchmarked against target values to understand what can be improved. It is, therefore, generally acknowledged that Energy Audits do represent an opportunity for companies to optimize management and production costs. However, the state of the art reveals some criticalities in the uptake of audit-oriented practices among those actors who are not legally obliged to do it SMEs in particular.

Main target groups of the INNOVEAS actions are listed below.

*SMEs, the final target group/beneficiary of the action. They are the actors who will have to encounter an environment favouring the implementation of Energy Audits and therefore the adoption of Energy Efficiency Measures (EEMs). The focus is mainly on the "non-energy-intensive" SMEs. The reason is that the "energy-intensive" enterprises have often (on energy issues) dynamics similar to large enterprises (i.e., they are almost aware of Energy Efficiency issues, their internal organizations is able to tackle energy saving related issues when considered relevant); in some cases they are obliged by the law to implement activities to promote energy saving, and Energy Audits are mandatory (this is the case of the energy-intensive SMEs in Italy).

* Energy auditors, who are one of the directly involved actors (in the Energy Audits, beyond the SMEs) and, through their work, contribute substantially in assessing the barriers to SMEs Energy Efficiency improvement. Their experiences so far are important for the assessment of Energy Audits in SMEs.

* Policymakers, i.e., any institutional actor who can contribute to the creation of a favourable regulatory environment for the implementation of Energy Audits. Their involvement as stakeholders in the focus groups/panels foreseen in WP2 was necessary to discuss the state-of-the-art and co-create solutions towards a common direction.

* Financial institutions, i.e., all those actors who are involved in financing schemes for SMEs and can, therefore, support them in the implementation of audits and the adoption of Energy Efficiency measures.

* Industrial associations and other intermediaries, who will be responsible for the implementation of an awareness raising and training programme directly targeting SMEs and who will play a necessary role as impact multipliers. Intermediaries will be the most important hub connecting all the stakeholder typologies addressed by the project, mainly SMEs, policymakers, financial institutions, auditors, Energy Efficiency technology providers, and the Energy Service Companies (ESCOs)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

2.1.2. Work Package 2

In the framework of the project, the WP2 on "State of the art, needs and barriers assessment", to be implemented from June 2019 to February 2020[2], is devoted to carrying out an analysis of:

- The current attitude towards Energy Efficiency and the perception of Energy Audits as an instrument to abate costs
- The non-technical barriers that hinder the diffusion of Energy Audits as a common practice in SMEs in the participating countries, and
- The existing regulatory and financial conditions that influence the use of Energy Audits and the uptake of energy-saving measures.

For attaining these objectives, WP2 develops through three tasks:

- An analysis of the current state of the art of energy culture in SMEs in the participating countries, entailing, among others, the attitudes of involved actors about Energy Audits implementation (T2.1)
- An analysis of the state of the art in EU countries (taking specifically into account the partners' countries, i.e., Germany, Italy, Poland, Belgium, Spain and Slovenia) regarding the existing non-technical barriers, that hinder the use of Energy Audit to uptake energy-saving measures (T2.2), and
- An analysis of the state of the art for what concerns external factors that are currently in place at EU level and which aim at encouraging the adoption of energy-saving measures in SMEs (T2.3).

All the tasks have been, until now, duly implemented.

2.1.3. This deliverable

This deliverable falls under Task 2.2. and has been prepared after the completion of the review of the scientific literature and relevant documents at the European level, at the international level and at the level of the selected individual European countries (Germany, Italy, Poland, Belgium, Spain and Slovenia) and the implementation of the key-informants interviews in

[2] In agreement with the INNOVEAS project officer, this deadline was extended until 31st March 2020.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

these same countries as well as at the European level (European Commission, EAPNE, European Investment Bank, European Bank for Reconstruction and Development).

Besides this introduction (that entails also a theoretical "core" description and a methodological framework describing how the literature review and the key-informants interviews were implemented and represents the Chapter One), it includes 4 chapters.

- Chapter Two, dedicated to the description of the barriers that hinder SMEs in the implementation of the Energy Audits.
- Chapter Three, dealing with the barriers that hinder the other actors (the ones mentioned above) in the implementation or in the assistance to the implementation of the Energy Audits.
- Chapter Four, tries to resume which are the knowledge added value of the research implemented in this WP.

In the last chapter (Chapter 5), we suggest some recommendations that according to our results could be useful for the implementation of the following steps of the INNOVEAS project.

The overall list of the documents analysed in the Literature Review is reported in annex.

This deliverable has been prepared mainly by K&I (Andrea Declich, Paolo Signore and Gabriele Quinti) with a precious contribution of the Local Energy Agency of Gorenjska (Slovenia), the National Energy Conservation Agency (Poland), the Asociación de Empresas de Eficiencia Energética (Spain), UTBW and Dr. Jakob energy research GmbH & Co. KG (Germany), Confindustria Bergamo and IIPLE (Italy), and CKA (Belgium), IIPLE, as coordinator, supervised also the entire work.

2.2. Theoretical "core": from barriers and drives to the system of actors

Many studies related to the challenge of Energy Audits and, more broadly, to the challenge of the design and implementation of Efficient Energy Measures in SMEs were drafted in the last 20 years. These studies mainly concentrate on the barriers or obstacles on one side and on the driving factors (or facilitating factors) on the other, that the SMEs meet in implementing Energy Audits (narrowly) and in relation to the adoption of EEMs (broadly). Of course, most of these studies consider many other actors that deal directly or indirectly with these issues, but "from the perspective of SMEs" (e.g., industrial associations promoting awareness-raising initiatives among SMEs and/or providing associated SMEs with guidance and support in Energy Audits; Energy Auditors dealing with SMEs; financial institutes proposing convenient financing solutions to improve SMEs Energy Efficiency; policymakers designing the regulation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

and incentive schemes for Energy Audits and, more generally, dealing with energy issues in relation to SMEs; etc.).

Therefore, the existing barriers affecting the entrepreneurs are mostly well known. What is missing is a picture of the earlier process through which EEMs are promoted, defined and, eventually, undertaken and implemented, and therefore, Energy Audits could be useful. Such a process takes place in a context characterized by the presence of the various above-mentioned actors, so called "actors of context", which play different roles. Then, an "added value" of the INNOVEAS project could be the identification of factors related to the context's actors' nature and their mutual interaction, which (beyond the SMEs perspective) produce the various barriers. In this perspective, we have to consider the points of view of the "actors of the context". Which are the barriers that these actors (not the SMEs) meet?

Therefore, we suggest a transition:

- From barriers and drivers affecting SMEs (also related to other actors)
- To barriers and drivers affecting the whole system of actors (e.g., SMEs + "actors of the context").

Reference is made, of course, to the actors involved in Energy Audits and, broadly, in the identification and implementation of EEMs.

This widening of the scope allows to take a more complete view of the obstacle towards the implementation of Energy Audits and, more generally, towards the identification and implementation of the EEMs. These obstacles are not "localized" only in SMEs and, as we will see in the following pages, there are some that are not connected to SMEs themselves (e.g., the lack of knowledge on SMEs by some Energy Auditors). It will also be possible to better understand the depth of some problems: a barrier (e.g., those related to languages), which tends to concern all actors and not only SMEs, appears much more structured and difficult to remove than the numerous individual barriers specific only to SMEs on which other actors, not affected, can instead intervene.

2.3. Methodological framework

For investigating on the barriers that hinder the implementation of Energy Audits in SMEs (considering the position of all the actors directly or indirectly involved), a two-step methodology has been adopted in WP2:

- Step 1 – a literature review
- Step 2 – key-informants consultation.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

2.3.1. The literature review

The literature review was supposed to consider:

- The European level (with some references at the international level)
- The national level in the six countries of the INNOVEAS partners (Belgium, Germany, Italy, Poland, Slovenia, and Spain).

However, during its implementation, interesting documents and studies referring to further countries were found. More specifically:

- Further European countries, such as Finland, France, Netherlands, Norway, Portugal, Sweden, Switzerland, Turkey, and UK
- Countries outside Europe, such as Australia, China, Japan, Pakistan, US, and Zimbabwe.

Documents written after 2009 have been mainly considered, but also prior texts – in particular, scientific literature that is mentioned often in more recent texts – have been analysed.

The documents taken in to account were written mainly in English, but also French, German, Italian, Polish, Spanish, and Slovenian.

The following sources were taken in to account:

- Scientific texts and papers (dissertations included)
- Policy documents/policy papers/strategic documents
- Reports/documents on specific cases
- Evaluation reports
- Legislative and regulatory texts
- European and national statistics documents
- PPT presentations at conferences, seminars, etc.
- Articles from newspapers and social media
- Web-pages/blogs.

Authors/editors of the documents/texts are from:

- Scientific community
- Public administration (national, regional, and local)
- European Union entities (European Commission, European Parliament, European Investment Bank, etc.)
- International organisations
- The business world (e.g., industrial associations)
- Citizens/consumers/Civil Society Organisations (CSOs) working on issues, such as climate change and energy transition
- Financial institutions.

The texts were mainly found on the Internet (more than 90%).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

Some of the analyzed texts (less than 20%) addressed other issues that are not of specific interest to INNOVEAS; these texts have been still considered as they deal with individual points such as the INNOVEAS project.

In case of books, journals, websites or other publications containing more than one text, the considered unit was the single text (e.g., an essay).

Globally, more than 200 texts were identified; nearly 100 texts were considered relevant and, therefore, deeply analysed (and reported in the references).

2.3.2. Key-informants

As already stated, the studies and documents reviewed in the literature review talk of the barriers to EEMs and Energy Audits mostly from the point of view of the entrepreneurs and SMEs leaders. Since the diffusion of Energy Efficiency practices and Energy Audits is a complex process that involves many diverse actors (a system of actors – see §2 in this chapter) that play different roles, we decided that the point of view of the key informants should be aimed at understanding better how to foster such a process. Therefore, through the interviews with key-informants, we focus the attention on the points of view of the other relevant actors of the process.

Therefore, four types of Key Informants (KI) were interviewed.

A. Energy Audit professionals:
- Energy auditors
- Other professionals (public accountants, firm's consultants, etc.).

B. Energy Audit potential stimulators:
- Programmes leaders (e.g., leaders of regional programmes for the promotion of Energy Efficiency among SMEs)
- Officers of financial institutions dealing with SMEs
- Policy makers dealing with SMEs and/or with energy issues both at national levels
- Energy providers.

C. SMEs associations'/Industrial associations' leaders (or equivalent, such as Chambers, Regional Development Agencies, etc.).

D. Consumer associations' leaders and local authorities.

The above types of key informants were singled out:

- Because they could be involved in the promotion of Energy Efficiency among SMEs and, in this framework, of the practice of Energy Audits, or
- Because of their position and activities, they know the processes and policies for the promotion of Energy Efficiency in which the SMEs are involved.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

Globally, 42 interviews were held: 38 in the 6 countries of the partners of the INNOVEAS consortium (Belgium, Germany, Italy, Poland, Slovenia and Spain); and 4 at the European level (European Commission, EAPNE, European Investment Bank, European Bank for Reconstruction and Development).

The distribution of national interviews by countries and type of interviewed person is reported in the table below.

	Belgium	Germany	Italy	Poland	Slovenia	Spain
Professionals	3	3	1	2	1	1
Stimulators	2	2	3	2	2	1
SMEs association	0	3	1	1	1	4
Consumers association and local authorities	1	0	2	1	0	1
TOTAL	6	8	7	6	4	7

Key-informants were interviewed thanks to a protocol guide including the following sets of questions:

- Questions concerning the barriers met by the "actors of the context" in the promotion of Energy Efficiency Measures and Energy Audits
- Questions concerning the points of view of the "actors of the context" about the barriers met by entrepreneurs in practicing Energy Efficiency Measures
- Questions related to points of view concerning the promotion of Energy Efficiency processes within SMEs.

This protocol guide was organized for semi-structured qualitative research interviews. The questions were formulated to the interviewees so that they can respond openly. The questions were reported in a logical order (but this order changed in each single interview, according to the thread of the speech). The interviewees provided their points of view freely and have been asked for relevant information besides the formulated questions.

Each interview lasted from 45 min to 90 min so to make sure the interviewees had appropriate time to understand the issues being raised and figure out his/her possible position on them, including their experiences, perceptions and feelings[3] in a sort of flexible conversation (e.g., by adapting the order of the questions) but covering, at the end of the day, all the content mentioned in the protocol. Sometimes, further questions (not included in the protocol) raised from the dialogue between interviewer and interviewee. Each interview was prepared considering the role and level of engagement of the respondent and adapted (e.g., the way on how ask some questions) to the specific experience of each interviewee.

[3] Rubin, H.J. & Rubin, I.S. (2012). Qualitative interviewing the art of hearing data. Thousand Oaks, CA: Sage Publications.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

Most of the interviews were recorded[4] for analysis reasons. To each interviewed a project Information Sheet was provided and explained before starting the interview.

Interviews were implemented in English (just few) or in the national language of the interviewed (in most cases). A specific report was prepared for each interview.

[4] In Poland 3 respondents did not agree for recording.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

3. CHAPTER TWO BARRIERS: THAT HINDER THE USE OF ENERGY AUDIT TO UPTAKE ENERGY-SAVING MEASURES IN SMES

3.1. The great heterogeneity of European SMEs

In the first Deliverable of the WP2 (D2.1 "Energy culture and energy transition"), based on a large literature review, we highlighted (among other) the great heterogeneity that is hidden under the term "Small and Medium Enterprise" (SME).

We recall that according to the European Union (and all its member countries as well as many other ones), SMEs are defined as Title I of the Annex to Commission Recommendation 2003/361 / EC of 6 May 2003; the category of micro, small and medium- sized enterprises is up of enterprises which employ fewer than 250 people and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million[5].

Within the fence determined by these three characteristics, there is a wide variety: Giving some examples, SMEs differ:

- In number of employees (there is an abyss between a SME where 2-3 people work and a SME with over 200 employees)
- By sector of activity (from consultancy services to construction; from textiles to agro-food, etc.)
- By mode of activity (SMEs that produce "goods" internally as in textiles and SMEs that work externally as in construction; SMEs that work on their own and SMEs that live with sub-contracts; SMEs that execute external orders and SMEs that have to think to the marketing of their products; SMES low-technology manufacturing vs. SMEs high- technology manufacturing; etc.)
- Considering the various and multiple contexts (legal, economic, social, etc.) in which the SMEs operate
- Etc.

