E2DRIVER trainees' target groups definition

E2DRIVER H2020 project

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ABBREVIATIONS

AR: Augmented Reality

EC: European Commission

ESCO: European Skills/Competences, Qualifications and Occupations

GA: Grant Agreement

IATF: International Automotive Task Force

ICT: Information and Communication Technologies

ISCO: International Standard Classification of Occupations

ISO: International Organization for Standardization

KPIs: Key Performance Indicator(s)

OEMs: Original Equipment Manufacturer(s)

PV: Photovoltaic

SMEs: Small-Medium Enterprise(s)

VR: Virtual Reality

WP: Work Package

PROJECT PARTNERS

CIRCE: Fundación CIRCE Centro de Investigación de Recursos y Consumos Energéticos

FRAUNHOFER ISI: Fraunhofer Gesellschaft zur Förderung der Angewandten Forschung e.V.

POLITO: Politecnico di Torino

EPROPLAN: EPROPLAN GmbH Beratende Ingenieure

SINERGIE: Sinergie Società Consortile a Responsabilità Limitata

ENGIE: ENGIE Lab CRIGEN

SERNAUTO: Asociacion Espanola de Proveedoresde Automocion

AEN: Automotive.Engineering.Network – Das Mobilitätscluser e.V.

MESAP: Centro Servizi Industrie SRL

MOV'EO: Pole Mov'eo – Mobility Competitiveness Cluster

EPC: EPC Project Corporation Climate. Sustainability. Communications. mbH

MERIT: MERIT Consulting House

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PUBLISHABLE SUMMARY

The study presented in this document is included into WP2 "*Benchmarking and analysis of training programmes at the automotive sector*" of European project E2DRIVER.

At the end of the task "T2.2 *Profile design and characterisation of different roles within industries*" activity, this deliverable provides the results of the interactions between the Project team and the pilot companies, enterprises involved in the automotive industry, that have been selected through national clusters. By means of a questionnaire developed within the Project task and submitted to pilot company staff, the attitudes and efforts of companies toward the energy efficiency issue are evaluated. The main source of information are groups of selected workers of each pilot company staff that, with their contribution, has provided useful information within this task. Consequently, the task output is a set of groups of trainees with similar skills and competences about energy related issues. This sets form a base for the development of adapted training material that each enrolled pilot company trainees should perform in the future.

The questionnaire answers and the interviews during the pilot company site survey have gathered information about pilot company energy consumption, energy balances and fluxes, operational machinery and rated power so that the outline of company's energy framework have been defined.

These data have been collected to set up the current situation in terms of energy usage of each pilot company and will be used as a standard for understanding deeply the state of the sector. Furthermore, this is a great opportunity to know the context where the future trainees develop their work, being possible to comprehend if the final E2DRIVER trainees groups must reflect the different context/companies that is possible to find in the sector.

The same procedure has been performed for each enterprise representing national pilot companies. For this stage three companies for each involved country (Germany, Spain, France and Italy, for a total of 12), chosen according proper criteria, have been selected as a sufficiently representative sample of trainees within the staff to undergo questionnaire and interviews.

The contents of this deliverable can be summarized as follows:

- Interview and questionnaire submitted to pilot company trainees (inputs);
- Analysis of the results;
- Trainees clusters according to their skills and competences and companies' energy frame-works (outputs).

Due to privacy issues, only aggregated data will be published.

TABLE OF CONTENTS

1 INTRODUCTION

The automotive sector is organized in a hierarchical structure, with a small number of Original Equipment Manufacturers (OEMs) and a higher number of sub-tier suppliers (see D2.1), mainly represented by SMEs. In facts, the production of a car requires a huge number of elementary components and, as reported in the D2.1, it is difficult to fully characterize the sector since its workforce is intrinsically connected and distributed along a wide network composed by interaction between OEMs and suppliers, but also between suppliers themselves. Hence, challenges discovered during D2.1 development were related to analysing and grouping, at the finest level possible, data regarding energy consumptions involved in each supplier activities.

It has been observed that in most cases energy data are available in aggregated terms, resulting in lack of more specific information for each supplier activity in the automotive sector. Energy auditing procedures are essentially based on the availability of data regarding energy consumption, so currently it can be highlighted how lack of data reflects also a non-properly disseminated culture regarding energy efficiency.

As a preliminary conclusion, Deliverable D2.1 outlined the state-of-art of the sector in which E2DRIVER project is expected to work and a general cultural background lacking about energy topics within SMEs in automotive sector, specially at the sub-tier level. Starting by data availability by reports and recent studies, the analysis of the project is now required to move more detailed inside automotive sector reality by the proper choice of 12 representative companies (3 for each partner country), with the aim to involve them directly in the development of E2DRIVER project. This is done to understand:

- More in detail, which energy-consuming processes are adopted in each selected pilot company and in which part of the automotive supply chain they are working on;
- How lack of awareness about energy efficiency is distributed along the staff;
- Their expectation to be achieved thanks to E2DRIVER intervention.

The study reported in this deliverable has the goal to answer in detail afore mentioned points, with the aim to pave the way for future tasks within E2DRIVER project.

1.1 Deliverable and task targets

After the analysis of legislative framework and energy consumption patterns of automotive sector developed in task T2.1, it is necessary to clearly highlight how workforce is distributed within enrolled pilot companies and to understand current status of competences about energy efficiency measures. Task 2.2 "*Profile design and characterisation of different roles within industries*" is a WP2 task into E2DRIVER European project where a set of work profiles analysis are carried out so that they provide a baseline to identify training requirements for each group of trainees according to their role within automotive industry and their skills.

This stage requires interviews and a questionnaire that a small sample of trainees of each enrolled company must undergo. Questions about the covered role within respective industry, energy efficiency related topics, training format suggestions and past experiences will be crucial to define proper training format and obtain as key output trainees' groups with similar skills, which act as a standard to adapt future training material. Trainees skills are compared to ESCO (European Skills and Competences, Qualifications and Occupations) requirements during the analysis. In parallel, information about

energy consumption are collected in terms of electrical and thermal energy fluxes, installed power, machinery inventory, and energy balances to set up the current company's energy framework.
D2.2 Deliverable "E2DRIVER trainees' target groups definition" is subdivided into three main sections:

- Subtask 2.2A "*Analysis of the pilot companies' structure and roles of their workforce*";
- Subtask 2.2B "*Online structured questionnaire developed by MERIT for assessment of the companies under training*";
- Subtask 2.2C "*Site survey/interviews: elaboration of a template with questions to analyze the as-is energy framework of the pilot companies*".

The purpose of the deliverable is to provide a clusterization of different roles within analysed pilot companies and to consider them as a representative sample of the whole automotive sector. Each trainees group differentiated by each other by different skills and training needs. Obtained results act as a base for future tasks such as T2.4 (training format and capacity building program requirements), T3.1 (repository generation), T3.3 (customization training plan), among others.

2 INFORMATION GATHERING STRATEGY

Pilot companies are the main source of information for E2DRIVER to implement an adapted training platform in future tasks. With this goal, it is important to keep in mind that the approach through which information will be collected should highlight, as clearly as possible, areas where lack of knowledge is larger, in order to increase the training platform effectiveness and, at the end, the project.

Required information cover all possible involvement of energy within an organization, starting by the top management and going downwards to technical members. This is done to differentiate as much as possible the staff for the information gathering process with two main purposes:

- Provide as output of the deliverable groups of trainees with similar skills and awareness;
- Characterize in depth how lack of awareness is fragmented into company occupational profile, in order to highlight both management and technical issues.

The proposed approach is structured into two parts:

1. *A questionnaire*, for a proper number of selected workers. The sample size should be defined to cover the widest number of occupational profiles. On the other hand, it is obvious that different number of employees between each involved pilot company lead to different sample sizes;
2. *A site survey/interview*, where the energy/maintenance manager or the nominated energy management responsible have given answers to closed and open questions about the current pilot company involvement and interests in energy efficiency measures.

2.1 Staff questionnaire

E2DRIVER required information to develop an adapted training methodology. In order to define the general groups of trainees, a direct questionnaire was developed and provided at an appropriate sample of workers of each company. Sample size has been chosen to obtain the most possible effective top-down analysis and understand how lack of knowledge in energy efficiency is distributed along the company occupational profile. The questionnaire (see Annex B: Staff questionnaire), which structure had been set up in subtask T2.2B "*online structured questionnaire developed by MERIT for assessment of the companies under training*", is divided into six main sections:

1. **Personal information**. The questionnaire begins with an initial presentation of the worker where name, gender and age are asked.
2. **Occupational profile according to ESCO.** The section is aimed to highlight the basic educational background and main role within organization of the worker undergoing the questionnaire. The experience is evaluated through possible certifications obtained and the number of years in the current occupation. In addition, it is necessary to understand how much the person is involved into energy efficiency related topics, if any, and in which manner.
3. **Involvement in energy efficiency measures.** The section is crucial since it represents the core of the purpose of E2DRIVER project. The lack of knowledge and awareness about energy efficiency benefits can be evaluated by the use of direct questions regarding the degree of involvement of the person in the energy management. The energy knowledge degree about energy is outlined by understanding if the staff knows about company policies and actions in the sector. In addition, the role of the staff to develop measurements, technical and

economical evaluation of new efficient equipment, on-site evaluation about how to use more efficiently energy carriers (i.e. wastes, losses, energy-consuming systems inspection) and gathered data treatment processes, is analysed.

4. **Energy management**. ISO 50001 is the international standard regarding the implementation of a proper energy management system within an organization, in order to integrate energy issues in the company policy and consider the sector as a possible source of investments to increase its value in the market. As in the previous point, a comprehensive analysis should give, as key output, how energy savings are planned and carried out in the organization. In facts, in this context a proper management and technically skilled staff is required to evaluate profitable investments and expenditures in the energy sector and maximize achievable economic savings through energy efficiency measures. Quality and Environmental management systems are regulated through the adoption of ISO 9001 and ISO 14001, respectively.
5. **Training information**. The last section of the questionnaire reflects how much the company is oriented towards training procedures in energy topics for the enrolled staff. Proposed questions highlight worker training format preferences, past training experiences and their expectations to be achieved thanks to E2DRIVER.