From all these internal differences in the SMEs world, it follows that, beyond the subjective dynamics (of the entrepreneur, of the employees, of the "milieu"), the approach to energy issues, among the SMEs, can only be very differentiated; also, because the energy requirement is very differentiated.

[5] According to an interviewed key-informant working in the European Commission in the DG Energy and transports, the definition of SME is being revised. The issue is if the dimension is the only relevant aspect to consider or if it is relevant also the actual consumption of energy.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

The identification of barriers that hinder the use of Energy Audit to uptake energy-saving measures in SMEs should consider all these differences (and since this is impossible, a certain level of abstraction must be accepted). “Barriers are often idiosyncratic to the particular situation of the business (e.g., its staff, premises, organisational characteristics, and financial situation). It is evident that each business experiences a unique combination of barriers, even though operating in the same industry and the same geographic location”[6]. Therefore, each SME has to face its individual barriers.

Moreover, beyond what has just been said, slightly more complex factors come into play where the subjective level plays a decisive role. Mention may be made, among other, to the environmental or even social awareness, to, the relevance of energy culture, to the propensity towards innovation. All this further differentiates SMEs.

It can be interesting to report the categorization suggested by Palm[7] on how and why companies deal with Energy Efficiency. According to Palm, SMEs can be classified into four categories concerning EEMs.

- The ignorant companies have no special focus on energy-related issues, and they generally lack anyone working on these issues.
- The sceptical company is quite aware of the easy and relatively cheap measures to reduce their energy use. They are fairly satisfied with their activities in the energy area and believe that only expensive and complicated measures remain, which they may take in to account given appropriate economic incentives.
- The economically interested company invest in easy measures focus strongly on the pay-back time and the need for the investment to give economic benefits (increased Energy Efficiency as a means to cut costs). Measures that have a 5-year payback time or longer do not interest these companies. The starting point is the economic benefit of all activities undertaken. Behavioural issues are too ‘fuzzy’ and just for idealists.
- The innovative environmentalist companies, aware of both energy and environmental issues in general, and have worked successfully on these issues for some time. These companies often have one or several people who are enthusiasts and constantly come up with new ideas, invested in efficient systems for ventilation, lighting, heating and production processes. Energy efficiency is not seen as a problem but a challenge. They face customers who require that they take in to account environmental concerns, and their managers are supportive of all kinds of environmental activities.

The relevance and type of barriers that hinder the Energy Audits (EAs) is very different between these four categories (at the last level the barriers may be non-existent but perhaps, at this level – you could say jokingly – a much more radical barrier emerges: in these enterprises the Energy Audits could be completely useless!).

[6] Meath, C., Linnenluecke, M., Griffiths, A. (2015). Barriers and motivators to the adoption of energy savings measures for SMEs: The case of the ClimateSmart Business Cluster Program. In Journal of Cleaner Production, doi: 10.1016/j.jclepro.2015.08.085.
[7] Palm, J. (2009). Placing barriers to industrial Energy Efficiency in a social context: a discussion of lifestyle categorisation. In Energy Efficiency, 2(3), 263-270.

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N°847095

3.2. Energy Audits and European SMEs

First, the role and the function of an Energy Audit have to be reminded. An Energy Audit is a measure towards Energy Efficiency/management improvements in SMEs; it is "an effective tool for overcoming the information barriers to Energy Efficiency and facilitating the implementation of Energy Efficiency Measures (EEMs) in SMEs[8]". It is a "special" measure, supporting to identify other EEMs to be implemented for improving Energy Efficiency/management considering the specific characteristics of each SME, its present energy management and its context.

Moreover, as "contextual" data, it could be the case also to recall the following data (already mentioned in D2.1)[9].

- Croatia had the highest participation rate of SMEs having implemented an Energy Audit; a large difference from most EU countries. Its level accounted for 53%, almost five times higher than in Estonia (11%), which had the lowest participation rate in Europe. Most countries were evenly distributed around the average EU participation rate of 30%. Western European countries ranked above the EU average while Southern European countries and the Baltic countries are placed below it. Firms operating in the central, eastern and south eastern European countries are less keen to conclude an Energy Audit, except for Croatia.

- Larger SMEs present higher average participation rates (40%) than smaller SMEs (15%). However, Energy Audits appear to be more beneficial for smaller firms. Beyond size, energy-intensive use, higher energy costs, productivity and capital intensity appear to be determining factors in Energy Audit participation.

- Audit participation rates are higher in the manufacturing sector (42%), which is more energy-intensive than any other economic sector. The services and infrastructure sectors follow (respectively, 31% and 28%) whereas the construction sector is substantially far behind (20%).

- Innovative firms are also more likely to conclude an Energy Audit. This decision might be driven not only by financial and operational objectives but also by strong environmental concerns. Most of them include in their production function elements of Energy Efficiency as a means of bridging the "Energy Efficiency gap". For innovative firms, the information provided by the Energy Audit plays a crucial role in overcoming the existing numerous market failures and economic, organisational and behavioural

[8] Kalantzis, F., Revoltella, D. (2019). How Energy Audits promote SMEs Energy Efficiency investment. In EIB Working Papers (No. 2019/02).
[9] Kalantzis, F., Revoltella, D. (2019). Cit.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

obstacles, especially when the Energy Audit identifies measures that offer great savings, require limited capital and are financially profitable (innovative firms are twice as likely to invest in energy-efficiency improvements after an Energy Audit than such firms without an Energy Audit).

3.3. Well-founded issues on barriers hindering Energy Audits

As it was already highlighted in D2.1, the subject matter of this chapter has already been widely addressed by multiple authors (Enrico Cagno, Stefano Farné, Tobias Fleiter, Lisa Nabitz, Jenny Palm, Joachim Schleich, Steven Sorrell, Patrick Thollander, and AndreaTrianni, among many others).

What are barriers?

A first well-founded issue is the notion of barrier. "A 'barrier' was defined as a mechanism that inhibits a decision or behaviour that appears both energy and economically efficient. This term is widely used within the Energy Efficiency literature[10]".

We recall that barriers are real, in the sense that there are objective factors that can be directly observed; but they can also only be perceived, in the sense that they are considered as such even if perhaps the situation is different. Both of them influence the adoption of Energy Efficiency measures in the firms. A simple example: the absence of tax benefits connected to specific improvements in Energy Efficiency can be real (in the sense that, in a given territory, actually, there are no tax benefits) or simply connected to an absence of information in this regard. The result is the same (the manager of an SME puts no effort in this matter as he/she believes that there is no such an opportunity) while the barriers are different and any solution to overcome them will be equally different. In the literature, both kinds of barriers are taken in to account. However, there can be "a misalignment between perceived and real barriers in SMEs[11]".

From the literature review implemented in the frame of the INNOVEAS project (and largely reported, already, in D2.1), many barriers that hinder the implementation of Energy Audits in the SME field were identified. None of these barriers was denied by any among the key-informants interviewed and all, accentuated by one or the other (and sometimes with different emphases), were confirmed. Therefore, the existence of these barriers too can be considered well-founded. What is it about?

[10] Sorrell, S., Mallett, A., Nye, S. (2011). Barriers to industrial Energy Efficiency: A literature review. UNIDO. Available at:
https://www.sciencedirect.com/science/article/abs/pii/S0928765516302846
[11] Palm, J., Thollander, P. (2010). An interdisciplinary perspective on industrial Energy Efficiency. In Applied Energy, 87(10), 3255-3261.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

A generalized reluctance

The main barrier is that, since many SMEs show a strong reluctance to use Energy Efficiency criteria – and to consider its added value in terms of higher profit potential and multiple further non-economic benefits –, there is no reason for implementing any Energy Audit. This reluctance was confirmed (more or less explicitly) by almost all the key-informants interviewed.
Beyond this barrier, there are many specific barriers directly linked to the implementation of an Energy Audit. Some examples, emerging from the literature, as well as from key- informant interviews, are reported below.

Lack of qualified human resources

1. A small number of the SMEs has appointed an energy manager (or, at least, a person specifically in charge of energy issues) or have a specific procedure to enhance systematically Energy Efficiency.

- Primarily in micro and small enterprises, there is no energy expertise (also at "terminological/language" level[12]). Therefore, the possible Energy Auditors do not have quite relevant interlocutors in many SMEs.
- Moreover, often in the enterprises there is reluctance toward studies (and business plans) and no knowledge about measurements (that are part of any audit).

2. In many SMEs, the entrepreneur has to cover several different roles: operations, safety, administration, sales, marketing, planning, and he/she may also be employed within the factory. Briefly, energy is just one of the issues and there is not a specified focus on it. Therefore, Energy Auditors may not receive enough attention.

3. Moreover, time devoted to Energy Efficiency activities is usually quite limited.

Economic issues

4. Also, in the (more or less rare) cases where the entrepreneurs are deeply aware of the importance of energy issues (and perhaps on climate change challenges too) they have limited access to economic resources to be devoted to Energy Efficiency analyses and measures compared to larger enterprises. Therefore, they will do what they can without losing time and resources in an Energy Audit of which it may not perceive the possible "added value" (with respect to what they believe they already know about EEMs to be implemented, they consider that the Energy Audit would not yield any important further indication).

5. Broadly, entrepreneurs are unwilling to spend money for the audit without the certainty of the results (sometimes, she/he can be also almost certain of a lack of results, etc.[13]).

[12] According to a policy-maker interviewed, there is a real problem of communication among most SMEs entrepreneurs and Energy Auditors and other consultants (they use different languages).
[13] According to an interviewed auditor, entrepreneurs are not aware on what they "buy" through an Energy Audit.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

6. At the same time, in many territorial contexts, not enough subsidies or other incentives are available[14] (we will discuss again this issue later) as well as other tools, such as "energy networks" that can compensate for this possible unwillingness.

Lack of information

7. Where such tools exist, there is often a lack of information. Therefore, the entrepreneur (that, as noted above, cannot dedicate time to these issues) is not aware of their existence.

8. Often, there is also a lack of information among entrepreneurs on the legislative/regulatory frameworks of the Energy Audits (narrowly) and on the EEMs implementation (broadly). Moreover, when this information exists, there is sometimes the fear that rules can change (e.g., too much uncertainty on rules).

9. Information regarding energy-efficient technologies and economic incentives (e.g., financing for Energy Efficiency investments) is not available to relevant decision-makers, or it is only available in a very generic form, not tailored to the company needs.

Relations with Energy Auditors

10. The image of an Energy Audit is sometimes influenced by previous experiences in Energy Audits in which the main interest was that of selling a single commercial solution (e.g., selling a new piece of equipment) instead of analysing the whole production process to identify the best opportunities for Energy Efficiency. More generally, sometimes, entrepreneurs don't have enough trust in Energy Auditors (already mentioned language difficulties do not help, at this regard). And it happens that the Energy Auditors' ability is questionable tout court.

11. Energy auditors' ability is not enough focused on specific energy issues characterizing SMEs, in particular the micro-enterprises; moreover, many SMEs need "personalized" assistance that does not fit a lot with Energy Audits.

Practical concerns in implementation

12. There is sometimes a worry in disclosing data on production processes (however, these data are needed in an Energy Audit). Moreover, a remarkable lack of data on energy consumption is common (however, these data too are needed in an Energy Audit).

13. There is sometimes a worry towards Energy Audits because their implementation stops the normal implementation of the activities in a SME. This is relevant, mainly, when the production process must be stopped due to the audit.

[14] Sometimes, as mentioned by some interviewed key-informants, the available support mechanisms are complicated and hidden – and not directly targeted at SMEs. E.g., there are too many legal conditions and obligations that SMEs need to meet when applying for support.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

3.4. SMEs and EEMs

As detailed in D2.1, Energy Audit is only a part (or a "point") albeit widely important of a broad trajectory to be followed towards improved Energy Efficiency. So, beyond the ones already mentioned, the barriers SMEs face or may face in pursuing greater Energy Efficiency, in improving energy management or, more generally, in developing eco- innovations including sustainability actions, should be considered. Since this issue was extensively addressed in D2.1, here we just recall some ideas that may be useful for a better understanding of what we will discuss later.

Barriers are classified according many criteria. Recalling just an example (the oldest of the many described in D2.1), Sorrel et al.[15], in 2004, proposed a taxonomy of barriers based on six broad categories.

1. Imperfect information, which includes transaction costs (e.g., search costs) for identifying the energy consumption of products and services.

2. Hidden costs, which include the overhead costs for management, the transaction costs associated with gathering, analyzing and applying information, the costs associated with disruptions to production, or with staff replacement and training.

3. Risk, which captures the technical risks of energy-efficient technologies as well as the financial risks associated with irreversible investments and the uncertainty about the returns (paybacks) of EEMs (e.g., because future energy prices are uncertain).

4. Access to capital, which includes lack of external and internal funds for energy-efficiency investments. In the case of external funds, the costs to assess the risks associated with the investor (e.g., small EEMs) or the technology might be too high. Internal funds may be inhibited by internal capital budgeting procedures, investment appraisal rules, or the short-term incentives of energy management staff.

5. Split incentives, which imply that the investor in EEMs cannot fully appropriate the benefits (e.g., landlord-tenant or user-investor problem).

6. Bounded rationality, which means that constraints on time, attention, and the ability to process information prevent individuals from making "rational" decisions in complex decision problems. Rather than optimizing, they use heuristics and rules of thumb to decide on investments in EEMs.

[15] Sorrell, S., Schleich, J., O'Malley, E., Scott, S. (2004). The Economics of Energy Efficiency: Barriers to Cost-Effective Investment. Available at: https://www.researchgate.net/publication/43185108_The_Economics_of_Energy_Efficiency_Barriers_to_Cost-Effective_Investment

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

Re-reading the various classifications and rankings discussed in the previous D2.1, you get an overall picture connecting the barriers to[16]:

- The lack of funds and/or access to finance
- The fear of facing unnecessary costs (and the so-called "hidden costs")
- The lack of internal (in the SME) human resources or the lack of appropriate skills among the human resources present
- The difficulty of using external human resources
- The internal lack of time
- The emergence of more urgent priorities
- The plurality of interests (perhaps divergent) and points of view and, more generally the malfunctions in decision-making processes
- Organizational deficiencies
- The lack of sensitivity to environmental issues
- The lack or inadequacy of technical resources
- The difficulty of planning in the medium and long term
- The lack of trust (in the market; in other interlocutors; in the announced future benefits; in the future; etc.)
- The lack of subsidies and incentives or their lack of knowledge
- Legislative and/or regulatory difficulties
- The lack of information and its imperfections.

There are specificities according territorial areas (well described in D2.1 where an outline for 8 European countries – Germany, Italy, Poland, Portugal, Slovenia, Spain, Sweden, and UK – and 5 further countries are included Australia, China, Pakistan, Turkey, Zimbabwe), but these are not so relevant (SMEs tend to meet more or less the same barriers in all countries). Of course, in economically weaker countries barriers tend to be more pronounced. Conversely, in some countries where more subsidies (e.g., Germany, Sweden) are available some barriers are weaker, but not non-existent (e.g., the existence of subsidies should be known by the entrepreneur that should be able to get them); it is the same where regulations are more favourable (on these last issues, please refer to D2.3).

By looking at SMEs size, there are substantial differences between the Small and Medium ones. "Smaller enterprises highlighted greater barriers, in particular related to the lack of personnel and expertise regarding Energy Efficiency issues greater awareness barriers in non-energy-intensive enterprises (they limit their focus strictly on production- related issues); smaller enterprises that highlighted major difficulties in the effective implementation of an intervention (lack of expertise and competences)[17]". Moreover, smaller SMEs tend to have a lower perception of barriers: "Medium-sized companies showed a more pronounced perception of barriers compared to smaller ones. A higher level of market innovation reduced

[16] Dozens or perhaps more than a hundred barriers have been identified; in some cases, it is the same phenomenon called differently; often then, the barriers are grouped into different, partially overlapping categories.

[17] Trianni, A., Cagno, E., Farnè, S. (2014). An empirical investigation of barriers, drivers and practices for Energy Efficiency in primary metals manufacturing SMEs. In Energy Procedia, 61, 1252-1255.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

the barriers significantly and more innovative enterprises faced fewer barriers related to technology, external risks and lack of information[18]".

Many differences exist also according to the activity sector: Barriers, in principle, appears stronger in the construction and agriculture sectors; less in the high technology manufacturing and services sectors[19]; and, of course, among SMEs that are large users of electricity (as well as heat, gas, oil, coal, etc.).

As stated above, in each SME, there is a unique combination of barriers. However, these barriers are among the ones mentioned above some or many of which may be absent; and those present are more or less important. Barriers might be persistent and remain also after the Energy Audits even when they are unequivocally convenient for the SME (for the entrepreneur) and also in the short term. Often, in fact, "the positive impact of Energy Audits on the implementation of energy- efficiency measures cease to exist in the presence of financial constraints, especially for smaller firms. This indicates that not only information barriers but also financial constraints (as well as many others as seen in the previous pages) discourage firms from investing in energy-efficiency measures[20]".

3.5. Controversial issues

Beyond the well-founded issues above, there are also many controversial issues.

Some disputes can be considered as only apparent; that is, connected not so much to different positions, but rather to the differences between the types of SMEs analyzed or the contexts in which these SMEs work.

First, "there is no consensus on how barriers should be understood, how important they are in different contexts, and how (if at all) they should be addressed. This makes barriers the subject of disciplinary disputes within academia and more fundamental conflicts within the politics of climate change[21]". Actually, the barriers underlined within the groups of authors consulted through the literature review and the group of key-informants interviewed later are different. Therefore, apparently, there is no consensus. Nevertheless, no one denies (among the interviewees) or would deny (among authors) the barriers reported by others (apart the issues that will be specified below). If anything, it is noted that they are specific to other contexts or other types of SMEs than the ones we are talking about. Sometimes, moreover, a different terminology is used to say similar things. In the end, therefore, one has the impression that regarding what has been said above in this chapter, there is, beyond appearances, a substantial consensus.

[18] Trianni, A., Cagno, E., Worrell, E. (2013). Innovation and adoption of energy efficient technologies: An exploratory analysis of Italian primary metal manufacturing SMEs. In Energy Policy 2013, 61, 430–440. In this same study, the authors highlight that "problems affecting SMEs ("operational" barriers), reveals that the barriers lack of time and lack of internal capital are more pronounced in-smaller firms (up to 100 employees) than in larger firms (100 to 250 employees. Then, they highlight the importance of considering firm-specific factors".

[19] Kalantzis, F., Revoltella, D. (2019). How Energy Audits promote SMEs; Energy Efficiency investment. In EIB Working Papers. (No.2019/02).

[20] Kalantzis, F., Revoltella, D. (2019). Cit

[21] Sorrell, S., Mallett, A., Nye, S. (2011). Cit

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

Some differences, of course, depend on the heterogeneity of contexts. For instance, on subsidies, some key informants (and some authors) attribute a big importance to the lack of subsidies whereas according to others this is not a problem but this depend (beyond the perception issue – see above) from the fact that in some territorial contexts this problem exists and in some other it doesn't exist or is less relevant.

Another partly true example is the lack of awareness to environmental issues. With multiple terminologies (speaking of lack of energy culture, ignorance about energy transition or on the importance of climate change, lack of sensitivity about environmental values, etc.) this is considered an important barrier by many authors, as well as by a lot of interviewed key-informants[22]. However, some others underline that this is not a problem. But these are those, who have to deal with agro-food SMEs[23] or, also, with tourism which, by force of circumstances, are more often sensitive to environmental issues or are forced to be sensitive to protect their image[24]. The difference of the point of view, also here, depends on the difference of the reference context[25].

A further example is the "physical space" of a SME. While in many cases (e.g., services, textile, manufacturing), this space corresponds to the premises of the SME), in the construction sector (as it is underlined by enterprises associations of this sector) there is not a physical space, in the sense that the physical space cannot be considered only the premises of the SME and all the buildings/the constructions where any SME is working should be considered (e.g., efficient application of materials or preferred choice of energy friendly materials, overall construction process, etc.)[26]. And this is by no means simple or obvious.

Again, another important difference emerges, according to few authors and some interviewed key-informants among the SMEs that are the owners of the buildings or spaces they occupy and the ones located in rental buildings. The latter are less prone to implement an Energy Audit, since they are able to benefit from some possible EEMs to be implemented after the audit only if they keep the same location.

As it is evident, reading the D2.1, there is also heterogeneity in the categorizations of the barriers. But then you can also notice that there are many overlaps and intersections. So, beyond the terminologies and the classification criteria, even here it seems that, in the end, everyone tends to say similar things.

[22] According to an interviewed key-informant working in the DG Environment of the European Commission "we have not developed the 'driving narrative' that will place SMEs at the forefront of the energy transition".
[23] According to a key-informant working in an association of SMEs in the agro-food sector "in the wineries, there is a clear environmental awareness. This is not a barrier".
[24] According to a key-informant working in an association of SMEs, there are SMEs sectors where the awareness of energy consumption is relevant (e.g., production, energy, technology). In these sectors, there should be more promotion and clear information considering Energy Efficiency, no matter what the consumption is.
[25] However, there are also few key-informants that state that the lack of awareness tends, independently to the SMEs sector, tends not to be a problem anymore. By now, almost all tend to have a sensitivity to environmental issues
[26] However, by most common definition – Energy consumption of a company is the volume of energy measured and paid directly in the bills accounted in the company. Majority of consumption of "construction" SME is expected to occur on the construction sites (fuel and electricity), not in their office building.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

Then there are some real controversial issues, with different positions, that emerge, in particular (but not only) in the interviews.

Energy Audit for SMEs – mandatory or not?

A first controversy is on the mandatory character of the Energy Audits for European SMEs. According to some interviewed key-informants (mainly Energy Auditors) the lack of obligation to implement Energy Audits is a barrier[27]; according to others (belonging, mainly to other categories), this is not a barrier. Maybe, if there was an obligation, necessarily, many more SMEs would have to adapt, but, in these cases, the Energy Audits would be completely useless (or almost)[28]. According to some interviewed persons, this would be an administrative fulfilment and would not be followed by the implementation of any EEM. What is more, we should remember, that, according to the literature review findings reported in D2.1, already in the voluntary audits the adoption rates of their recommendations range between 40% and 80% (i.e., on average almost half of the Recommendations remain a "dead letter". Imagine if Energy Audits were mandatory ...).

Energy Audits should be tailored?

A second controversy is connected to the concept of Energy Audits.

According to some key-informants, the audit procedure should be more tailored to the specific characteristics of each type of SME (even to each SME)[29]. And the fact that this is not the case represents an important barrier as many entrepreneurs would believe that such an Energy Audit is not useful for their SME.

According to others, this is not a problem since the procedure, in reality, already has a certain degree of flexibility: Moreover, many problems (e.g., heating, lighting, air conditioning in hot areas/seasons, etc.) concern all the SMEs. Again, in the context of the production of goods, the possible presence of obsolete machinery with high energy consumption should be checked anyway. Therefore, the conception of the audit, according to this second perspective, is not a barrier. And according to those who support this thesis, making Energy Audits further flexible could make this tool useless[30] and those who resort to it would no longer know what type of service they are buying[31] (and moreover tailored audits could lack of quality and comparability).

[27] E.g., according to one of them, "it is already difficult to make SMEs do what is required by law, imagine when something, as it is the case of the Energy Audits, is not". According to another one: "I don't know of any SME that would voluntary do an Energy Audit. In all audits conducted in SMEs, the SMEs were obliged to carry out the audit due to their links with a group of companies".

[28] According to a key-informant working in a Regional Development Agency, obligatory implementation of Energy Audits will transform them in 'another paper'.

[29] According to a key-informant, working in a Regional Chamber Energy Audits should be tailored to company size, orientation and sector.

[30] According to a key-informant working in an association of SMEs in the construction sector "doing an audit give you a standard and if it is going to be custom-made, it is no longer a standard. And more or less, all SMEs have the same problems, as long as you compare consumption".

[31] According to an auditor interviewed, there must be some rules to follow. So when you hire an Energy Auditor, you know what you can get in return.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

An intermediate position (supported by an interviewed Auditor) is not to make Energy Audits more flexible, but, nevertheless, "the audit report should always be adjusted on the specific situation / circumstances of the enterprise" (interviewed Auditor).
A complementary aspect to be mentioned speaking on the conception of Energy Audits concerns their scope. According to a large minority of the interviewed key-informants, this scope should be enlarged and consider not only the energy footprint of SMEs, but, broadly, their "carbon footprint". Some among the auditors interviewed suggest the implementation of a "carbon audit" or, an "ecological audit"[32] that cover the whole "relationship" of an SME and its activities with environmental issues beyond the sole energy aspects. It could be noted that for some SMEs the "practical" difference among these approaches is not sensitive.

Is an Energy Audit efficient for a SME?

A third controversy is related to the cost of energy. According to many authors and some key informants, one of the main barrier that hinder the implementation of the Energy Audits in SMEs (with the exception of the energy intensive companies) is related to the low percentage of energy costs in the SMEs budgets. Therefore, the implementation of EEMs, which often entail costs, even large ones, would not bring comparable savings (at least in the short term). Then, there is no reason to held an Energy Audit[33]. Instead, according to other authors and some further key-informants, this should be not a real problem. Some EEMs entail only very little costs and therefore an Energy Audit, anyway, is convenient also from an economic perspective (and anyway "the entrepreneur who has an open-mind towards technical innovation in Energy Efficiency always find the resources for implementing EEMs; and therefore, is interested in an Energy Audit implementation").

Further issues

A further aspect is the availability of Energy Auditors. This point is rarely underlined (therefore it is not considered as a barrier). However, according to few key-informants "availability of good and suitable Energy Auditors is very different regionally, causing a locally lacks of Energy Auditors".

A final aspect is related to gender. No one among the authors consulted in the literature review deals with this issue that is considered not important also by most interviewed key-informants. However, some of them considers that SMEs women leaders are more aware of environmental issues and more open to technological innovation and, broadly, to change. Therefore, according to them, having women in the SMEs leadership should be a "counter-

[32] This already exists with EMAS and 14001 – by the way they both cover energy questions.
[33] According to an interviewed Energy Auditor, in companies with consumption of less than 2GWh/year, it is usually not cost-effective to conduct an Energy Audit. According to a further one, asking SMEs to do Energy Audits is not reasonable. In general, their energy consumption is modest and the scope for Energy Efficiency is low. If a SME wants to reduce its energy consumption or increase its Energy Efficiency or better manage energy, it can do that in a variety of ways , without incurring the extra expense of the audit. According to a key-informant working in a SMEs association, the energy cost is very low; therefore, there is no interest among SMEs for this issue. Furthermore, the cost of implementing Energy Audit is high. For this reason, it is difficult to talk of Energy Audits to SMEs. According to a further key-informant, SMEs sometimes are not even aware of energy consumption, as it is not their priority.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

barrier" for implementing Energy Audits. This is an aspect that should be analyzed in depth in the future (also if women are a minority among the SMEs leaders).

4. CHAPTER THREE: BARRIERS THAT HINDER THE "ACTORS OF THE CONTEXT"

Some not secondary factors hindering the adoption of Energy Audits (AEs) by SMEs, concern the area of the consultants responsible for carrying out the audit and, in general, and all those who, for various reasons, both on public mandate and private companies, have relationship with the varied world of SMEs, regarding the Energy Efficiency programs. We can call these actors "actors of the context" as they are all those who make up the context of SMEs in relation to Energy Audits (EAs) and the design and implementation of Energy Efficiency Measures (EEMs).

These are a group of actors that perhaps deserve more attention as they often play a key role in the decision making of small and medium size entrepreneurs regarding Energy Efficiency programs.

These are all those actors, external to SMEs, who however interact with SMEs regarding Energy Audits and/or the design and implementation of EEMs. Specifically, regarding the EAs (object of this text), these actors are distinguished, in turn, into two groups.

- On one hand, those who work directly with the firms on EAs, i.e. Energy Auditors and/or other business consultants and contribute directly to definition of the firm decisions.

- On the other hand, those who have (or could/should have) an indirect influence in the implementation of the EAs, namely:
  - Officers of financial institutions dealing with SMEs
  - Policy makers dealing with SMEs, energy issues and other related topics
  - Programme officers dealing with EAS leaders
  - Local authorities
  - SMEs associations'/Industrial associations' leaders
  - Energy providers
  - Development agencies and other territorial actors
  - Consumer associations' leaders and local authorities.

We will discuss Energy Auditors and consultants in the first part of this chapter; while we will dedicate the second part to the sets of actors listed above.