2.2 Energy assessment

This section has the goal to clearly understand the current situation in terms of energy consumption and related policies of each pilot company. Differently from the questionnaire, a survey with questions is provided to the energy manager of the company (or the staff responsible for energy management). The information is collected via the survey by means of face-to-face interviews with the energy-responsible person in order to be able to answer possible questions directly. The output is a depth comprehension of the organization energy behaviour and how its top management considered improvement in a short-term period (i.e. past and future two years). The structure (reported in Annex C: Energy assessment interview) is represented by three main sections:

1. **Organization's information.** The first part is structured as an organization-oriented list of open questions. It is important to clearly describe main productive processes representing company's core business, the annual turnover, number of employees and relevant production data. Latest refers to water, electricity and fuels consumptions registered for last year and the relative production level. Even energy manager personal data are required since it will represent the reference personnel of the organization aimed to provide E2DRIVER necessary data when needed.
2. **Energy management and energy audit.** Through open and closed forms questions, this section of the survey provides useful data to E2DRIVER project about the implementation of energy management and energy audit procedures in the companies. Key Performance Indicators (KPI) for energy management are queried in terms of their qualitative definition. In general, a KPI indicates how much energy is spent to deliver a specific output through the ratio between the energy consumed and the amount of useful-products (i.e. kWh/units produced). Open questions point to understand which KPIs are monitored, if any, and if their current trend is considered as a parameter to assess specific energy consumption rates. Regarding the assessment of basic energy control procedures in the companies, the implementation of specific energy targets and an internal energy policy is evaluated. Furthermore, it is aimed to

outline studies regarding external variables affecting energy consumptions, interests towards energy audits and employee trainings, the level on which consumptions data are collected (i.e. from building to single machinery level) and the internal nominated department dealing with energy topics. The results can give insights which procedures and means are already in place to support correct implementation of subsequent energy measures and in which areas further support for the companies is needed.

3. **Energy efficiency measures.** Last sections address specific implemented energy efficiency measures by the company divided by sector (supply, buildings and production). The final reporting includes a list of measures already in place of planned in the immediate future and the relative impact evaluated/estimated.

3 PILOT COMPANIES' STRUCTURE ANALYSIS

In this section, it has to be defined how collected information are treated and what kind of analysis are done in order to carry out trainees working profiles.

3.1 Staff analysis

The analysis performed in this section are related to subtask T2.2A "*analysis of the pilot companies' structure and roles of their workforce*". All collected data were incorporated into a single file and coded for the analysis purposes. Statistical analysis tools are used to draw the graphs and conduct the statistical analysis.

3.1.1 General and personal information

There were 45 questionnaires collected from pilot sites within four participant countries (Figure 1), being 92% of the respondents male and 8% female and the average age of the respondents was 43.05 (±11.74) years.

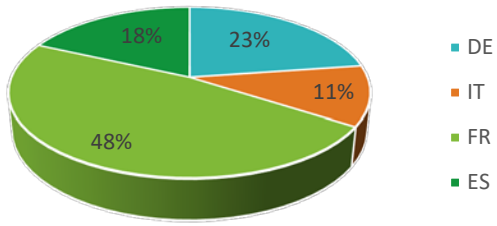


Figure 1. Collected responses per country

3.1.2 Occupational profile

Occupation of the responders was reported using the ESCO classification. Responses fall into four main categories: Managers, Science and Engineering professionals, Technical Managers and Technicians (Figure 2).

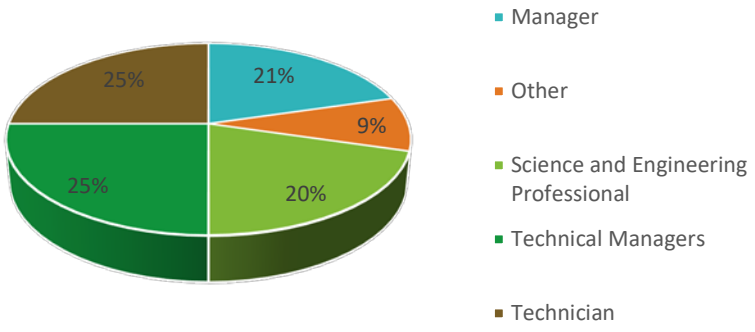


Figure 2. Collected responses by ESCO class

The academic background of the respondents varies from less than high school diploma to Doctorate. Distribution of academic background is presented in Figure 3.

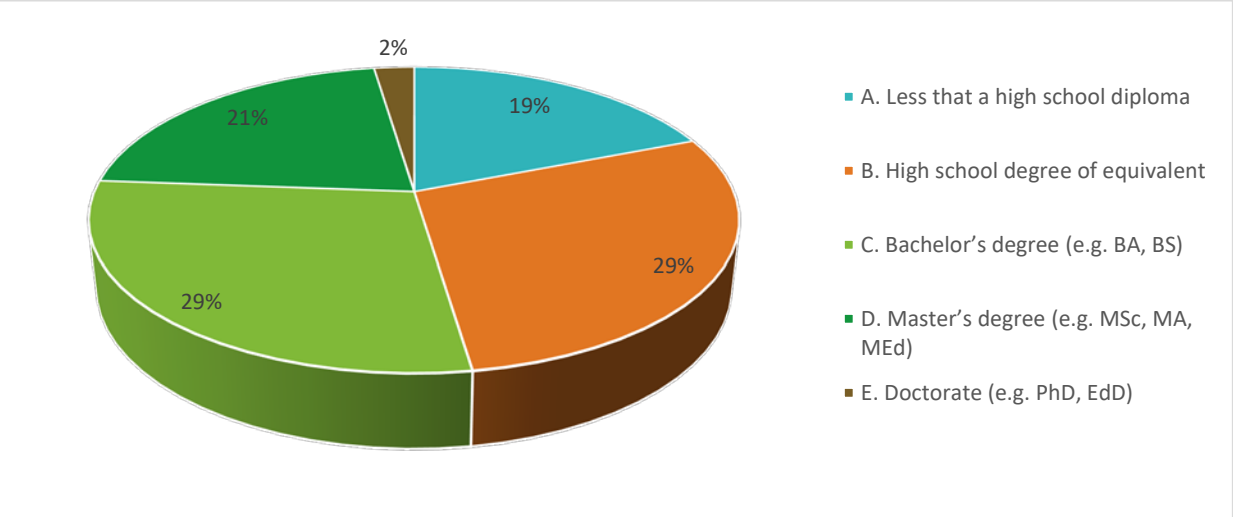


Figure 3. Academic background distribution

Around 16% of the respondents were chartered engineers, in one of the following areas of practice: environment, mechanical or production. Another 16% of the respondents, hold some kind of certification, but none of them related to energy efficiency.

Respondents have on average 16 years of experience, which are distributed according to the following graph in Figure 4.

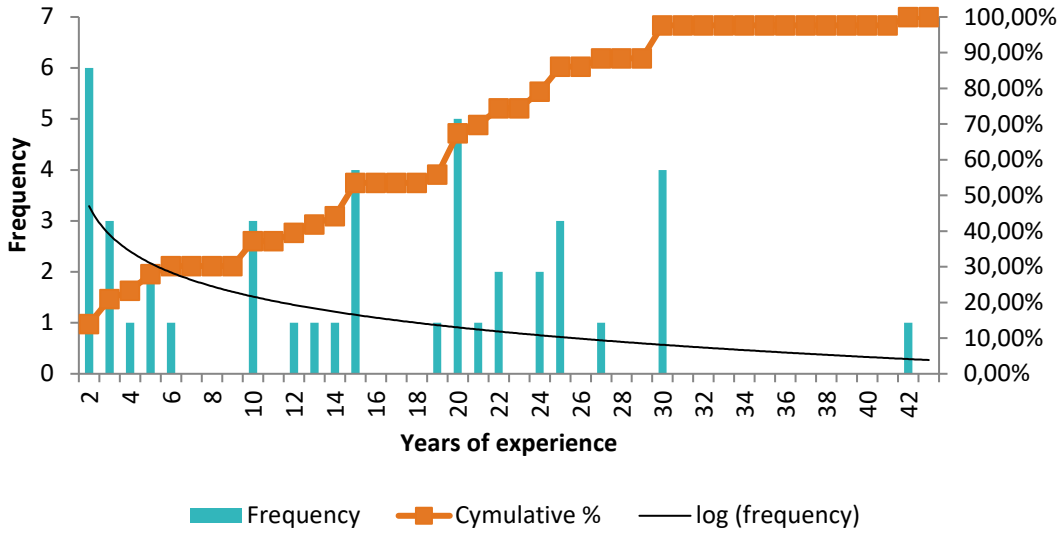


Figure 4. Distribution of experience in years

The sections of the automotive industry supply chain that were included in the study are presented in the following Figure 5.