4.1. Obstacles concerning auditors and consultants

First, it is possible to find six kinds of obstacles involving the Energy Auditors, so as they emerge from our review, which are:

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

1. Lack of a general Energy Efficiency expertise
2. Lack of specific skills on the target of SMEs
3. Obstacles in language and communication in general
4. Scepticism related to the complexity of the consultants' world
5. Lack of motivations
6. Quantitative shortage of auditors.

1. Lack of a general Energy Efficiency expertise

Some auditors' difficulties concern the level of understanding and update of Energy Efficiency regulations. The uncertainty of the legislation in this sector, in fact, was one of the main difficulties encountered in promoting Energy Efficiency measures (the regulatory framework of the audit and the mechanisms of access to incentives are constantly evolving and are therefore uncertain and difficult to read for those who are not particularly up-to-date), also with regard to the world of consultants[34].

2. Lack of specific skills regarding SMEs

Despite the numerous training activities that are carried out at various levels (European, national and in some cases local), only some auditors are able to follow companies from the beginning to the end of the Energy Efficiency process. It is pointed out that sometimes experts even have knowledge gaps regarding energy issues in production processes and the varied funding opportunities for EEMs for SMEs, which also exist (the so-called funding jungle). The competence of the auditors and what is called "lack of transparency in the way they approach SMEs", has a major impact on the resistance of small and medium sized entrepreneurs, who often have not had positive experiences with Energy Auditors. It should also be remembered that, as the literature review shows, the figure of the Energy Auditor still has elements of "weakness" in regulatory terms (an official register exists only in Ireland, while in other countries there are other forms of certification of Energy Auditors provided by different institutions and different database; this aspect makes it more difficult, for SMEs to recognize accredited professionals).

3. Obstacles in language and communication in general

Many interviewees stress that consultants/Energy Auditors are not able to speak in a non-extremely technical language that is, thus, understandable to their counterparts in SMEs. This language barrier creates the risk for entrepreneurs of missing the overall picture and the very meaning of auditing as an important business opportunity. The communicative approach that should be used by consultants should also be improved: for small and medium sized entrepreneurs a certain confidence with those who would be in charge of helping them and integrating them into the complex world of Energy Efficiency measures is necessary. Because of these factors, auditors and consultants are not perceived as "third parties", charged with supporting the company in a not easy task, but almost as representatives of a hypothetical "counterpart". The same communication tools adopted by the world of consultants are

[34] The phenomenon of the scarce ability of "energy experts to carry out Energy Audits or assist SMEs to implement EEM" has been singled out also in a research on the practice of EA carried out in the framework of the project SPEEDIER (see IERC 2020, 57),

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

considered too generalist and not very calibrated to the target of medium and, above all, small companies, which would require more intuitive, direct, simplified communication tools. Often, once the initial mistrust of the entrepreneur is overcome, the whole subsequent process becomes easier. But without proper language it is difficult to take this first step. On the other hand, establishing an immediate contact and relationship based on trust and transparency could be very helpful for a good start.

It has also been recorded a lack of auditors' communicative strategy aimed at small and medium-sized entrepreneurs on Energy Efficiency issues (which, of course, hinders not only SMEs, but also Energy Auditors who should work with them). For example, some of the strengths of the audit should be highlighted, such as the fact that the audit can be partially financed (i.e., funds are not only dedicated to the efficiency measures that can result from it). It is pointed out, for example, that auditors and consultants make little communication about the possible schemes known as "third party financing" that make it possible for enterprises introducing new energy innovations without providing the amount needed by using their own funds or borrowing from banks.

4. **Scepticism related to the complexity of the consultants' world**

Beyond what has already been said in the previous points, the excessive variety of consultants, professionals, Energy Efficiency service providers, increase the scepticism of entrepreneurs when faced with the opportunity to initiate the process and adhere to the Energy Audit procedure. It is stressed that the communication effort towards entrepreneurs should be coordinated by all the actors in the sector (consultants, PA, associations, consulting companies). This scepticism (which sometimes becomes suspicion and a real lack of trust) is obviously an additional barrier that Energy Auditors have to face in order to carry out EAS at SMEs.

5. **Lack of motivations**

The auditors and consultants too (and not only the entrepreneurs) often find the audit process too complicated. This often leads them to be unmotivated towards the implementation of Energy Audits in SMEs, as they feel this requires too much effort, often useless (no consultancies are commissioned) or poorly remunerated. This lack of motivation is perhaps also linked to the need to make the auditor's profession more solid, from the point of view of their professional career, of what they are "selling" and what are the returns. Energy auditors might strengthen their professional identity, for example by making them consultants for overall energy issues in companies.

6. **Quantitative shortage of auditors**

There are too few qualified Energy Efficiency professionals and consultants comparing to the number of SMEs and often they have to reject some of the existing audit requests. Also, for this reason, the few operating auditors, beyond their qualification, have little experience of audits with small and medium enterprises and have difficulty in understanding entrepreneurs' doubts, accepting them, interpreting and overcoming them.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

On the basis of what said above, it is possible to say that (as already mentioned) most of these obstacles can generate a lack of confidence/truth between the small or medium entrepreneurs and Energy Auditors/consultants, to the detriment of the identification of Energy Efficiency Measures, also because of problems regarding the methods and the strategies of communication and the system of relationships that is established between SMEs and the people on the "front line" of Energy Efficiency programmes (represented by Energy Auditors and consultants).

4.2. Obstacles concerning further actors not entering in the SME's dynamics but relevant

Some of the barriers that are relevant for the following type of "actors of the context" will be identified on the basis of our sources of information:

- Energy Audit potential stimulators (Programmes leaders, Officers of financial institutions dealing with SMEs, Policy makers, Other "territorial" actors, Energy providers)
- SMEs associations'/Industrial associations' leaders
- Consumer associations' leaders and local authorities.

Analysis of these actors' role is not very common when dealing with EAs related issues. There are, of course, studies that consider the "milieu" in which policies are implemented that are aimed at Energy Efficiency Measures and at the practice of Energy Audit (EA). Nevertheless, the issue has not been investigated systematically.

These three types of "actors of the context" have in common the fact that they do not enter in the dynamics internal to the individual enterprises, in the operational field in which decisions and actions concerning EEMs and EAs are taken and implemented, as it is the cases of the "consultants" and auditors (to which the previous paragraph has been dedicated). These "actors" are those whose points of view, decisions and activities contribute significantly to making SMEs' action meaningful and successful. As a matter of fact, SMEs orientation to practicing EEMs and EAs is as much relevant to them as long as such an orientation is shared by peers, supported by financial institutions, acknowledged by local stakeholders who appreciate it and its outcomes.

The obstacles generated by the "actors of the context" have been found by analysing the ways in which they address the challenges faced by SMEs in approaching (or not approaching) Energy Efficiency related issues, including the practice of Energy Audits. Seven main categories of obstacles were identified through the analysis of the interviews, which represent the main source of this report. These seven categories are:

1. EEMs and EAs costs
2. Energy culture related barriers
3. Lack of personnel with appropriate skills
4. Lack of awareness about the benefits of EEMs and EAs
5. Ineffective action for involving SMEs
6. A scarce focus on SMEs specificity

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

7. Policies' fragmentation.

1. **EEMs and EAs costs**

There were identified types of obstacles that concern the SMEs as such, i.e., those that concern their points of view, orientation, endowment of resources, etc. related to EEMs and EAs. From the interviews emerge that such factors are relevant also for the actors whose role is to interact with SMEs for the promotion of EE. In practice, any SMEs subjective factor end up being relevant also for those who interact with them.

In general, lack of funds is a type of factor that has been reported by various key persons as those that prevent an activation of SMEs on EEMs and to the connected practice of EAs. The lack of funds is not considered by these key persons in "absolute terms": EA costs are considered high because in many enterprises the overall cost of energy is perceived as low (relative to the overall expenses) and there is no knowledge, among the SMEs, of the possible saving brought about by EEMs. In this framework, it is taken for granted that this evaluation depends on the general ways in which SMEs consider energy issues.

Would SMEs consider EE as a priority, the lack of firms' own funds could, indeed, be offset by credit and paid back in due time[35]. The judgment on the advisability of such an initiative, of course, depends on the overall point of view of the decision-makers within SMEs on the importance of doing certain investments, the ability of carrying them out and so on.

It emerges, therefore, that the issue is almost a matter of interpretation (for example, some key persons stress that energy-intensive firms, in general, have a concern for energy issues, since they are closer to energy management issues). The "actors of the context" contribute to the definition of the most common interpretation and some actors like SMEs associations, according to some key persons, accept the idea that EAs' costs too high for SMEs.

2. **Energy culture related barriers**

It seems to be, in a certain sense a cultural matter. Energy culture is important since it "mediates" the interaction between SMEs and the "actors of the context". Culture, by definition, is formed by values and ideas that are shared by a diverse array of actors forming a group (therefore, is something that concerns the "milieu" in which SMEs operate and the context in which EEMs and EAs are promoted). The possible forms of cooperation among these two types of actors impacts the ways in which SMEs actions (investments, other relevant choices, information acquisition, etc.) are carried out. Therefore, it is important to report what the key persons have told concerning energy culture of various "actors of the context".

It emerges from the interviews that SMEs associations tend not to consider energy as a priority and they not always have an energy culture; traditionally, they have been more interested to

[35] As far as credit is concerned, it is worth noticing that one of the difficulties that have been reported in some interviews is that normally credit is difficult to access also because of the limited dimension of the loans needed for implementing EE projects. This difficulty could be overcome through the definition of specific and standardized banking procedures that nevertheless are not common.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

limit the impacts of regulation on SMEs and the costs implied thereby and supported, for example, the idea that EAs should not be an obligation. This, of course, does not mean that there are not people within these organizations that are sensitive to energy and environmental issues; rather, this sensitiveness has not impacted the overall orientation of these organizations. On the other hand, according to few interviewees (the few who express themselves in this regard), banks are not particularly willing to fund investment for EE. These views, according to an interviewee, are changing but, probably, they are one of the reasons of the relatively low involvement of SMEs in the practice of EEMs and EAs.

It was said in D2.1 that "lack of time", or the conviction that time to dedicate to EEMs and EAs is lacking, is an important aspect of energy culture of SMEs that impacts a lot on their decision on the matter. It emerges that SMEs' lack of time is recognized as an obstacle by the key persons; one key person noted that this is connected to entrepreneurs' little awareness of energy issues.

The issue of time is relevant since it implies that trust has to be gained so that SMEs decide to "waste" some time on energy issues. Of course, in order to do so, it is important that time – a scarce resource – is considered worth being invested in the promotion of EE and, in this framework, of EA. In practice, it has to be recognized that time is not lacking in absolute terms, as sometimes is understood, but can be traded-off against other uses. This aspect – i.e., availability of time is also a matter of choice depending on the importance given to Energy Efficiency – is stressed by some key persons[36]. It seems, anyhow, that the general orientation among the "actors of the context" – as reported by the key persons – is to consider such a lack of time as something of strictly objective, almost similar to a physical obstacle.

If the conception of time – particularly, the lack of time – is an aspect of the energy culture of entrepreneurs that seems almost unquestioned by the "actors of the context", it can be observed that there are further signs that the current energy culture "Actors of the context" is not clearly conducive to EEMs and EAs. In certain countries (for example in Poland, according to an interviewee) it seems to be absent while some scholars who studied the phenomenon of the diffusion of the practice of EAs all over Europe, there are differences in energy culture among countries and regions (e.g., East and West, who have different industrial policy traditions).

In summary, it can be said that the presence of a widespread culture conducive to Energy Efficiency cannot be taken for granted. From the interviews it seems that cultural barriers to EEMs and EAs are not located only among SMEs and that this point of view is oftentimes shared among the diverse "actors of the context".

3. Lack of personnel with appropriate skills

Some interviewees indicate the lack of personnel able to deal with energy issues is a type of obstacle that is relevant also for the "actors of the context" and not only for those that, at least in principle, have to deal directly with the individual SMEs (like the Energy Auditors or other consultants). From an interview in Italy emerged that financial institutions do not have

[36] Including some Energy Auditors interviewed who maintain that "at certain conditions", entrepreneurs could revise their view concerning lack of time.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

the skills to evaluate the environmental impacts of the investments they fund. A couple of interviewees, in Italy and in Germany, stressed that the various actors that in principle should support SMEs for EEMs and EAs have little knowledge about the financial mechanisms aimed at promoting these initiatives (e.g., those connected to ESCOs). Some key persons stressed that SMEs associations are not capable of assisting SMEs on energy issues, for various reasons, not only because these issues are not true priorities for these organizations (see above) but also because of the lack of trained people able to do so or for the lack of contacts with auditors. The ability of the "actors of the context" to help SMEs is important because, as someone stressed, the system of funds for EEMs and EAs is complex and not transparent (a couple of interviewees termed it "a jungle"). An interviewee said that the issue is the lack of trained specialists that are able to support SMEs.

This issue is particularly relevant as long as SMEs, as stressed in the previous chapter, lack the organizational characteristics, the skills and the knowledge needed for implementing those innovations connected to EE and EA. In this framework, it is particularly important what some interviewees stressed, i.e., that the competences needed concern also how to communicate with SMEs: communication about EE, EAs and the related issues should be done using approaches that are appropriate to the audience represented by SMEs – for example the use of good practices, or the use of appropriate and understandable set of data
– but this is not common among the "actors of the context" (e.g., SMEs association and officers of the financial sector).

4. **Lack of awareness about the benefits of EEMs and EAs**

Some key persons highlighted that the value of EEMs and EAs depends on how such practice is communicated to the wider public, particularly to help to improve SMEs' reputation[37]. The fact that this awareness is not present among SMEs means also that the milieu has not been sensitized on EE and this is clearly a responsibility not of entrepreneurs (or of the consultants), but of other "actors of the context". Some key persons (representative of policy actors) suggested this conclusion stressing that, so far, no narrative has been produced concerning the promotion of EEMs and EAs, and this help explain why these issues are not so much felt by small entrepreneurs. Other "actors of the context" such as the consumer associations, according to some interviewees, result ineffective in impacting the SMEs behaviour. Furthermore, information on EEMs and EAs is much dispersed; this is stressed by interviewees in countries like Poland but emerges as quite common also from other interviews (it is almost taken for granted that the individual small entrepreneur normally has not all the information needed to practice EEMs and EAs).

5. **Ineffective action for involving SMEs**

In this framework, it is important the role of SMEs associations, since they are those who should primarily convey information to their associates that needs technical assistance to implement EEMs and EAs. According to some of the interviewees, SME associations have not been able to involve their associates on EEMs issues and EAs (at least in certain regions that are, nevertheless, among the most industrialized in Europe) and they should manage to reach

[37] This opinion concerning the role of EAs is providing objective "evidence" that SMEs are engaged in promoting EE was also shared by some Energy Auditors.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

more SMEs. For this reason, it is recognized that SME associations would need training for their personnel so to be able to better inform firms.

From the interviews emerges that the "actors of the context" have not been effective and even engaged in promoting a widespread mobilization of groups of SMEs. This is clear – using an "a contrario" reasoning – if we look at the positive but not very diffused experiences of mobilizing SMEs within procurement chains, in "energy communities" and in "energy networks". These initiatives, of course, are practicable only if they are supported and promoted by those actors whose prerogative is to take appropriate action for this kind of "supra-individual" activities that can be promoted by local authorities, local associations, large enterprises (i.e., actors whose outreach is larger than those that are typical of individual SMEs).

6. **A scarce focus on SMEs specificity**

The kind of obstacles that are relevant for the "actors of the context" are those originated in the milieu where they interact with SMEs. Some key persons stress that one of the problem typical of this milieu is a diffuse lack of trust of SMEs in the functioning of the market for what concerns the positive impact of investment in Energy Efficiency (and the related EA). Someone stresses, for example, that SMEs have little trust in the financial system or the fact that the funding system for EEMs and is complex and does not fit the SMEs needs and characteristics. In one region, for example, the implementation of public support to EAs foresaw that the reimbursement period exceeded the planning time-span that is typical of SMEs (they should have repaid the loan in 4 years but they are not used to such a long-time planning horizon). Connected to trust is also the problem stressed by one key person, according to which there is a high level of uncertainty of the investment in EEMs, the dependence of success of such investments on too many possible events in the future, on the behaviour of many actors and on the need on a wide array of different information to decide in such a situation. All this requires a sort of "ecosystem" of diverse actors who have to coordinate, somehow, their activities but who may have, according to a key person, very different levels of action quality. In general, we could say that many of the actions that should be prerogative of the "actors of the context" are carried out without considering SMEs actual feelings, needs and operational routines.

7. **Policies' fragmentation**

This is confirmed by what some key persons said about legislation that tends to be too complex (see the "funding jungle" above and uncertain). Someone stressed that an effective and clear EE support system would need national strategies, but that this is not the case. One policy maker stressed that the process of refining EE policies for SMEs is under way (e.g., by refining the definition of SMEs); in any case, policies are not complete since there are no obligations concerning the implementation of the results of the EAs.

In general, there are various obstacles to the practice of EEMs and EAs that are rooted in the scarce capacity of the "ecosystem" in which SMEs operate to orient policies in the right direction. Besides the lack of sensitiveness of SMEs – notwithstanding that it is growing, according to some – the problems of legislation and the dispersion of information, various key

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

persons noticed that the EA schemes do not fit the peculiarities of the different economic sectors in which the SMEs operate or the specificity of the SMEs.

This is not a surprise, given that the work to be done to promote EEMs is enormous and the number of actors to be involved is huge. In this framework, it should be noted that dialogue with SMEs promoted by the “actors of the context” sometimes s not continuous and takes place only when some specific regulation is being prepared. Other key persons note that the innovation connected to EEMs depends also on the availability and adoption of specific equipment that sometimes is difficult to access or do not incorporate energy saving technical characteristics. This is a sign that one of the obstacles is also represented by an appropriate technology and innovation policy (again, something that should be a prerogative of the “actors of the context”).

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N°847095

5. CHAPTER FOUR: TOWARDS AN INNOVATIVE INTERPRETATION FRAME

5.1. A holistic scheme for the interpretation of information

In this chapter, we propose an analysis of the information collected in which the SMEs' operational milieu (as defined in the previous chapters) is considered as a whole. This choice is due to the main feature of the problem that the INNOVEAS project faces: promoting the EAs among SMEs. SMEs are a very particular type of economic actor who, among the other things, have the characteristics of being very dependent on the environment in which they operate. Each SME, of course, has an entrepreneurial nucleus with a strong subjectivity (often composed of one or, in any case, very few people), but many of the company functions and activities are carried out thanks to external contributions. It is very common, for example, that fundamental services are outsourced, such as tax calculation and settlement or staff payments; frequently, also technological choices are made thanks to contributions from external consultants. In addition, SMEs (perhaps to a greater extent than larger companies) need (or should need) support and interaction with other actors, such as banks, public administrations, regional development agencies, representatives of projects through which public policies are implemented, etc.

Based on the recognition of this fact, we chose to look at the context represented by the initiatives aimed at the promotion of Energy Efficiency and Energy Audits (EAs) and focus the attention on the other actors that operate in this "context". The idea, in summary, is that the implementation and outcome of policies for promoting EE and EAs among SMEs depend a lot on what happens outside of them. Through the adoption of this approach, we tried to highlight the complexity of the transition process towards more efficient systems of energy use by considering the diversity of the points of view of the actors involved, of their decisions and of the initiatives they actually take.

In this framework, it is important to highlight that all these actors (including the SMEs) have an approach to EE and to the practice of EAs that is far from being irrational. EE, in general, is presented as a strategy aimed at reducing energy costs for businesses, at least in the long term. The scarce sensitiveness on this matter of the SMEs should not be seen as inconsistent with the objective or reducing costs. SMEs, in fact, operate on the basis of their own habits, therefore on their usual practices and routines (that they are able to control), as well as by pursuing their own strategies concerning the future (as they imagine it). If such strategies and praxis have to change due to a modification in the surrounding context – for example, the adoption of new policies, the availability of new technical or financial support, etc. – it is necessary that SME's change appears to the entrepreneurs not only feasible and accessible, but also credible. If SMEs change occurs, it is because the environment in which SMEs operate

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

sends unambiguous signs related to the good sense of it. It cannot be said, therefore, that the energy choices of entrepreneurs are not rational, neither that they are due only to a lack of information that would justify the possible change of the current practices. SMEs choices have to be understood in the light of the context in which they are taken. The reasons of the relatively difficult practice of EE and EA, indeed, have to be searched in the overall interaction among the actors that operate in the same milieu of the SMEs: the latter could interpret the situation in which they operate as non-convenient for the introduction of the practice of EE Measures and for the EAs. The lack of information, in this framework, is just one of the relevant factors in the transition process towards EE.

In this framework, we decided to interpret what emerged from the analysis of the literature and from the interviews to the key persons in the light of some ideas related to the study of collective action[38]. Particularly, we looked at the various actors such as SMEs and the "actors of the context" in relation to their orientation to EE and, possibly, to the practice of EAs. More in general, it was decided to consider the actors involved as a whole, on the basis of the awareness that Energy Efficiency is a process in which coordination between different actors[39] is of the utmost importance. In this way, it was possible to verify the degree of consonance between the actors concerning their respective orientation and attitude toward the practice of EE and EAs and verify the ways in which they (can) contribute, through their activity, to the promotion of such practices.

In practice, it was decided to (re)read the results of the interviews in the light of four characteristic aspects of the actors operating in this context and of the SMEs, all relevant in determining the action in favor of the EE and the possible practice of EAs. We will therefore refer to the following aspects:

1. The culture of the actors, therefore their values and worldview that inspire and give foundation to their action; particularly, the focus will be on energy culture
2. The orientation to change (or agency), i.e. their motivation to act in order to promote Energy Efficiency and, in this framework, to practice Energy Audits and the related measures
3. The action, i.e. the operational aspects (and difficulties) met by the actors connected to actual implementation of activities aimed at promoting Energy efficiency
4. The identity, i.e. the capacity of an organization to implement its own objectives and programs related to the promotion of EE and EAs through its staff, internal regulation, routines and infrastructures, through the relationships with external players; the endowment of human resources and skills.

Such a perspective is based on a double assumption: each actor has a "cognitive" dimension and an "operational"[40] one, and its efforts are both aimed at the self-construction and at modifying external reality. Culture is cognitive and is inward looking, while orientation to

[38] On this issue, and for the approach followed, see Quaranta and d'Andrea (1995). For a brief presentation of this approach d'Andrea and Declich (2005); the approach has been recently used by Declich (2019).
[39] Among the drivers to the use of resources of EEM and EAs there is the awareness of each SME that in its own environment everybody is behaving in a specific way; therefore, there is a need of a certain degree of consonance; this is a typical issue at the center of collective action.
[40] The cognitive dimension concerns the mental aspects of action, that is ideas, representations, interpretations, worldviews and values; the operational dimension has to do with external (to individuals) and explicit aspects of action such as the use of resources, technologies, norms, institutions, etc. (see below).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

change is cognitive but has to do with the modification of external reality. Action, is both operational and outward looking, while identity is an operational aspect of the life of an organization dealing with its internal reality.

It is on this basis, therefore, that will be interpreted the obstacles toward collective action towards EE (through the undertaking of EEMs and the EAs), therefore by looking at these four aspects concerning both SMEs and the other "actors of the context". The obstacles could be connected to one of the 4 aspects of the actors and could be either cognitive or operational in nature, as well as being aimed at either the internal construction of the actor or at trying to change the external reality.

This re-organization of the information obtained through the literature review and the interview to key persons is useful because helps to better locate the obstacles and understand the type of actions that could be undertaken to overcome them. Training is one of such types of action. We can say that these "re-organized" information could help to single out the various actors' training needs to be addressed (it is worth stressing that in the INNOVEAS Project capacity building activities will be aimed not only to SMEs but also to the other "actors of the context").

This fourfold approach is useful also because helps in comparing diverse actors. It is possible, in other words, to control if an obstacle is originated in the culture or in the orientation of the actors or in the ways they act or organize themselves. Because of the centrality of the context, through this approach it is possible to understand if the actors are in consonance among themselves in relation to certain aspects (e.g., the culture or the orientation to change). Furthermore, it is possible to control if each of them is experiencing a certain degree of internal dystonia (e.g., an actor has a positive energy culture but does not have the strength, or the capacity, for acting accordingly).

5.1.1. Energy Culture of "actors of the context"

An important issue that emerges from the interviews to the key persons consists not so much in the corroboration that the limited practice of EAs is an expression of the feeble Energy Efficiency culture of the SMEs. Rather, it is worth stressing that also the other "actors of the context" seem to share such a feeble culture, at least partially. The only exception, not surprisingly, is represented by the Energy Auditors and by the other consultants who, by definition, cannot be indifferent to the EE related issues. Obviously, the ways in which such a feeble EE culture is expressed change according to the diverse types of actors.

As was said in the Chapter Two, SMEs tend to have little awareness of environmental issues and of the management criteria to use for promoting EE (this is corroborated by the judgments on the lack of time to dedicate to these issues because of other urgent priorities). In addition, it should be considered the existence of a sort of culture of discretion, i.e., a certain reluctance to share data with external actors concerning production activities. What emerges is the confirmation, after the literature review and the interviews to the key persons, of a scarce consideration of the importance of EE by SMEs.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

This is what could be termed a "typical" orientation of SMEs. Obviously, there are many differences among them for what concerns the intensity in which the cultural factors operate among SMEs as well as the distribution of such factors within the various industrial sectors and even different countries.

Anyhow, these do not seem to be the only cultural barriers at work and that bring about difficulties in the practice of EAs and of EE. Among the "actors of the context" that "trespass the firms' gates" there are the Energy Auditors and the other consultants (who can provide suggestions also for what concern energy related issues). While they bear a culture that recognizes the importance of energy issues, it is frequently complained they use a too specialized language. This appear not only an indicator that their culture is characterized by specialized/engineering traits, but also – and because of this – an obstacle to sharing of EE culture with actors, like SMEs, who do not have such an orientation.

Energy culture is an open issue also for the other "actors of the context". According to some key persons, these actors – SMEs associations or other SMEs representative bodies, consumer associations, representatives of financial institution or of public bodies – not always bear an Energy saving oriented culture of, in the case they do, they are very different.

According to many interviewees, SMEs associations are not very keen to consider energy as a priority. Indeed, traditionally their action has been aimed at defending the SMEs from the excessive burden of regulation. Obviously, such actors are very diverse internally and many people that work for them have a strong sensitivity to environmental issues. Nevertheless, as a general rule, energy has not become a priority yet. Also, financial operators (at least those in touch with SMEs) do not have such a strong sensitivity. There are other signs that the energy culture is not widely shared by all the "actors of the context", such as the lack of a positive narrative on Energy Efficiency or the fact that the practice of EEMs and EAs improve the reputation of the practitioners. This calls into questions also those who promote and implement public policies on the matter.

In general, from the sources we used emerges that within the milieu in which SMEs act there are various cultural orientation concerning energy saving issues that involve the practice of EA. It is not only that there is – if not aversion – at least strong insensitivity to the issue (although, in general some interviewees stressed that the awareness of energy issues is increasing). It could be also noticed that the presence of a positive orientation among some actors on these issues does not automatically create a consonance with the other actors. In general, in the context in which EE and EAs should occur is not characterized by cultural dynamics that are conducive to this objective.

5.1.2. Orientation to change

A further obstacle to the practice of EAs and, in general, to the adoption of EEMs is constituted by the scarce orientation to this kind of practice also when energy saving is considered important. From the interviews and from the literature emerges, indeed, that a reluctance does exist among SMEs due to the fear of having to bear non-necessary costs, hidden costs or other burdens (e.g., the fear of having to interrupt production activities). Reluctance is also due to the inconvenience of activating new decision processes that involve a number of actors

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

(both internal and external) to implement a change. This perception of "fear" is compounded by the awareness that legislation can always change, and this makes the context in which the SMEs act less reliable. The scarce orientation to the practice of EAs and EEMs can be observed also among Energy Auditors and consultants, who are not motivated to work with SMEs because of the number of further difficulties they have to cope with (and also for the relatively scarce earnings[41]).