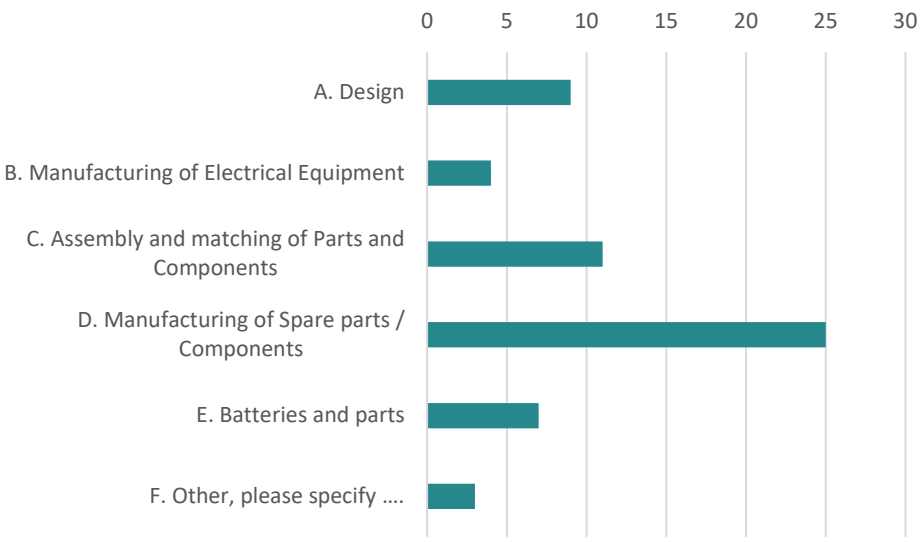


Figure 5. Positioning at the automotive supply chain

The occupational profile of the respondents is presented in Figure 6:

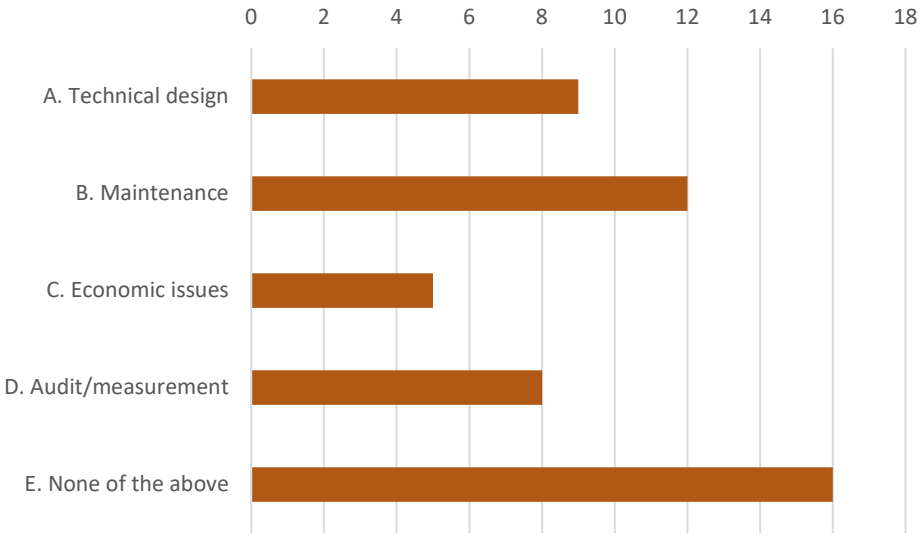


Figure 6. Occupational profile of respondents.

At this point, it is important to note that 32% of the respondents were not familiar in a professional level with any of the above, while none was familiar with the Design of energy saving measures, service contracting and supervision (Figure 7).

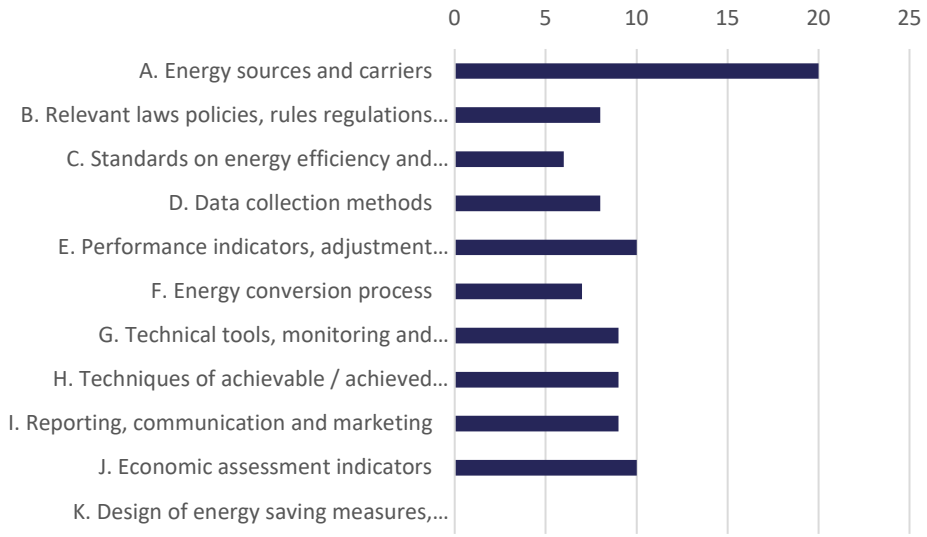


Figure 7. Familiarity with relative topics at a professional level

3.1.3 Involvement in energy efficiency measures

Almost one out of three respondents (32%) reported that they are not aware of any energy measuring procedures in their company. The most common methods reported were energy measuring devices and energy bills. The vast majority of respondents (82%) reported that is not involved in the calculation of the potential for energy savings in their daily job. Half of the respondents (48%) reported there is no policy/procedure in place, for the identification and promotion of interventions to improve the operation, maintenance, or energy efficiency of process systems. Moreover, 73% reported that they do not systematically record energy use, energy loss, or calculate potential energy savings in their facilities. Statistical analysis indicates that there are no statistically significant differences between those figures for the four basic ESCO classes, or the different occupational profiles. Out of those that systematically record energy use, 65% compare real data to theoretical figures and previous data, while only 19% of them provide recommendations for improvement as part of their job.

Only one out of three respondents (32%) reported that they perform tests on site to locate possible energy waste problems, while only 22% inspect or evaluate mechanical systems, electrical systems, or process systems to determine the energy consumption of each system. Finally, 41% of the respondents reported that they do not inspect newly installed energy-efficient equipment to ensure that it is installed properly and performing according to specifications.

3.1.4 Energy management

Regarding the systematic management of energy in the pilot sites, 23% reported that they do not integrate their energy management into a certified management system. Actually, 20% of respondents reported that there is no written procedure for Quality Management. The rest of them reported that they mainly ingrate energy management into ISO 9001 and/or ISO 14001. Only about one out of three respondents (38%) is involved in technical cross-cutting energy efficiency measures (e.g. heating system, lighting - LED, ventilation). Around 40% is involved in organizational energy efficiency measures (e.g. managerial measures), while participating to the "energy savings" in-house group and

this is mainly correlated to managers. Finally, 40% are involved in at least one process-specific energy efficiency measure (e.g. designing new process, suggest new equipment etc.) for the pilot site.

3.1.5 Training information

According to the collected questionnaires, almost none of the respondents has ever participated in a course/seminar organized by the company about measures to increase energy efficiency associated with his/her tasks. The preferred training format was reported to be workshops, as presented in Figure 8.

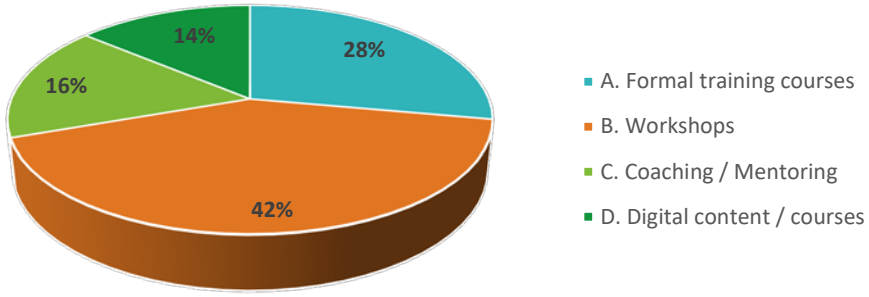


Figure 8. Preferred training format

Around the same figures apply for the perceived effectiveness of the training formats (Figure 9).

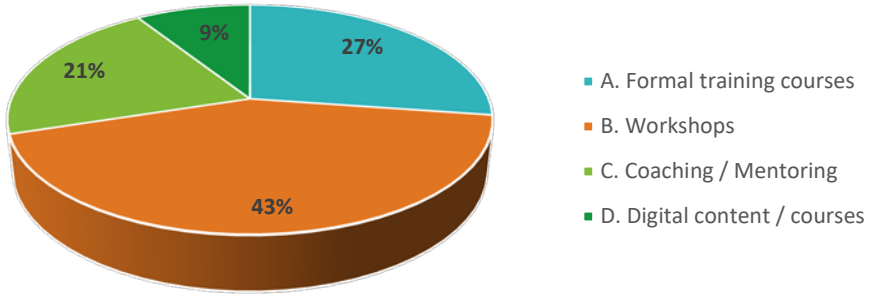


Figure 9. Perceived effectiveness of training formats

According to Figure 8 and Figure 9, it is obvious that the penetration of digital training methods in the pilot sites is limited. Respondents do not prefer those methods and do not regards them as effective. This could be justified by the fact that they may not be aware of capabilities offer by new technological means and technologies such as augmented reality (AR), virtual reality (VR) etc. Only 11% has been exposed to an educational initiative based on AR / VR before, while only 2% has previously participated other kinds of non-typical/non-traditional educational initiatives, mostly managers.

They seem to prefer more traditional approaches. Statistical analysis reveals that Digital content/courses are mainly preferred by Managers. Actually, there are 3 times more chances for them to select a digital course compared to technicians, who mainly prefer workshops.

Training preferences and perception on the respective effectiveness are summarized in Table 3.

A green dot would indicate that the training method is preferable, an orange that it is not the most preferable but it will probably work and a red that this method is not appropriate (according to the respondents' consideration) to be used for training and promote energy efficiency culture and mindset.

Table 3. Training preferences according to perceived effectiveness

	Traditional Training	Workshops	Coaching/ Mentoring	Digital content/ courses
Managers	🟠	🔴	🟢	🟢
Science and Engineering Professionals	🟢	🟠	🟢	🟢
Technical Managers	🟢	🟢	🔴	🔴
Technicians	🟠	🟢	🔴	🔴

However, most of the respondents agreed that there are several concepts / activities which are difficult to learn in typical / traditional education settings. Those can be summarized as:

- field handling,
- practical knowledge,
- outdated machines for demonstration,
- lack of visuals, and
- lack of training course customization to individual knowledge levels and needs.

Assuming that with some new technology it is possible to improve the effectiveness of job tasks that require practical skills, the tasks/skills related to their job, that respondents felt that would need/benefit more were reported to be:

- feasibility studies for manufacturing,
- plant maintenance,
- 3D visualization of energy flows,
- technical information,
- integration of new equipment and technical support,
- measuring the impact of new machines on energy savings,
- improvements on the installations and planification, and
- control and data analysis.

Particular topic/s of training that are considered to be valuable to promote energy efficiency, were reported to be:

- Energy saving good practices and tips (e.g. turning off electricity sources at the end of the day).
- Training on monitoring systems, tools, performance indicators, data analysis and energy management.
- Provide a broader knowledge on the topic, including economic impacts for the company and environmental impact.

- Use of practical examples – e.g. Comparison between "before and after" implementation of new methodologies.
- ISO 50001.
- Search for business specific energy-saving practices.
- Renewable energy sources.

Finally, valuable topics of training for the company in promoting energy efficiency were reported to be:

- Energy saving good practices and tips (e.g. turning off electricity sources during breaks).
- Topics that explain what the company wants to achieve in this context, with the consequent positive implications for the company.
- Provide a broader knowledge on the topic, including economic impacts for the company and environmental impact.
- Use of practical examples – e.g. Comparison between "before and after" implementation of new methodologies.
- Staff involvement part / workers' participation.
- Raising awareness of good practice and announce the monthly energy balance.
- Search for business specific energy-saving practices.
- ISO 50001.
- Training on monitoring systems, tools, performance indicators, data analysis and energy management.

3.2 Energy assessment

Under the subtask T2.2C "*site survey/interviews: elaboration of a template with questions to analyze the as-is energy framework of the pilot companies*", a site survey was performed in order to gather initial information on energy consumptions, electrical and thermal energy fluxes, energy management, energy auditing, the companies' energy policy and, more generally, the as-is state of the company's energy framework. In addition, the energy efficiency measures implemented are examined.

3.2.1 General information about pilot companies

Within the task a total number of 12 interviews was conducted in the 12 pilot companies from Germany, Spain, France and Italy. The predefined questions of the interviews are provided to the energy manager of the company (or the staff responsible for energy management). Mainly the energy, production, maintenance and quality manager, the head of the company or other energy-related personnel was interviewed.

The project focuses on SMEs trying to encourage them to perform energy audits. Concerning the company size of the 12 pilots, it can be seen that the majority of the companies are medium-sized with less than 250 employees (Figure 10). One of the companies has a turnover below 50 Million Euro but slightly more than 250 employees and hence is slightly above the threshold of the EU-definition of SMEs. However, it still was selected for the participation in the E2DRIVER project, since the E2DRIVER training is able to make them aware of the benefits of implementing the measures deduced from the audits.

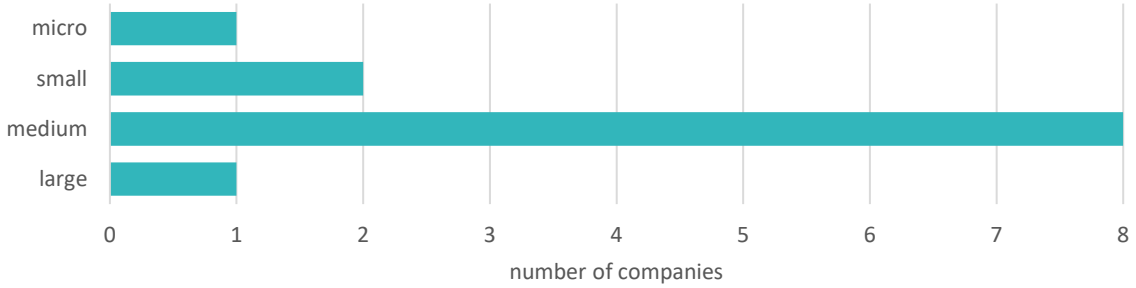


Figure 10: Pilot companies by company size. Scale: micro 1-9 employees, small 10-49 employees, medium 50-249 employees, large: over 250 employees[1]

Figure 11 shows in which parts of the automotive supply chain the 12 pilot companies are active (multiple answers were possible). One third of the companies manufactures spare parts.

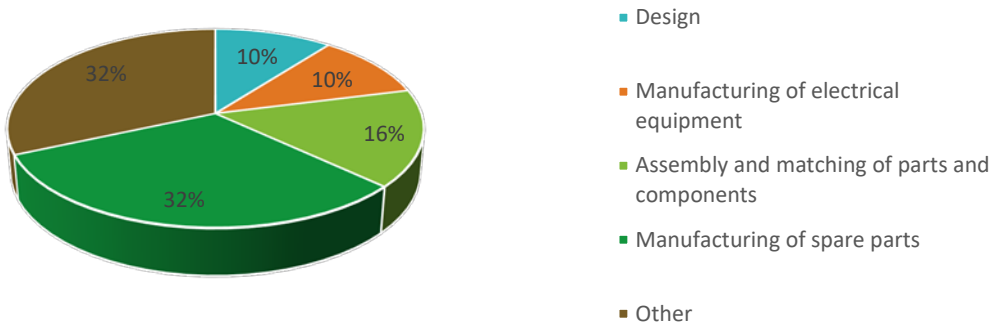


Figure 11: Parts of the supply chain in the automotive sector the pilot companies are involved in

In Figure 12 it is shown which standards are implemented in the companies. Only one company has an energy management system according to ISO 50001. Environmental certification according to ISO 14001 and a quality management system according to ISO 9001 are more widespread amongst the companies (they have been implemented by respectively 6 and 9 companies). 8 of the 12 pilot companies state that they also implemented IATF 16949, which is a technical specification aimed at the development of a quality management system that provides for continual improvement, emphasizing defect prevention and the reduction of variation and waste in the automotive industry supply chain and production based on the ISO 9001.

[1] according to the Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises (Text with EEA relevance) (notified under document number C(2003) 1422).

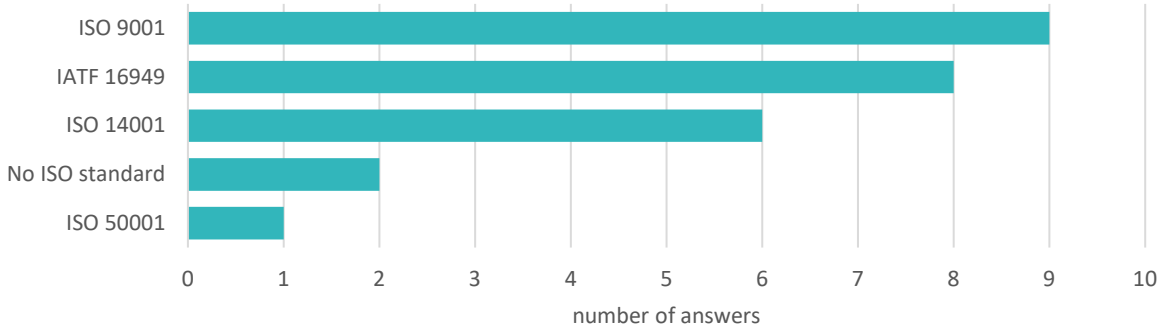


Figure 12: ISO standard implemented in the pilot companies

3.2.2 Energy management results

In Annex A, the results of the energy assessment consisting of two the subject areas - the general evaluation of energy management and KPIs and the basic check of energy control - are reported. In this report, we focus on the comparison of the twelve individual pilots, rather than a comparison between countries. For each of the 24 queried measures in the survey, we report whether the measure has been implemented/fulfilled by the pilot: yes (green), no (red), or partially (yellow).

Table 4 (next page) shows which measures have already been implemented/fulfilled by the pilots. Regarding the two sections of the survey about energy management procedures, on average 8.2 pilots implemented measures there. With regard to the basic check of energy control, the pilots have implemented more measures on average in the area of policy (7 pilots), procedures in place (8.1 pilots) and actions (7 pilots); while less measures are implemented in the field of training (4 pilots). The individual measures are shortly discussed per category below.

Energy management & KPIs

Two sections of the survey deal with energy management procedures and KPIs. Almost all pilots state that they manage energy consumption in their company (11 pilots), while only half use key performance indicators for energy management (6 pilots). Only a small number of four pilots has specific targets for reducing energy consumption or for improving energy efficiency.

General assessment

There is a large interest in conducting energy audits in the companies (9 pilots). Moreover, there is great interest (9 pilots) in implementing a management system (e.g. ISO 9001/ ISO 14001/ ISO 50001) or additional certifications to those already existing since, as shown in Figure 12, only two companies have no ISO standards implemented yet. For those companies without a certified energy management system the departments which are related to energy initiatives and control vary from company to company as depicted in Figure 13.

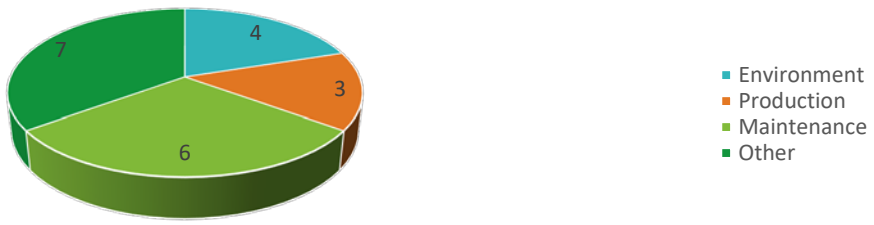


Figure 13: Departments related to energy efficiency initiatives and control in the companies without a certified energy management system (other: Purchasing, Engineering Department, Safety and Environment, Management, Administration).