Another factor that limits the diffusion of EAs and, in general, the adoption of EEMs is connected to the low level of mutual trust among the different actors. Trust, as it was noticed, is necessary for the change process to occur. Nevertheless, SMEs seem do not trust very much the diverse "third parties" they inevitably have to work with in the process, such as consultants, financial bodies, other firms in the same region, the diverse administrative bodies that control procedures such as the provision of incentives, etc. Some key persons suggest that SMEs do not think these actors have a strong motivation to the promotion of EE. From some interviews emerges a certain lack of trust in the orientation and in the capacity of the associations in promoting EAs and EEMs among the SMEs, also on the basis of some experiences for supporting such initiatives that were not successful. The possibility that an orientation of SMEs to change their current practice in energy use is stronger than what is indicated by the low implementation of EAs is suggested by a study that highlighted a higher practice of EEMs in Italy, where the "White certificate scheme" seems to be effective. This could mean that, at least partly, such an orientation, when existing, is neglected by external (to the firms) difficulties[42].

We can affirm that for the diffusion of EAs a lot of the necessary conditions should occur outside of SMEs. The awareness that such an occurrence cannot be taken for granted brings about – among the involved actors – a scarce mutual trust.

According to our sources among a minority of SMEs and Energy Auditors there is an orientation to practice EAs and promoting EEMs; nevertheless, we cannot say that within associations and other relevant "actors of the context" there is a more generalized proactive orientation. Indeed, from most of the analyzed sources appears that there could be a consensus towards the practice standards recommended on the EEMs and EAs, but not a strong orientation to go beyond them (e.g., through the promotion of "Carbon Audits").

Generally speaking, it emerges that many among the "actors of the context" and SMEs – also contrary to their beliefs concerning EE – end up with not having an actual orientation to change because of the specificities of the environment they act within and to the existing relations in this environment. According to the interviews and the literature this is also due to the situation of uncertainty (about the future, also in the short term) and to the distrust towards this type of innovation also of the actors that should promote them among SMEs.

5.1.3. Action

The implementation of EAs and the related EEMs by the SMEs meets several obstacles of mostly an operational nature, such as the lack or the inadequacy of subsidies, difficulties

[41] The reluctance of consultants to work with SMEs emerges also in the research on the practice of EA carried out in the framework of the project SPEEDIER (see IERC, 2020, 37).
[42] See IERC (2020, 38).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

connected to the existing regulation to access them and a lack of an adequate information on the entire procedure. Almost all the key persons and the literature recognize that implementing EAs is not an easy task for small firms – even for those who are motivated to do so (not the most common case, see above). In this framework, it is worth stressing that one of the operational obstacles stems from the diversity of SMEs: Energy Auditors' ability is not focused on the specific characteristics of the various types of SMEs that sometimes are of "micro" dimensions; diversity concerns also the sector. In summary, EAs and EEMs promotion should not be of a "one-size-fits-all" type. Once this happen, the resulting action is strongly hampered.
Also, the constellation of actors who should help SMEs in changing the ways they use energy mirror the problem of SMEs diversity: there are many types of suppliers of consultancy and auditing services with different skills and specializations and it is not always easy to inform correctly the potential users about what is being offered. This is a problem not only for the SMEs, who find it difficult to choose, but also for the suppliers of services. The shortage of professionals implies also a further burden to the action, since those who are available are obviously less compelled to meet the very idiosyncratic need of each possible SME.

Furthermore, action is hampered also by the difficulty to communicate among the different "actors of the context" with SMEs. If these actors – see below – are seldom endowed with the skills needed to deal in depth with energy related issues and EA, this means that communication is difficult to be carried out. Such difficulties in communication are not only related to the technical aspects of the implementation of EAs or EEMs (i.e., communication between SMEs and auditors), but also to the other exchanges needed for the promotion of a long-lasting process of energy transition. (Such a process implies not only the implementation, hic et nunc of EEMs and EAs, but also the evaluation of the policies, the assessment of the difficulties met by the various actors, the possible policy measure to undertake concerning both the firms and the milieu in which they operate, etc.).

The same difficulty of correctly informing SMEs should be considered as an operational obstacle for the "actors of the context". Difficulties in communicating, informing and mobilizing a certain economic milieu towards EE and the practice of EAs should be seen as specific obstacles generated by those actors who should make things happen outside the firms' gates (for example, promoting an energy network or community to which individual firms just have to adhere). Obstacles can be found in the ways in which action is carried out by "actors of the context" also for what concerns the implementation of policies: dialogue with firms, for example, is carried out just in some critical phases of policies formulation and is not a continuous endeavour; or SMEs diversity is not duly considered in this exercise. Another crucial obstacle consists in the lack of a coordination among the various stakeholders and actors, especially those charged of defining and implementing policies. This generates a state of uncertainty that hampers the practice of innovation in energy use, therefore EEMs and EAs.

In general, we can say that there exist a number of obstacles to the implementation of actions for the promotion of EE and EAs connected to the inconsistency and fragmentation within the milieu in which SMEs operate.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

5.1.4. The strength of the actors

A further area of obstacles can be connected to the strength – indeed an aspect of identity – of all the actors considered, and not only of SMEs. From the interviews emerged clearly that each type of actor faces peculiar problems that represent obstacles to the promotion of EAs and EEMs, but the common characteristics is that they are not duly endowed with some of the skills, capabilities, resources that are crucial to this end. It is to stress that SMEs are a very diverse type of economic actors.

In general, it could be said that while SMEs weakness is almost well known, it is less so regarding the other "actors of the context". Diversity of SMEs sector is an example: while it is a fact of reality, it represents an obstacle because of the scarce ability of the "actors of the context" to interact with such a diverse array of firms. Other examples, connected to SMEs specificities could be formulated: investment in EE is difficult because the time horizon of SMEs – as indicated by some- is shorter than the re-payment period foreseen by the existing policies. This is clearly a sign of the inadequate knowledge, among the policy makers, of the typical characteristics of SMEs. As such, it can be considered a weakness typical of the "actors of the context" that are mostly involved in the promotion of policies.

Further weaknesses emerge concerning other types of actors.

- Financial operators often are not able to evaluate the merit of energy saving investments; moreover, those who deal specifically with Energy Efficiency with reference to SMEs are few; while others have this theme as a reference they have to deal with and therefore often have not many skills in this regard.
- Associations and supporters of SMEs do not know very well the "jungle" of funding for such type of investments; these are often institutionally weak actors and sometimes not very capable of exerting a "strength" towards the SMEs associated with them or with whom they are in contact.
- Energy auditors – as it was said in the Chapter Three are a very weak professional figure (e.g., there are no professional registers in many countries; because of lack of training, etc.).

Moreover, the inadequate lack of trust in consultants and auditors is not offset by a communication approach and by the adoption of a language aimed at increasing it. It is worth stressing that the task of communicating the importance of EE and EAs cannot be attributed to individual actors (consultants and/or their companies, who on the other hand are also weak because of their technical skills concerning SMEs and SMEs sector). The plethora of SMEs can be reached with innovative messages only in the framework of strategic initiatives that involve several "actors of the context", including associations and other SMEs representative organizations. While most of these actors – as we have just seen − are often weak, it should be stressed that carrying out such initiatives require stronger actors at least for what concerns their ability in communication, coordination, and promotion of consensus.

5.2. Some conclusions

In the presentation above we proposed an overview concerning the context in which the promotion of EE and EAs takes place and, in this way, we singled out, if not new phenomena,

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

at least a different perspective on the obstacles met in the implementation of these promotion initiatives and policies.

Notwithstanding the differences among the obstacles met by the various types of actors (described in the previous chapters) some common elements could be singled out among them. As it was said, the obstacles can be cognitive or operational. Among the former there are those connected to Culture and Orientation to change (Agency) of the actors, that is to say obstacles connected to ideas, representations of reality and decisions. They have not to do directly with rules or technologies, therefore with the operational aspects of the obstacles connected to Action and the "Strength" (Identity) of the actors.

Through this re-organization of the obstacles singled out through our sources, we can say that a lot of them are cognitive in nature and, unexpectedly, highlight shared various commonalities and points of view among the "stimulators" of EEMs and EAs, and SMEs. Basically, in many cases, the idea that EE and EAs are not priorities for SMEs. Notwithstanding this point of view is changing and that, in any case, we cannot say that there is a complete lack of interest for environmental and energy issues, we can say that it is not credible a dichotomous view based on a clear distinction between:

- SMEs – who would be responsible of the scarce implementation of EAs, maybe because they are unaware of the potential benefits – and
- The other actors, who have an opposite orientation and, as such, would be – more or less – the champions of the promotion of the EAs.

The obstacles to the practice of EAs, anyhow, are not dependent only on a "worldview" in which EE is not a priority. The milieu is characterized also by a certain distrust in this type of activities and investments as well as by a varied degree of quality of the various involved actors (meant as the actual orientation to the fulfillment of each actor's specific roles and task).

Although culture and agency, in the proposed framework, are cognitive in nature, this does not mean that (contrary to what one could expect) it is easy to orient them towards EE and the practice of EA. Rather, it is a matter of accepting their importance and main characteristics: the representations of the energy issues and the recognition of the opportunity to act on them are important because they bring about a greater openness of SMEs to an operational activation that facilitate the adoption of EEMs and the practice of EAs. In this framework, it is worth stressing that culture and agency are transversal and involve, in different ways, all the actor of the context and not only the firms.

This does not mean that the other operational obstacles do not matter. On the contrary, we can say that it is necessary to act upon them in order to make more credible the arguments to convince the entrepreneurs to practice EEMs and EAs (and all the "actors of the context" to support them). Simplifying access to incentives; making the EAs procedure more fit to the diverse characteristics of different firms (particularly the smallest ones); making policies stable and consistent; helping the operators to better "talk" with the various types of SMEs: these are all examples of the possible removal of operational obstacles that could be necessary also for the very sensitizations of enterprises on EE and EAs.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

The fourfold approach presented above helps to highlight also that each actor, including those of the context, in a certain way have to "adapt themselves" if they want to pursue the objective of EE. Particularly each of them has to do it differently.

SMEs are not very sensitive to the energy issues and poorly equipped to deal with them. Obviously, these problems could be solved by acknowledging SMEs' peculiar characteristics, particularly their intrinsic weakness and big differentiation. It is impossible to ask SMEs to do activities that for them are out of reach (SMEs are, anyhow actors with relatively small capacities, at least compared with large firms). Therefore, the initiative should be coherent with this fact. The needed strengthening of the actors (not only of SMEs but also of those of the context) should be based on this assumption: everybody has to learn how to communicate with SMEs who have relatively little resources to dedicate to this task, so that appropriate strategies could be implemented. Also, the culture of the "actors of the context" should adjust to this situation, particularly (but not exclusively) in relation with EE.

Such an adjustment, anyhow, would be useless if not based also on the strengthening of the structures of these organizations aimed at making them more effective in the implementation of their role (connected to EE and EA).

An effective action in favor of EE and the practice of EA, nevertheless, should consider also the ways in which the actors interact with the others. The feeble trust of actors among themselves, or the fear of entrepreneurs to invest in EE have to be dealt with through appropriate actions, starting from those concerning the ways in which each actor plays its own role. If SMEs have to "learn" what is for them EE and EA, or the need to approach these issues through a close co-operation with external actors, a similar attitude should be adopted also by the "actors of the context". Particularly, they should try to play their role with the awareness that it is part of a wider process (let's think to training of financial operators on the issues of Energy Efficiency, or the capability of the SMEs association to keep in touch on a continuous basis with their associates through the adoption of appropriate language and communicative approaches).

From the analysis above emerges that, in order for SMEs and "actors of the context" to undertake effective initiative for EE and EA, it is necessary to remove the obstacles that concern the context as a whole. Particularly, it is necessary that the context is characterized by a good degree of consistency. The various actors have to play their respective roles through a consonance among themselves: it is unavoidable that obstacles arise if energy cultures are divergent within the same milieu, if actors do not share a common orientation to change their own innovative practices concerning energy issues, etc.

Projects such as INNOVEAS or huge supra-national actors such as the European Commission could (or should) play the role of "maitre des jeux" among the many different actors who have different orientation, often weak and, anyhow, not able of any form of hegemony over the other.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

The main types of obstacles emerged from our sources[43]

BARRIERS RELATED TO ENERGY CULTURE	BARRIERS RELATED TO THE STRENGTH OF THE ACTORS
Lack of a strong generalized energy culture among SMEs and the "actors of the context", for example: • Lack of a widespread awareness of the relevance of EE, including of EAs • Specialized/engineering culture among Auditors and Consultants that create difficulties in communication • Energy issues are not a priority among many actors, including those of the context • Scarce consonance among the "actors of the context"	SMEs and "actors of the context" are, generally not well equipped for the effective practice of EAs and EEMs SMEs, in general, have little or no expertise concerning EE and EAs issues or people dedicated to them; especially in micro and small firms, the entrepreneurs have to cover several roles, no specific attention is put on these issues and oftentimes the time to devote is very limited. As for the "actors of the context", it can be said that they: • Are not able to interact properly all the various types of SMEs; • Oftentimes are weak from several points of view relevant for dealing with SME because of inadequate knowledge of the funding systems for the promotion of EAs and EEMs, scarcity of human resources to dedicate to the promotion and implementation of EEMs and EAs • Have difficulties in adopting correct communication approaches
BARRIERS RELATED TO ORIENTATION TO CHANGE	**BARRIERS RELATED TO ACTION**
Scarce orientation to change among the actors, for example: • Reluctance of SMEs to undertake EEMs and EA because of the possible economic and operational burden • Reluctance of Auditors to support SMEs • Low level of mutual trust among different "actors of the context" • Just a minority of actors has taken on a proactive orientation towards EEMs and EAs	Type of barriers to action are: • SMEs' resources to dedicate to EEM and EAs are, normally quite limited • Regulations aimed at favouring the practice of EAs and EEMs, in general, is very complex • Lack of clear information concerning the procedures for practising EAs and EEMs • The practice of EA is different for different types of firms. The need for protocols that fit the specificities of SMEs is not addressed • Difficulties in communicating among the diverse actors involved in the promotion and practice of EAs and EEMs • Lack of coordination among the actors in the promotion, implementation and evaluation of policies

[43] This table, of course, is not aimed at giving a complete picture of the set of obstacles described in the main text. Rather, is is aimed at providing a synoptically idea through some general examples

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

6. CHAPTER FIVE: RECOMMENDATIONS

In the previous chapters, we singled out the obstacles met in the promotion and implementation of Energy-Audits not only by SMEs but also by the so-called “actors of the context”. Such obstacles concerned directly or indirectly the Energy Audits (indeed, they were also related to support activities of SME's associations, chambers of commerce, and the policy-makers, etc). In this framework, we stressed that the nature of the obstacles could be either cognitive or operational and they involve, beyond the very implementation of audits, also the actors’ culture, their orientation to change, and their identity (strength).