Table 4: Energy assessment overview

		Total implemented or fulfilled
	Energy management & KPIs	7
1	Do you manage energy consumption in your company?	11
2	Does your location use key performance indicators (KPIs) for energy management?	6
3	Are there specific targets for reducing energy consumption or for improving energy efficiency (e.g. % / per unit produced)?	4
	General assessment energy management	9,3
4	Has there been any interest in conducting energy audits in your company?	9
5	Is your company interested in implementing a management system if it doesn't already have one (e.g. ISO 9001/ISO 14001/ISO 50001)?	9
6	If energy management is not integrated in certified management system, please specify which departments are related to energy efficiency initiatives and control in the organization	9
	A. Energy.	0
	B. Environment.	4
	C. Quality.	0
	D. Production.	3
	E. Maintenance.	6
	D. Other, please specify.	7
7	Which department is leading these efforts? Is there an energy committee in place? (single choice)	10
	A. Energy.	0
	B. Environment.	2
	C. Quality.	0
	D. Production.	1
	E. Maintenance.	2
	D. Other, please specify.	4
	Basic check energy control	
	Internal policy	7,0
8	Do you know the regulation that apply in your country and region about energy efficiency?	3
9	Is energy efficiency a decision criterion for purchasing new machines or systems (e.g. in the specification sheet)?	10
10	Are investment criteria based on risk (e.g. payback time < 3 years) and / or internal rate of return?	8
	Procedures in place	8,1
11	Is the energy use known and available (e.g. in an Energy Savings Plan, Energy efficiency plan, or from your monitoring information)?	11
12	Has the organization determined the main energy aspects based on energy use? Is this information up to date?	7
13	Is there a measuring, evaluation and monitoring concept on energy consumption?	9
14	On which level(s) is data on energy consumption collected? On the level of…	12
	...the entire production site	10
	…a single building	0
	…individual production areas or production lines	2
	…individual machines or systems	0
	...no data collection on energy consumption	0
15	If energy consumption indicators are used; on which levels are they used? On the level…	8
	...the entire production site	6
	…a single building	1
	…individual production areas or production lines	1
	…individual machines or systems	0
	...no data collection on energy consumption	2
16	Do you benchmark your energy consumption?	7
17	According to the requirements of the energy management policy obligations of energy efficiency, is there a 'plan of execution', to improve energy performance?	3
	Training	4,0
18	Is the necessary knowledge and information in the field of efficient energy use known? Have the employees who are able to influence energy use been instructed or educated?	3
19	Have you identified concrete needs in the energy training of employees? Please specify (for example: specific processes or utilities, energy audit procedures, measurement equipment, etc.)	5
	Actions	7,0
20	Are there regular internal information exchanges about the energy performance and energy management obligations at executive and board level? And is there agreement on in what way and to whom the energy performance is communicated?	6
21	Are sufficient financial means made available for managing and improving the energy performance (use and efficiency)?	9
22	Do you monitor areas of Significant Energy Use (SEUs)?	5
23	In case of deviating energy use, is the cause investigated and are measures taken to prevent repetition?	8
24	Do you perform an annual (or more frequent) internal evaluation of energy performance? Do you report on the functioning to the board?	7

Internal policy

Within the policy part of the basic check of energy control, only three pilots state that they know the regulations about energy efficiency that apply in their country and region. Regarding the purchase of new machines or systems energy efficiency is commonly used as a decision criterion (10 pilots) and investment criteria are based on risks like payback time or internal rate of return (8 pilots).

Procedures in place

All pilots collect data about energy use, primarily on the level of the entire production site. Two pilots also collect this data on the level of individual production lines or areas. Moreover, at least 9 pilots have a measuring, evaluation and monitoring concept on their energy. However, many pilots still lack insight into the energy aspects, have only partial insight or have information that is not up-to-date (5 pilots). Only a few pilots benchmark their energy consumption (7 pilots).

Training

Many pilots have not determined tasks and responsibilities for employees involved in energy management and an identification of specific training needs for employees is missing (7 pilots). They also often lack the necessary knowledge about energy efficiency and clear instructions or education on this topic (9 pilots).

Actions

Most pilots indicate that they have sufficient financial means available for managing and improving energy performance (9 pilots). Yet, many pilots have no agreements on monitoring of energy use (5 pilots), while in case of deviating energy use a slightly higher amount of companies (8 pilots) investigates this and takes measures to prevent repetition. The results also show that a common agreement how energy performance is communicated is missing (6 pilots): There are no regular internal information exchanges about this topic and no reporting at executive and board level.

3.2.3 Energy efficiency measures

The last part of the energy assessment has the practical aim to gather information about the areas in which selected pilot companies' investments had been recently oriented. The analysis focuses on three typical sectors of an industrial organization, each one characterized by more specific detailed sections (see more information in Annex D: Energy efficiency measures):

1. **Measures in supply technologies**
    a. Electric drives
    b. Compressed air systems
    c. Pump systems
    d. Process heating
    e. Process cooling
    f. Logistics
2. **Measures in building technologies**
    a. Building heating/cooling
    b. Building envelope
    c. Lighting
    d. ICT (Information and Communication Technologies)
    e. Air supply and climatisation

3. Measures in specific processes

The analysis relies on collected information by pilot companies through afore mentioned energy assessment. Thanks to the use of 12 pilot companies as representative sample of the automotive sector, it is possible to check which energy efficiency measures a typical SME belonging to this sector take into account. The energy efficiency interventions cover a time lapse of four years (last and next 2 years, from 2018 to 2022) enough significant to identify current efficiency situation from a technical point of view. It is first useful which sectors are mostly implemented in the pilot companies (Figure 14).

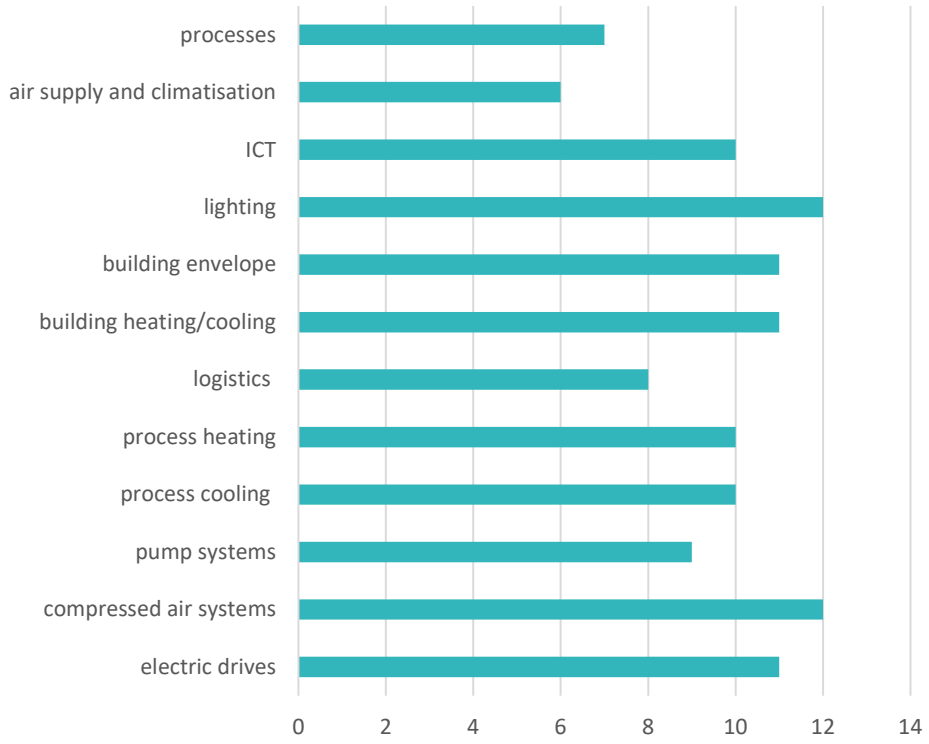


Figure 14: pilot involved technologies

Lighting and compressed air systems are the sectors used in all 12 pilot companies, 11 pilot reported to use electric drives, building heating/cooling and building envelope and 10 of them are using ICT, process heating and process cooling technologies. The sectors below double digit threshold are pumps systems (9 pilots), logistics (8 pilots), process-specific (7 pilots) and air supply and climatization (6 pilots). Process section allow more than one answers, so multiple specifications cases have been accounted just as one.

A total of 48 considered and/or implemented measures and 28 planned measures have been identified belonging to listed above groups. The specific weight of each above-mentioned areas is shown in Figure 15.

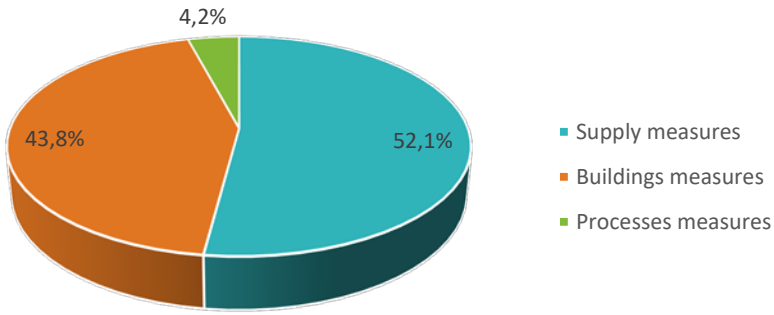


Figure 15: last two years energy efficiency measures

By Figure 15 it can clearly be noticed how supply and building sectors have been mostly investigated rather than processes one, with the former representing about half of the total measures. In fact, process-specific oriented investments revenues are related to the yearly production and higher initial investments are expected. In other words, the energy efficiency in processes requires higher investments, hence higher pay-back time, in a sector in which the market is mainly represented by high productions of low-cost components, thus meaning low-specific revenues for produced component. Given such consideration, the analysed organisations sample has been more oriented towards not-production related sectors and increasing auxiliary and general services efficiency. Another important aspect to be take into account is that the general low awareness about energy efficiency laws explained section 3.2.2 may lead to low knowledge about incentives schemes and subsidies, particularly important for higher investments.

More in detail, in 25 considered supply technologies 28% are represented by compressed air systems, 20% by logistics and the remaining improvements are distributed with values from 12 to 16%. Lighting is the most exploited intervention (38.1%) in 21 building technologies improvements, followed by building heating/cooling (23.8%), building envelope and air supply/climatization (both 14.3%) and ICT technologies (9.5%).

In Figure 16 the total distribution of 48 measures is shown.

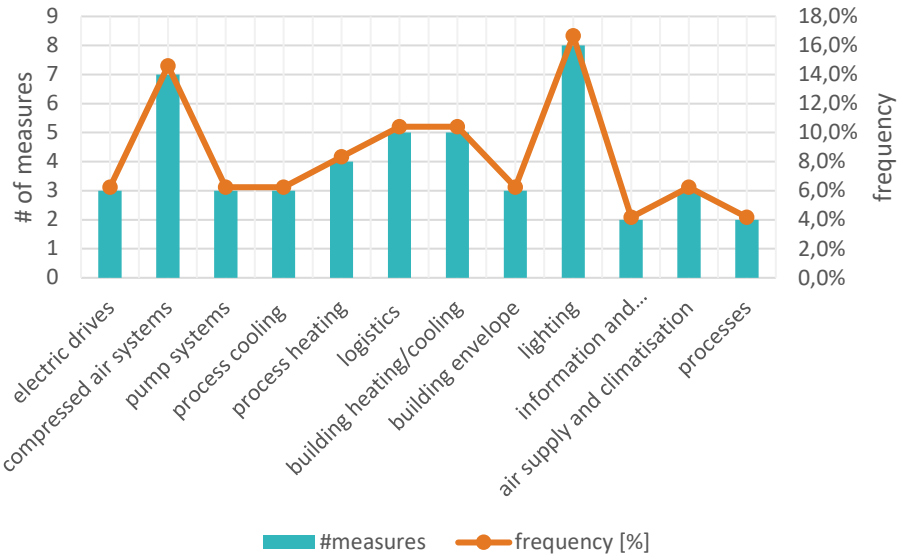


Figure 16: considered/implemented energy efficiency measures list

It can be seen how lighting (16.7%), compressed air (14.6%) and, in the same percentage, logistics and building heating/cooling systems (10.4%) have been more exploited. Information and Communication Technologies and processes are the least economic attractive segments for automotive sector investors (both 4.2%) and the remaining elements are in a range between 6.3 and 8.3%.

As shown in Figure 17, the situation is different if future measures plan is considered. Despite supply and building technologies still represent the widest areas in which automotive pilot companies will be likely to invest, process-oriented measures cover a percentage more than four times higher its past situation. Higher investments for production machines can be achieved increasing organization capital availability year by year with revenues by smaller expenditures. For this reason, it is possible that processes measures are scheduled with higher time lapses with respect to other ones. This means that the typical way in which SMEs finance huge investments is through previous short-term and low risk measures with the aim to increase its financing availability for more important actions. In this way, more efficient equipment can be purchased and installed increasing the specific efficiency of related production lines as a driver to begin an energy and cost saving process for each produced component.

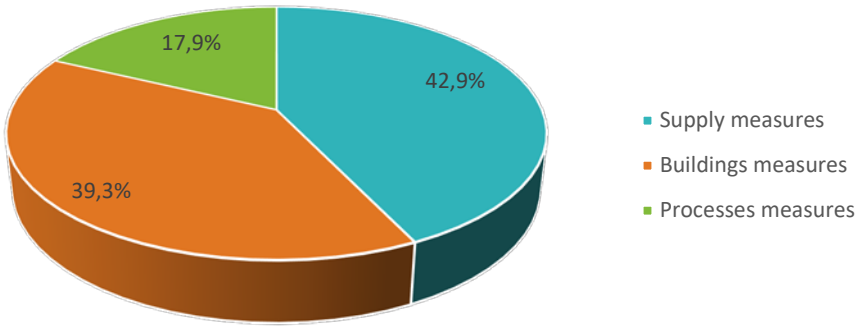


Figure 17: next two years energy efficiency measures

A detailed analysis into technology areas shows how compressed air systems is by far the most investigated sector for efficiency improvement (41.7%) over a total of 12 planned supply technologies measures. Both electric drives and process heating account for 16.7% while pump systems, logistics and process cooling each represents an 8.3% contribution. Among 11 refurbishment building measures, lighting and building heating/cooling represent both 36.4% of the total, followed by air supply and climatization (18.2%) and building envelope (9.1%). No innovative ICT improvements are scheduled for next two years.

Similarly, as before, the total distribution of 28 planned energy efficiency measures is shown in Figure 18:

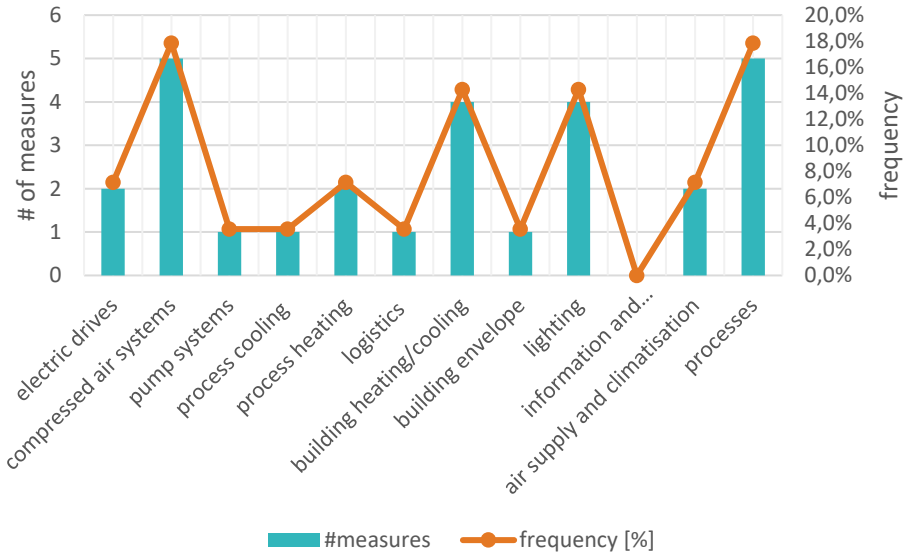


Figure 18: planned energy efficiency measures list

Processes-related measures and compressed air systems (together 17.9%) represent the sectors in which pilot companies will focus more economic efforts. After these, building heating/cooling and lighting (14.3%) remain high attractive improvements for the near future. Other sectors contributions do not exceed 7.1%.

The analysis presented in this section can be summarized in Figure 19 and Table 5. In the latter all implemented measures are grouped into elementary groups and then subdivided according to the proper sector.

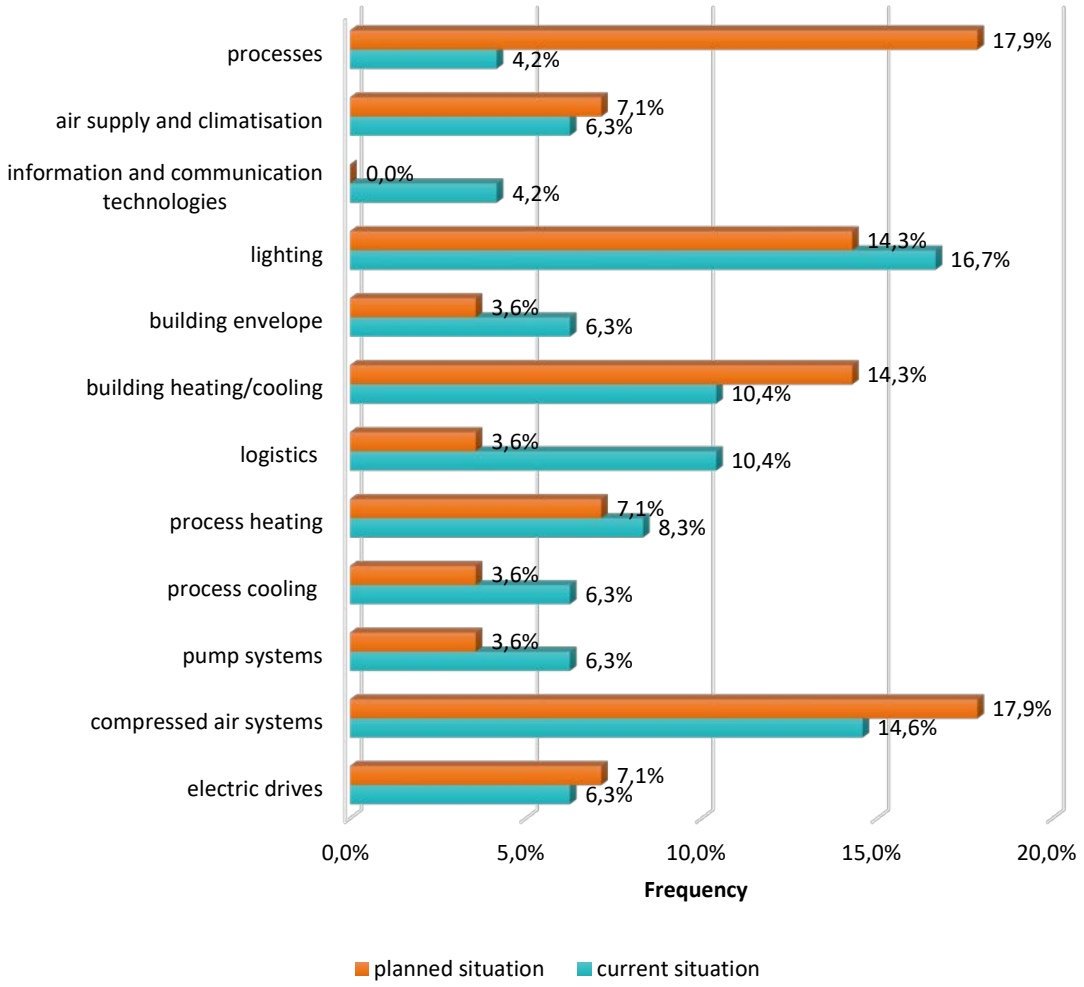


Figure 19: current vs. future situation

Table 5: energy efficiency measures

Area	Sector	Measures
Supply technologies	*Electric drives*	•High efficiency motors •Inverters installation
	Compressed air systems	•More efficient equipment •Inverters installation (VSD) •Leakage detection on regular basis
	Pump systems	Variable Speed Drive (inverter)
	Process cooling	•Heat recovery from cooling circuit • AHU substitution •Set point temperature optimisation
	Process heating	•Heat pipes insulation • AHU substitution •Installation of condensing boiler
	Logistics	•Low-emission/electric vehicle fleet •Substitution of gasoline forklifts with electric ones
Building technologies	*Building heating/cooling*	•Boiler substitution •Compressors exhaust heat recovery •Heat recovery from process •heat pumps
	Building envelope	•Building insulation •Heat recovery from process
	Lighting	•LED installation •Light and presence detection sensors
	ICT	•Server and machinery substitution
	Air supply and climatisation	•HVAC optimisation •Free coolers adoption
Production processes	*Processes*	•New efficient process equipment

As already pointed out, only measures belonging to afore mentioned sections and in a period of 4 years (previous and next 2 years) are considered within present analysis. Some of them have been excluded because of they are out of time lapse implementation or because they are not included in any of the defined categories (i.e. only one PV plant installation is planned).

4 DISCUSSION

In this report, attitudes and actions of the twelve pilot companies toward energy efficiency have been discussed, highlighting shared and different undertakings. These considerations are based on the energy assessments, interviews and cultural positions. In short:

- The staff analysis provides implications for training target groups and context for developing trainings in the pilot companies
- The energy assessment identifies current gaps in energy management and energy auditing procedures within the pilot companies.
- The energy efficiency measure assessment analyses the best opportunities and main hindrances for implementing energy efficiency improvements.