Energy Audits are also for the SMEs (therefore not only for large enterprises, apartment buildings, etc.) a very important tool for promoting EEMs, and more generally, for the transition toward low carbon societies. The INNOVEAS project should play (together with other on-going twinning initiatives – e.g., the SPEEDIER project) an important role in this regard.

Some recommendations can be suggested.

1. The INNOVEAS project foresees a “multi-actors” approach in capacity building and awareness-raising activities. Particularly, not only managers and employees from SMEs but also other “actors of the context” will be involved, such as Energy Auditors, policymakers, financial institutions' officials, industrial associations' representatives, and other intermediaries. We suggest that this approach is aimed at removing obstacles and promoting changes that originate both within SMEs and in the context in which all these other actors operate. The “multi-actor” approach is not solely a methodological choice concerning how training is carried out but it has to do with a substantive − ontological − aspect of the problem that should be addressed through training. Obstacles to EAs and EEMs, being generated also by the behaviour of the actors of the context cannot be removed if such actors are not involved in any action aimed to this end.

2. The INNOVEAS project addresses the major barriers that oftentimes hamper the adoption of the Energy Auditing practice. Perhaps it would be better to say “the Energy Auditing approach”. Nevertheless, if we want to maintain the terminology already adopted, it will be necessary to avoid restricting the scope only to Energy Audits as they are conceived by the European standard (e.g., ISO 50001). On the basis of what was seen in the previous pages, it is the aim of the Energy Auditing practices that should be mainly adopted, whereas the methods can and, perhaps, must be multiple (from the Energy Audit strictu sensu, to flexible accompanying programs for SMEs) if you really want to include SMEs in the perspective of Energy Efficiency and, broadly, in the energy transition. In this framework, we could consider that, for a micro and non-energy-intensive enterprise, the implementation of an EA procedure could be, at least prima facie, excessive. Some preventive checks could be implemented to see if some standard measures are in need (e.g., change of bulbs or simple insulation measures). Should from these checks emerge some critical aspects in the energy consumption of the firm, then a more proper EA could be implemented. This more flexible procedure could represent also a way to raise the

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N°847095

awareness of firms about energy issues. It goes without saying that such procedures could be assisted by several actors because, even if simplified, entail the intervention of different expertise (e.g., for financing the change, the very preventive check, for singling out the professional that implement it, etc.).

3. Apart from the specific EA methodological issues, it should be stressed the EEMs and EAs depend a lot on cognitive aspects and, more specifically, on the culture of the actors and their orientation to change. The INNOVEAS project should contribute to the creation of an "enabling environment" aimed at the design and the implementation of EEMs in SMEs and their insertion in the general trend of the energy transition. Some SMEs the so called "innovative environmentalist companies", is not only located, but is the protagonist of this process. All this entails also a shift from a focus restricted on EAs - to be considered as mere tools and not an end in itself - to a wider perspective focused on Energy Efficiency (as suggested by the literature).

4. The INNOVEAS project should base its activities - particularly the on-going design of capacity-building and awareness-raising actions - on the awareness of the great heterogeneity that exists among SMEs. As stressed above, SMEs differ in different dimensions: size (e.g., number of employees), industrial sector, mode of activity (e.g., sub-contracts/external orders/market-oriented), use of technology (low intensive vs. high intensive) and ownership of premises. Consequently, INNOVEAS activities should be tailored, as far as possible, to the various types of SMEs. This is in line with the strong orientation of INNOVEAS project on specific sectors (food, chemicals and construction).

5. Particular attention should be paid to those SMEs whose activities, for the most part, take place outside their premises (e.g., the construction sector). To improve their Energy Efficiency, these companies need special forms of assistance connected to the chain of their activities (for example, the use of particular materials in the case of the construction sector). It could be useful to adopt a value chain (or filière) approach and involve in the promotion of EE and EAs also the firms who buy the services and/or products of the SMEs. Particularly, big clients could ask SMEs to practice EAs and EEMs. Furthermore, promoting EE and EAs as a form of collective action carried out by local clusters, or within specific value chains could be a strategy also for enlarging the efforts toward other aspects of the energy transition, such as reducing the carbon footprint or practising the circular economy.

6. The INNOVEAS project deals with Energy Audits. However, energy issues are only one "component" (albeit a very important one) of the wider problem of climate change mitigation. As far as possible, it should be promoted not only (or not so much) audits aimed at improving the Energy Efficiency of SMEs, but rather functional audits to limit their emissions as much as possible. It would, therefore, be a matter of promoting the so-called carbon audits (for some SMEs there is no difference, for others yes). The INNOVEAS project could take this into account when determining its capacity- building and awareness-raising activities.

7. These pages are being written while the Coronavirus epidemic is underway. Beyond the humanitarian and health aspects, this crisis is already having disruptive economic and financial effects for many SMEs. It is, therefore, to be expected that the low interest in Energy Audits by some/many entrepreneurs will grow. This disinterest, today (and tomorrow), could

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

be more justified than yesterday and, perhaps also affect entrepreneurs who already have an energy culture or a pro-environment culture (faced with the prospect of a possible bankruptcy or collapse of assets, EVERYTHING else becomes secondary). Promoting EAs and talking about EEMs with many SMEs and with many of the “actors of the context” could become difficult. A very difficult task of the INNOVEAS project will be the elaboration of appropriate messages, probably based on the idea that the likely economic recovery after the health emergency will be guided by a growing environmental concern. In this framework, it is important to look at the future realistically, avoiding to think that the recovery will conduce to Business-as-usual situation as it was before the crisis.

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N°847095

7. BIBLIOGRAPHY

- Andersson, E., Arfwidsson, O., Bergstrand, V., &Thollander, P. (2017). A study of the comparability of Energy Audit program evaluations. Journal of cleaner production, 142, 2133-2139.
- Backman, F. (2017). Barriers to Energy Efficiency in Swedish Non-Energy-Intensive Micro- and Small-Sized Enterprises – A Case Study of a Local Energy Program. Energies 2017, 10, 100.
- Balachandra, L., Briggs, T., Eddleston, K., & Brush, C. (2019). Don't pitch like a girl!: How gender stereotypes influence investor decisions. Entrepreneurship Theory and Practice, 43(1), 116-137.
- Barbara, J., Marcus, P., Stijn, D., Hide, B. (2018). Retrofitting the building envelope of SME industrial buildings: hydrothermal risk assessment. Available at: http://kmoreno.be/sites/default/files/2019-03/Barbara%20Joseph%20Retrofitting%20the%20building%20envelope%20of%20SME%20industr ial%20buildings%20hygrothermal%20risk%20assesment.pdf
- Baranova, P. (2017). Environmental capability of SMEs: Capability building towards a low carbon economy.
- Beckert, J. (2016). Imagined futures. Harvard University Press.
- Bourdieu, P. (1990). The Logic of Practice. Cambridge: Polity Press.
- Brems, A., Steele, E., &Papadamou, A. (2016). A study on Energy Efficiency in enterprises: Energy Audits and energy management systems. European Commission Library of typical Energy Audit recommendations, costs and savings, 1-48.
- Brough, A.R., Wilkie, J.E., Ma, J., Isaac, M.S., & Gal, D. (2016). Is eco-friendly unmanly? The green- feminine stereotype and its effect on sustainable consumption. Journal of Consumer
Research, 43(4), 567-582.
- Brown, P., & Sherriff, G.A. (2014). Research to assess the barriers and drivers to Energy Efficiency in small and medium sized enterprises.
- Cagno, E., Trucco, P., Trianni, A., Sala, G. (2010). Quick-E-scan: A methodology for the energy scan of SMEs. Energy, 35(5), 1916-1926.
- Cagno, E.; Trianni, A. (2013).Exploring drivers for Energy Efficiency within small- and medium- sized enterprises: First evidences from Italian manufacturing enterprises. Applied Energy, 2013, 104, 276–285.
- Cagno, E., Worrell, E., Trianni, A., Pugliese, G. (2013). A novel approach for barriers to industrial Energy Efficiency. Renewable and Sustainable Energy Reviews, 19, 290-308.
- Carbon Trust (2014). Opportunities in a re source constrained world. How business is rising to the challenge.
- Catarino, J., Henriques, J., & Egreja, F. (2015). Portuguese SME toward Energy Efficiency improvement. Energy Efficiency, 8(5), 995-1013.
- Center of Energy efficient solutions Slovenia (2018). Further incentives for new investments in Energy Efficiency and renewable resources for small businesses. Available at: http://www.cer- slo.si/dodatne-spodbude-za-nove-nalozbe-v--energetsko-ucinkovitost-ter-obnovljive-vire-malih- in-srednjih-velikih-podjetij-11-09-2018.html
- CERFE (2001), Action-Research on Corporate Citizenship among European Small and Medium Enterprises. Available at: http://www.cerfe.org/public/CorCit1.pdf

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

- Change (2010). Energy Efficiency in SMEs: Success Factors and Obstacles. Available at: https://drive.google.com/drive/folders/1HUXUybF-caQ6EkpF-ylbeFu3fU1MDkWu(accessed 25 July 2019)
- Change (2010). Motivations and barriers for Energy Efficiency improvement in small and medium enterprises in Poland. Available at: http://www.change.kig.pl/pliki/CHANGE_Rezultaty_badania.pdf
- Chiaroni, D., Frattini, F. (2018). Energy Efficiency Report 2018 - Il mercatodell'efficienzaenergetica in Italia dallaprospettivadegliutentifinali (The Energy Efficiency market in Italy from the end user perspective). Available at: https://www.federesco.org/images/EER_2018.pdf
- Chiaroni, D., Salvio, M., Bazzocchi, F. (2016). Diagnosienergetica, primo passo verso un'industria
4.0 (Energy audit, a first step towards Industria 4.0), EnergiaMediaEfficienzaEnergetica, paper 10/2016.
- Churchill, N.C., Lewis, V.L., (1983). "The five stages of small business growth", Harvard Business Review, May-June 1983.
- Cooremans, C. (2012). Investment in Energy Efficiency: do the characteristics of investments matter? Energy Efficiency, 5(4), 497-518.
- Cooremans, C., & Schönenberger, A. (2019). Energy management: A key driver of energy- efficiency investment? Journal of Cleaner Production, 230, 264-275.
- d'Andrea L. and Declich A., (2005), The sociological nature of science communication, JCOM 4 (2), June 2005,jcom.sissa.it/jcom0402.html)
- Declich, A. (2014). Aspettative e narrazioni: spunti per unariflessione interdisciplinare. Quaderni di Sociologia, (64), 111-138.
- Declich A. (2019) (ed), RRI implementation in bioscience organisations, Uppsala University).
- Eaton, R., Johnson, L. (2015). A Study on Energy Efficiency in Enterprises: Energy Audits and Energy Management Systems Implementation of national minimum criteria for Energy Audits, in line with Annex VI of the Energy Efficiency Directive.
- Energia media (2016). Diagnosienergetica, primo passo verso un'Industria 4.0 - EfficienzaEnergetica. Paper 10/2016.
- Energy Efficiency Council (2017). SME and community organizations – enabling best practice Energy Efficiency. Available at: http://www.eec.org.au/uploads/Projects/EEC2017_SMENFP_enabling_best_practice_energy_effi ciency.pdf
- EPC (2017). Energy Performance Contracting Plus. Available at: http://epcplus.org/upload/ue/wp7/EPCPLUS_Final_Brochure_PRO.pdfand http://epcplus.org/the-project/
- Erasme (2014). Energy Audits in SMEs. Available at: https://ec.europa.eu/energy/intelligent/projects/en/projects/erasme#partners
- Eurochambres (2015). Energy Audits for Europe Assessment of the transposition of Article 8 of the Energy Efficiency Directive (2012/27/EU) into Member State legislation.
- Eurochambres (2017). National Support Schemes for Energy Audits and Energy Management Systems as required by Art. 8/2 of the Energy Efficiency Directive (2012/27/EU).
- European Commission (2015). The EU Eco-Management and Audit Scheme (EMAS). Available at: https://ec.europa.eu/environment/emas/emas_publications/publications_studies_en.htm

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

• Fleiter, T., Gruber, E., Eichhammer, W., &Worrell, E. (2012). The German Energy Audit program for firms – a cost-effective way to improve Energy Efficiency? Energy Efficiency, 5(4), 447-469.