In the upcoming sections, the implications for the development and implementation of trainings in pilot companies is discussed in detail for the staff analysis in paragraph 4.1, as well as briefly for the energy assessment and the energy efficiency measures in paragraph 4.2. The limitations of the approach used in task 2.2 are discussed in section 4.3.

4.1 Trainees classification according to staff analysis

In this section the data analysis performed in previous chapters will be used to obtain the groups of trainees with similar skills and knowledge about energy efficiency topics. These clusters of workers will act as an input for several upcoming E2DRIVER tasks.

Identification of different groups of trainees, having different coaching needs, could address educational issues in a more effective way. In that context, training material, methods and practices could be more focused and consolidated. Educational level can also be taken into consideration. Based on the above data analysis and findings of the questionnaires, four groups of trainees can be identified:

- **Group 1:** *Managers* should be aware of practices and process related to energy management, as well as with more technical aspects, from a high-level perspective, like energy flows and conversions. Technological means and new/digital training forms, like augmented reality and virtual reality could significantly contribute on that, as well as good practices, renewable energy and integration of energy management in existing management systems. Coaching and mentoring could be used for training. Digital content and training will provide them high customization capabilities, according to their background, needs and time.
- **Group 2:** *Science and Engineering Professionals*, should be provided with training on monitoring systems, tools, performance indicators, data analysis and energy management. Moreover, they should get a broader knowledge on the topic, including economic impacts for the company and environmental impact. All kind of training could be suitable for them, however highly customized digital content would allow them to build training according to their needs and background.
- **Group 3:** *Technical Managers* training on energy saving practices and tips, on monitoring systems, tools, performance indicators, data analysis and energy management, economic impacts for the company and environmental impact. Moreover, training on ISO 50001 and staff involvement. Traditional training and workshops are mostly suited to this group. However, they could significantly benefit from the use of digital content in terms of customization and presenting complicated topics in an easy to understand way.

- **Group 4:** *Technicians* that should be made aware of energy management concept, policy and systematically assess energy consumption and effectiveness of equipment. Training should provide them also with a broader knowledge on the topic, including economic impacts for the company and environmental impact and practical examples. Workshops can be used mainly for effective training, however digital technologies could significantly contribute in effective training given the capabilities of AR and VR.

The training needs and format preferences can be summarized in Table 6.

*Table 6. Training needs for each one of the four identified groups**

	GROUP 1	GROUP 2	GROUP 3	GROUP 4
	Managers	Science and Engineering Professionals	Technical Managers	Technicians
Traditional Training	🟡	🟢	🟢	🟡
Workshops	🔴	🟡	🟢	🟢
Coaching/ Mentoring	🟢	🟢	🔴	🔴
Digital content/courses	🟢	🟢	🔴	🔴
Energy management concept	🟢	🟢	🔴	🟢
Policy and processes	🟢	🟡	🔴	🟢
Energy consumption assessment / data analysis	🟢	🟢	🟢	🟢
Effectiveness of equipment	🟢	🟡	🟡	🟢
Economic Impact	🟡	🟢	🟢	🟢
Environmental impact	🟡	🟢	🟢	🟢
Practical examples	🔴	🔴	🟡	🟢
Energy flow	🟢	🔴	🟡	🔴
Monitoring systems, tools, performance indicators	🔴	🟢	🟢	🟡
ISO50001	🟡	🟡	🟢	🔴
Staff involvement	🟡	🟡	🟢	🟡

**A green dot would indicate that the training method/topic is preferable, an orange that it is not the most preferable but it will probably work/needed and a red that this method is not appropriate/less needed (according to the respondents' consideration) in order to promote energy efficiency culture and mindset.*

Almost one out of three staff answering the questionnaire is not familiar in a professional level with energy efficiency and energy management topics, and generally they also report not being aware of any energy measuring procedures in their company or of energy efficiency policy. Less than 20% reported to be involved in the calculation of the potential for energy savings in their daily job. Moreover, it was found that in the majority of cases, energy efficiency topics are not included in the established management systems. These findings provide evidence that there is significant headroom for energy efficiency improvement in pilot sites, meaning that there is a large energy saving potential in this segment of the economy.

4.2 Training implications according to energy assessment

Although energy consumption is perceived as in important topic by almost all the pilot companies, many of them are still lacking concrete energy management measures like the implementation of KPIs

or specific energy saving targets. However, there is large interest in improving this situation either by the implementation of additional ISO certifications or the implementation of energy audits.

The results of the energy assessment reveal that there are a number of areas where particular actions are needed: one point is the lack of knowledge regarding energy efficiency regulations in the respective country which might be a topic to be addressed in the trainings of E2DRIVER project. In addition, although all pilots collect energy data and many of them monitor their energy consumptions, support seems to be needed in the implementation of processes and management structures in order to deal with the monitored energy use and in the consistent implementation of energy efficiency measures. Therefore, methods to gather up-to-date energy data and to monitor areas of significant energy use and benchmarking approaches can be fostered. This consideration comes along with the need for a common agreement on how energy issues are communicated and the need for a regular exchange - especially with regard to a regular reporting at executive and board level. One of the most important points, where action is required, is the training and education of employees with regard to energy efficiency, since many pilots indicate a lack of knowledge and clear instructions of their staff.

The aforementioned lack of awareness in energy efficiency topics is reflected into pilot companies' attitude towards energy efficiency measures and especially on those they are willing to implement. In fact, as reported in section 3.2.3, the majority of investments are directed towards low-risk areas that also brought smaller economic revenues (lighting, electric drives, compressed air systems, logistics). Moreover, section 3.2.2 revealed that most of the companies declared to have sufficient financial availability to sustain energy efficiency improvements, however lacking a proper knowledge about energy efficiency regulations. It is also to be remarked an insufficient knowledge about incentives schemes and subsidies which are fundamental to implement expensive measures. In addition, former lack act as a barrier to renewable energy plants diffusion within this sector.

With regard to the training group definition as described in section 4.1, the results of the energy assessment reveal that all technical managers of the SMEs (micro, small or medium) have similar training needs and there is no need to divide them into different groups. This approves the choice of SMEs as a target group. For those companies, which did not implement an EMS, on the one hand, training needs include the provision of basic information on energy audits, regulations etc. and on the other hand provision of the necessary knowledge to implement concrete measures. While the needs of companies, which already implemented an EMS (currently concerns one pilot company), are more in the area of implementing concrete measures and raising awareness among employees by using modern tools such as those developed by E2DRIVER. Furthermore, these experienced companies can prospectively also act as role models and share their experience on energy auditing with other less experienced companies.

4.3 Limitations

Penetration of digital training methods in the pilot sites was found to be limited. However, those who had previous experience with digital content/training reported that they would use it again. Digital content and training can provide high customization capabilities, according to trainees' background, needs and time. Moreover, most of the questionnaire answers recognize the capabilities offered by new technological means and technologies such as augmented reality (AR), virtual reality (VR), which have the potential to explain complicated topics in an easy conceived was.

5 CONCLUSIONS

Based on the above data analysis and findings of the questionnaire answers, four groups of trainees can be identified:

1. Managers.
2. Science and Engineering Professionals.
3. Technical Managers.
4. Technicians.

Identification of different groups with different training needs could address training issues in a more effective way. In that context, training material, methods and practices could be more focused and consolidated.

The findings of the staff questionnaires are in line with the findings of the site survey/interviews with people responsible for energy management in the companies. It is found that the topic of energy efficiency requires more attention in the already established management systems of most of the pilot companies. Helping the companies with setting specific energy targets, e.g. via energy audits, and expanding the monitoring of energy use are necessary steps here. Another important lever, which was identified to improve energy performance in the companies, is the identification of company specific training needs for employees and more training and education in the field of efficient energy use and regulations itself.

A training education in these topics could reveal possible areas of improvements in which pilot companies were not used to direct economic efforts, leading to higher awareness about economic (via incentives and subsidies) and environmental (pollutant emissions reduction) topics which are fundamental to consider the energy efficiency as a core business of an organization. In this way, the implementation of energy management systems (according to ISO 50001) or energy audits will increase the knowledge about consumption best practices, measurements and improvements in energy uses and would lead to an increase in economic and environmental revenues, finally being a driver to future investment and an increase in the productivity of an organization.