• Fleiter, T., Schleich P., Ravivanpong, P. (2012). Adoption of energy-efficiency measures in SMEs – An empirical analysis based on Energy Audit data. Energy Policy, Elsevier, 51, pp.863-875. hal- 00805748.
• Fleiter, T., Schleich P. (2017). Effectiveness of Energy Audits in small business organizations. Resource and Energy Economics.
• Forni, D. (2019). Stimulate Energy Efficiency in SMEs. Available at: http://blog.fire-italia.org/wp- content/uploads/2019/06/2019-06-EfficiencySMEs.rev1_.key.pdf(accessed 21 July 2019).
• Fresner, J., Morea, F., Krenn, C., Uson, J. A., & Tomasi, F. (2017). Energy efficiency in small and medium enterprises: Lessons learned from 280 Energy Audits across Europe. Journal of Cleaner Production, 142, 1650-1660.
• Fundación Gas Natural Fenosa (2017). "9º Indice de Eficiencia Energética en las PyMEs". Avaialble at: https://prensa.naturgy.com/noveno-indice-de-eficiencia-energetica-en-las-pymes/
• Geels, F.W., Schwanen, T., Sorrell, S., Jenkins, K., &Sovacool, B.K. (2018). Reducing energy demand through low carbon innovation: A socio-technical transitions perspective and thirteen research debates. Energy research & social science, 40, 23-35.
• Golea (2014). Strategy for rise of Energy Efficiency in companies. Available at: http://www.ceemproject.eu/wp-content/uploads/2014/11/Territorial-strategy-Slovenia.pdf
• Hampton, S., Fawcett, T. (2017). Challenges of designing and delivering effective SME energy policy. European Council for an Energy Efficient Economy.
• Hassan, MT., Burek, S., & Asif, M. (2017). Barriers to industrial Energy Efficiency improvement – manufacturing SMEs of Pakistan. Energy Procedia, 113, 135-142.
• Henriques, J., &Catarino, J. (2016). Motivating towards Energy Efficiency in small and medium enterprises. Journal of Cleaner Production, 139, 42-50.
• Hirzel, S., Nabitz, L., Wohlfarth, K., Rohde, C., Behling, I., Clarke, D., Perera, N., Turner, R. (2016). A study on Energy Efficiency in enterprises: Energy Audits and energy management systems. European Commission Report. Available at:https://ec.europa.eu/energy/sites/ener/files/documents/EED-Art8-Implementation-Study_Task12_Report_FINAL-approved.pdf
• Hrovatin, N., Dolsak, N., Zoric, J. (2015). Factors impacting investments in Energy Efficiency and clean technologies: Empirical evidence from Slovenian manufacturing firms. Journal of Cleaner Production,2015, 127
• IERC (2020) 'Report on findings from surveys of businesses participating in SPEEDIER' Deliverable
2.3 accessed on 4/3/2020 at https://speedierproject.eu/wp-content/uploads/2020/01/D2-3_Report-on-findings-from-surveys-of-businesses-participating-in-SPEEDIER-v1.0.pdf)
• Jary, J., & Jary, D. (2000). Collins Internet Dictionary of Sociology.
• Johansson, M.T., & Thollander, P. (2018). A review of barriers to and driving forces for improved Energy Efficiency in Swedish industry–recommendations for successful in-house energy management. Renewable and Sustainable Energy Reviews, 82, 618-628.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

• Johansson, I., Mardan, N., Cornelis, E., Kimura, O., & Thollander, P. (2019). Designing Policies and Programmes for Improved Energy Efficiency in Industrial SMEs. Energies, 12(7), 1338.
• Johnson Controls (2018). 2018 Energy Efficiency Indicator Survey – Spain. Available at: https://www.johnsoncontrols.com/media-center/news/press-releases/2018/11/15/~/link.aspx?_id=4B3426E1445A4F4FB85C6D504D000D2F&_z=z
• Kalantzis, F., &Revoltella, D. (2019). How Energy Audits promote SMEs Energy Efficiency investment. EIB Working Papers (No. 2019/02).

• Kerr, I.R. (2006). Leadership strategies for sustainable SME operation. Business Strategy and the Environment, 15(1), 30-39.
• Kluczek, A., &Olszewski, P. (2017). Energy audits in industrial processes. Journal of cleaner production, 142, 3437-3453.
• Kostka ,G., Moslener, U., Andreas, J. (2013). Barriers to increasing Energy Efficiency: evidence from small-and medium-sized enterprises in China. Journal of Cleaner Production Volume 57, 15 October 2013, Pages 59-68.
• Korczak, K. (2015). Master Thesis - Energy efficiency improvement in small and medium-sized enterprises. University of Technology, Faculty of Power and Aeronautical Engineering, Division of Rational Use of Energy.
• Kucęba, R.,Koszarek-Cyra, A. (2015). Directions, barriers, factors energy management in SMEs organisations.Scientific notebooks of the Silesian University of Technology, Series: Organization and management no. 83.
• La Moncloa-Spanish Government (2019). "Estrategia PYME". Available at: https://www.lamoncloa.gob.es/consejodeministros/resumenes/Paginas/2019/120419-consejo- ministros.aspx
• Leszczyńska, A., Curie-Skłodowska, M. (2016). Sources and barriers to the Energy Efficiency of Polish enterprises. AnnalesUniversitatisMariae Curie-Skłodowska, section H – Oeconomia, Vol 50, No 3.
• Liu, X., Wang, C., Zhang, W., Suk, S., &Sudo, K. (2013). Awareness and acceptability of Chinese companies on market-based instruments for energy saving: a survey analysis by sectors. Energy for Sustainable Development, 17(3), 228-239.
• Máša, V., Stehlík, P., Touš, M., & Vondra, M. (2018). Key pillars of successful energy saving projects in small and medium industrial enterprises. Energy, 158, 293-304.
• Mastropietro, E., Quaranta, G. (2002). Le condizioni del successo. Lineeguida per la creazioned'impresadestinateallaconsulenza e allaformazione. Available at: http://www.cerfe.org/public/ManualeRACRI.pdf
• Mauss, M. (1934). Les techniques du corps. Journal de Psychologie 32: 3-4.
• Meath, C., Linnenluecke, M., Griffiths, A., (2015). Barriers and motivators to the adoption of energy savings measures for SMEs: The case of the Climate Smart Business Cluster Program, Journal of Cleaner Production, doi: 10.1016/j.jclepro.2015.08.085.
• Meek, W.R., & Sullivan, D.M. (2018). The Influence of Gender, Self-Identity And Organizational Tenure on Environmental Sustainability Orientation. Journal of Developmental Entrepreneurship, 23(03), 1850018
• Ministerio de Industria, Energía y Turismo (2016). Real Decreto 56/2016, por el que se transpone la Directiva 2012/27/UE del Parlamento Europeo y del Consejo, de 25 de octubre de 2012, relativa a la eficiencia energética, en lo referente a auditorías energéticas, acreditación de proveedores de servicios y auditores energéticos y promoción de la eficiencia

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

del suministro de energía. Available at: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2016-1460
• Ministerio para la Transición Ecológica (2019). Real Decreto 263, por el que se regula el Programa de ayudas para actuaciones de eficiencia energética en PYME y gran empresa del sector industrial. Available at: https://www.boe.es/diario_boe/txt.php?id=BOE-A-2019-5570
• Muzamwese, T.C. (2016).Challenges and opportunities for mainstreaming industrial Energy Efficiency in small-to-medium-sized industries in Zimbabwe. Wiley Interdisciplinary Reviews: Energy and Environment, 5(5), 510-518.

• Muthulingam, S., Corbett, C.J., Benartzi, S., & Oppenheim, B. (2011). Investment in Energy Efficiency by Small and Medium-Sized Firms: An Empirical Analysis of the Adoption of Process Improvement Recommendations. Available at: https://escholarship.org/uc/item/6545t5bf (accessed 30 August 2019).
• Nabitz, L., Hirzel, S., Rohde, C., Wohlfarth, K., Behling, I., & Turner, R. (2016). How can Energy Audits and energy management be promoted amongst SMEs? A review of policy instruments in the EU-28 and beyond. Proceedings of the ECEEE Industrial Summer Study, 401-415
• Newell, R., & Anderson, S. (2002). Information Programs for Technology Adoption: The Case of Energy-Efficiency Audits (No. dp-02-58).
• OECD/EU(2018), Policy Brief on Women'sEntrepreneurship, Paris.
• Palm, J. (2009). Placing barriers to industrial Energy Efficiency in a social context: a discussion of lifestyle categorisation. Energy Efficiency, 2(3), 263-270.
• Palm, J., &Thollander, P. (2010). An interdisciplinary perspective on industrial Energy Efficiency. Applied Energy, 87(10), 3255-3261.
• Paramonova, S., &Thollander, P. (2016). Energy-efficiency networks for SMEs: Learning from the Swedish experience. Renewable and Sustainable Energy Reviews, 65, 295-307.
• Price, L., Lu, H. (2011). Industrial Energy Auditing and assessments: A survey of programs around the world. In Proceedings of the ECEEE.
• Quaranta and d'Andrea(1995. "Soggetti e rischi sociali: contributo per una teoria generale", Democrazia Diretta, 3, 1995.
• Rhode C., Mielicke U. (2015). Learning Energy Efficiency Networks -Evidence based experiences from Germany. Available at: https://www.researchgate.net/publication/281818276_Learning_Energy_Efficiency_Networks_- Evidence_based_experiences_from_Germany
• Robins, N. (2017). Mobilizing Green Finance for SMEs in the G7. Available at: https://www.minambiente.it/sites/default/files/archivio/allegati/sviluppo_sostenibile/G7_egf_S MEs_all_presentations_venezia05042017.pdf(accessed 29 July 2019).
• RWE Polska (2012). RWE Polska report "How do we save energy in the workplace?". Available at: https://www.cire.pl/pliki/1/Raport_RWE_13_12_20-12.pdf
• Schleich, J., &Fleiter, T. (2017). Effectiveness of Energy Audits in small business organizations. Resource and Energy Economics. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0928765516302846(accessed 30 August
2019)
• Serrenho, T., Bertoldi, P., Cahill, C. (2015). Survey of Energy Audits and energy management systems in the Member States. ENAC project.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

- Service Public de Wallonie DGO4 Département de l'Energie et du Bâtiment Durable Direction de la Promotion de l'Energie Durable (2017) 4e Plan d'Action en Efficacité Energétique wallon selon la directive EE 2012/27/EU. Available at: https://ec.europa.eu/energy/sites/ener/files/documents/be_neeap_2017_wallonie_fr.pdf
- Sherriff G. (2013). Drivers of and barriers to urban energy in the UK: a Delphi survey, Local Environment 19(5) 497–519.
- Sorrell, S., Mallett, A., & Nye, S. (2011). Barriers to industrial Energy Efficiency: A literature review. UNIDO. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0928765516302846(accessed 30 August 2019)

- Špacapan, F. (2015). Graduation thesis: energy management and efficient use of energy in companies. Available at: http://www.ediplome.fm-kp.si/Spacapan_Franko_20160215.pdf
- Spence, L.J., Agyemang, G., & Rinaldi, L. (2012). Environmental aspects of sustainability: SMEs and the role of the accountant.
- Steurer, M. (n.a.). Smart energy for growth - SME actions on Energy Efficiency powered by Chambers of Commerce and Industry. Eurochambres. Avaialble at: http://www.eurochambres.eu/Objects/3/Files/EUROCHAMBRES_Brochure_Smart_Energy_For_G rowth.pdf
- The Carbon Trust (2014). The Carbon Trust, Opportunities in a resource constrained world. Available at: https://cn.carbontrust.com/media/468325/ctc828-opportunities-in-a-resource- constrained-world.pdf(accessed on 05/08/2019)
- Theodorakopoulos, N., Hart, M., Burke, G., Stephan, U., Braidford, P., Allinson, G., ... & Jones, S.A. (2015). Sociology of enterprise. BIS RESEARCH PAPER NUMBER 238.
- Thollander, P., Danestig, M., &Rohdin, P. (2007). Energy policies for increased industrial Energy Efficiency: Evaluation of a local energy programme for manufacturing SMEs. Energy policy, 35(11), 5774-5783.
- Thollander, P., Dotzauer, E. (2010). An Energy Efficiency program for Swedish industrial small-and medium-sized enterprises. Journal of Cleaner Production, 18(13), 1339-1346.
- Thollander, P., Ottosson, M. (2010). Energy management practices in Swedish energy-intensive industries. Journal of Cleaner Production, 18(12), 1125-1133.
- Thollander,P.,Backlund, S., Trianni, A., Cagno E. (2013). Beyond barriers – A case study on driving forces for improved Energy Efficiency in the foundry industries in Finland, France, Germany, Italy, Poland, Spain, and Sweden. Applied Energy, Volume 111, November 2013, Pages 636-643.
- Thollander, P., Paramonova, S., Cornelis, E., Kimura, O., Trianni, A., Karlsson, M.,Navarro, J.P.J. (2015). International study on energy end-use data among industrial SMEs (small and medium- sized enterprises) and energy end-use efficiency improvement opportunities. Journal of Cleaner Production, 104, 2
- Thollander, P., Kimura, O., Wakabayashi, M., &Rohdin, P. (2015). A review of industrial energy and climate policies in Japan and Sweden with emphasis towards SMEs. Renewable and Sustainable Energy Reviews, 50, 504-512.82-296.
- Thollander,P.,Paramonova, S., Cornelis, E., Kimura, O., Trianni, A., Karlsson, M., Cagno, E., Morales,I.,Jiménez Navarro, JP. (2018). Energy efficiency in SMEs. Available at: https://www.sciencedirect.com/science/article/pii/S136403211500372X
- TreccaniEnciclopedy, see http://www.treccani.it/vocabolario/cultura/

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095

• Trianni, A., Cagno, E. (2012). Dealing with barriers to Energy Efficiency and SMEs: some empirical evidences. Energy, 37(1), 494-504.
• Trianni, A., Cagno, E., Thollander, P., &Backlund, S. (2013). Barriers to industrial Energy Efficiency in foundries: a European comparison. Journal of Cleaner Production, 40, 161-176.
• Trianni, A., Cagno, E., &Farnè, S. (2014). An empirical investigation of barriers, drivers and practices for Energy Efficiency in primary metals manufacturing SMEs. Energy Procedia, 61, 1252- 1255.
• Trianni, A., Cagno, E., &Farné, S. (2016). Barriers, drivers and decision-making process for industrial Energy Efficiency: A broad study among manufacturing small and medium-sized enterprises. Applied Energy, 162, 1537-1551.

• Trianni, A., Cagno, E., &Neri, A. (2017). Modelling barriers to the adoption of industrial sustainability measures. Journal of cleaner production, 168, 1482-1504.
• Triguero, A., Moreno-Mondéjar,L.,Davia, M.A. (2011). Drivers of different types of eco-innovation in European SMEs. Ecological Economics, August 2013, Volume 92, Pages 25-33.
• Various Authors (2015). A Study on Energy Efficiency in Enterprises: Energy Audits and Energy Management Systems – European commission report.
• Vascellaro, D. (2018). L'efficienzaenergetica è un'opportunità per le PMI (Energy efficiency is an opportunity for SMEs) , in Il giornaledelle PMI, interview to PatriziaMalferrari, Seaside, November 9th, 2018, https://www.giornaledellepmi.it/lefficienza-energetica-e-unopportunita-per-le- pmi/(accessed on 31/07/2019).
• Vickers, I., Vaze, P., Corr, L., Kasparova, E., & Lyon, F. (2009). SMEs in a low carbon economy: final report for BERR enterprise directorate.
• World Bank (2013). PROJECT INFORMATION DOCUMENT (PID) - Small and Medium Enterprises Energy Efficiency Project for Turkey. Available at: http://projects.worldbank.org/P122178/turkey- sme-energy-efficiency?lang=en(accessed 22 July 2019).
• Zinetti, S. (2017). Energy audit in SMEs could unlock great Energy Efficiency potential in Europe: a model. Available at: https://www.eeip.org/articles/detailed/?article=100069&cHash=999325585c33f81f2b4 2139 0498a8124(accessed 19July 2019).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°847095