6 ANNEXES

6.1 Annex A: Energy assessment results

Table 7: Energy assessment pilot 1 to 4

	Pilot company ID	1	2	3	4
	Energy management & KPIs	1	1	3	2
1	Do you manage energy consumption in your company?	●	●	●	●
2	Does your location use key performance indica-tors (KPIs) for energy management?	●	●	●	●
3	Are there specific targets for reducing energy consumption or for improving energy efficiency (e.g. % / per unit produced)?	●	●	●	●
	General assessment energy management	3	2	2	3
4	Has there been any interest in conducting energy audits in your company?	●	●	●	●
5	Is your company interested in implementing a management system if it doesn't already have one (e.g. ISO 9001/ISO 14001/ISO 50001)?	●	●	●	●
6	If energy management is not integrated in certified management system, please specify which departments are related to energy efficiency initiatives and control in the organization	●	●	●	●
	A. Energy.				
	B. Environment.	X	X	X	
	C. Quality.				
	D. Production.				X
	E. Maintenance.	X	X	X	
	D. Other, please specify.		X	X	X
7	Which department is leading these efforts? Is there an energy committee in place? (single choice)	*E. Maintenance.*	*Purchasing*	*B. Environment.*	*D. Production.*
	Basic check energy control				
	Internal policy	2	2	2	2
8	Do you know the regulation that apply in your country and region about energy efficiency?	●	●	●	●
9	Is energy efficiency a decision criterion for purchasing new machines or systems (e.g. in the specification sheet)?	●	●	●	●
10	Are investment criteria based on risk (e.g. payback time < 3 years) and / or internal rate of return?	●	●	●	●
	Procedures in place	6	4	5	5
11	Is the energy use known and available (e.g. in an Energy Savings Plan, Energy efficiency plan, or from your monitoring information)?	●	●	●	●
12	Has the organization determined the main energy aspects based on energy use? Is this information up to date?	●	●	●	●
13	Is there a measuring, evaluation and monitoring concept on energy consumption?	●	●	●	●
14	On which level(s) is data on energy consumption collected? On the level of…	●	●	●	●
	…the entire production site	X		X	X
	…a single building				
	…individual production areas or production lines		X		
	…individual machines or systems				
	…no data collection on energy consumption				
15	If energy consumption indicators are used; on which levels are they used? On the level…	(no answer)	(no answer)	●	●
	…the entire production site			X	X
	…a single building				
	…individual production areas or production lines				
	…individual machines or systems				
	…no data collection on energy consumption				
16	Do you benchmark your energy consumption?	●	●	●	●
17	According to the requirements of the energy management policy obligations of energy efficiency, is there a 'plan of execution', to improve energy performance?	●	●	●	●
	Training	2	1	1	1
18	Is the necessary knowledge and information in the field of efficient energy use known? Have the employees who are able to influence energy use been instructed or educated?	●	●	●	●
19	Have you identified concrete needs in the energy training of employees? Please specify (for example: specific processes or utilities, energy audit procedures, measurement equipment, etc.)	●	●	●	●
	Actions	5	4	4	4
20	Are there regular internal information exchanges about the energy performance and energy management obligations at executive and board level? And is there agreement on in what way and to whom the energy performance is communicated?	●	●	●	●
21	Are sufficient financial means made available for managing and improving the energy performance (use and efficiency)?	●	●	●	●
22	Do you monitor areas of Significant Energy Use (SEUs)?	●	●	●	●
23	In case of deviating energy use, is the cause investigated and are measures taken to prevent repetition?	●	●	●	●
24	Do you perform an annual (or more frequent) internal evaluation of energy performance? Do you report on the functioning to the board?	●	●	●	●
	Total	19	14	17	17

Table 8: Energy assessment pilot 5 to 8

	Pilot company ID	5	6	7	8
	Energy management & KPIs	1	3	3	1
1	Do you manage energy consumption in your company?				
2	Does your location use key performance indica-tors (KPIs) for energy management?				
3	Are there specific targets for reducing energy consumption or for improving energy efficiency (e.g. % / per unit produced)?				
	General assessment energy management	3	3	2	1
4	Has there been any interest in conducting energy audits in your company?				
5	Is your company interested in implementing a management system if it doesn't already have one (e.g. ISO 9001/ISO 14001/ISO 50001)?				
6	If energy management is not integrated in certified management system, please specify which departments are related to energy efficiency initiatives and control in the organization			(no answer)	
	A. Energy.				
	B. Environment.				
	C. Quality.				
	D. Production.	x			
	E. Maintenance.	x	x		
	D. Other, please specify.	x	x		
7	Which department is leading these efforts? Is there an energy committee in place? (single choice)	*Energy Savings Group*	*Management*		*None*
	Basic check energy control				
	Internal policy	2	2	3	1
8	Do you know the regulation that apply in your country and region about energy efficiency?				
9	Is energy efficiency a decision criterion for purchasing new machines or systems (e.g. in the specification sheet)?				
10	Are investment criteria based on risk (e.g. payback time < 3 years) and / or internal rate of return?				
	Procedures in place	5	6	7	3
11	Is the energy use known and available (e.g. in an Energy Savings Plan, Energy efficiency plan, or from your monitoring information)?				
12	Has the organization determined the main energy aspects based on energy use? Is this information up to date?				
13	Is there a measuring, evaluation and monitoring concept on energy consumption?				
14	On which level(s) is data on energy consumption collected? On the level of…				
	…the entire production site	x	x	x	x
	…a single building				
	…individual production areas or production lines				
	…individual machines or systems				
	…no data collection on energy consumption				
15	If energy consumption indicators are used; on which levels are they used? On the level…				
	…the entire production site	x	x	x	
	…a single building				
	…individual production areas or production lines				
	…individual machines or systems				
	…no data collection on energy consumption				x
16	Do you benchmark your energy consumption?				
17	According to the requirements of the energy management policy obligations of energy efficiency, is there a 'plan of execution', to improve energy performance?				
	Training	1	0	2	0
18	Is the necessary knowledge and information in the field of efficient energy use known? Have the employees who are able to influence energy use been instructed or educated?				
19	Have you identified concrete needs in the energy training of employees? Please specify (for example: specific processes or utilities, energy audit procedures, measurement equipment, etc.)				
	Actions	3	4	5	1
20	Are there regular internal information exchanges about the energy performance and energy management obligations at executive and board level? And is there agreement on in what way and to whom the energy performance is communicated?				
21	Are sufficient financial means made available for managing and improving the energy performance (use and efficiency)?				
22	Do you monitor areas of Significant Energy Use (SEUs)?				
23	In case of deviating energy use, is the cause investigated and are measures taken to prevent repetition?				
24	Do you perform an annual (or more frequent) internal evaluation of energy performance? Do you report on the functioning to the board?				
	Total	15	18	22	7

Table 9: Energy assessment pilot 9 to 12

	Pilot company ID	9	10	11	12
	Energy management & KPIs	0	3	1	2
1	Do you manage energy consumption in your company?				
2	Does your location use key performance indica-tors (KPIs) for energy management?				
3	Are there specific targets for reducing energy consumption or for improving energy efficiency (e.g. % / per unit produced)?				
	General assessment energy management	2	3	1	2
4	Has there been any interest in conducting energy audits in your company?				
5	Is your company interested in implementing a management system if it doesn't already have one (e.g. ISO 9001/ISO 14001/ISO 50001)?				
6	If energy management is not integrated in certified management system, please specify which departments are related to energy efficiency initiatives and control in the organization				
	A. Energy.				
	B. Environment.				x
	C. Quality.				
	D. Production.		x		
	E. Maintenance.		x		
	D. Other, please specify.	x	x		
7	Which department is leading these efforts? Is there an energy committee in place? (single choice)	*Management*	*E. Maintenance.*	*None*	*B. Environment.*
	Basic check energy control				
	Internal policy	1	2	0	2
8	Do you know the regulation that apply in your country and region about energy efficiency?				
9	Is energy efficiency a decision criterion for purchasing new machines or systems (e.g. in the specification sheet)?				
10	Are investment criteria based on risk (e.g. payback time < 3 years) and / or internal rate of return?				
	Procedures in place	2	6	2	6
11	Is the energy use known and available (e.g. in an Energy Savings Plan, Energy efficiency plan, or from your monitoring information)?				
12	Has the organization determined the main energy aspects based on energy use? Is this information up to date?				
13	Is there a measuring, evaluation and monitoring concept on energy consumption?				
14	On which level(s) is data on energy consumption collected? On the level of…				
	…the entire production site	X		X	X
	…a single building				
	…individual production areas or production lines		X		
	…individual machines or systems				
	…no data collection on energy consumption				
15	If energy consumption indicators are used; on which levels are they used? On the level…				
	…the entire production site			X	
	…a single building		X		
	…individual production areas or production lines				X
	…individual machines or systems				
	…no data collection on energy consumption	X			
16	Do you benchmark your energy consumption?				
17	According to the requirements of the energy management policy obligations of energy efficiency, is there a 'plan of execution', to improve energy performance?				
	Training	0	0	0	0
18	Is the necessary knowledge and information in the field of efficient energy use known? Have the employees who are able to influence energy use been instructed or educated?				
19	Have you identified concrete needs in the energy training of employees? Please specify (for example: specific processes or utilities, energy audit procedures, measurement equipment, etc.)				
	Actions	0	3	0	2
20	Are there regular internal information exchanges about the energy performance and energy management obligations at executive and board level? And is there agreement on in what way and to whom the energy performance is communicated?				
21	Are sufficient financial means made available for managing and improving the energy performance (use and efficiency)?				
22	Do you monitor areas of Significant Energy Use (SEUs)?				
23	In case of deviating energy use, is the cause investigated and are measures taken to prevent repetition?				
24	Do you perform an annual (or more frequent) internal evaluation of energy performance? Do you report on the functioning to the board?				
	Total	5	17	4	14

6.2 Annex B: Staff questionnaire

ID	Question **Name of Company: ……**
Personal Information	
1.	Name:
2.	What is your Gender? ☐ A. Male ☐ B. Female ☐ C. I prefer not to say
3.	What is your age?

Clause to inform respondents about the processing of their personal data.

This clause is related with the **H2020 E2DRIVER Project: Training on energy audits as an Energy Efficiency DRIVER for the automotive sector (Grant Agreement no. 847038)** (hereinafter, the "**Project**") which goal is to train SMEs in the automotive sector on energy auditing and energy saving measures for cost-effective energy efficiency improvements. The consortium is made up of 12 parties: Fundación CIRCE, FRAUNHOFER ISI, POLITECNICO DI TORINO, EPROPLAN GmbH, SINERGIE, ENGIE, SERNAUTO, AEN, MESAP, MOV'EO, EPC and MERIT (the "**Consortium Partners**").

According to the in-force regulation, you are informed that due to the monitoring and control obligations to which the Consortium Partners are subject in the project **H2020 E2DRIVER Project: Training on energy audits as an Energy Efficiency DRIVER for the automotive sector. (Grant Agreement no. 847038)** (hereinafter, the "**Project**"), in their condition of collaborators of the mentioned Project, are obliged to keep records of the activities carried out, including meetings, training and/or dissemination of Project activities, interviews, among others, in the frame of the Project, aiming at performing the actions required by the control bodies and any other competent authorities of the Project.

With this consent, you are informed that your personal data can be sent to control bodies and any other competent authorities of the Project and to the rest of the Consortium Partners in order to comply with the control requirements under Consortium Partners obligations in the frame of the Project. Results of surveys, interviews and other means of data collection will only reported in an aggregated way that does not allow the identification of individual respondents or companies. The data will be kept until the end of the Project and for the limited periods of the responsibilities that may result enforceable.

Additionally, Consortium Partners will process the personal data you provide us in this form to, in the framework of the Project, send you different surveys for completion, with the objectives of identifying

the specifications of the tools developed in the framework of the reference project, based on the preferences of potential users, under their consent and / or the relationship maintained with any of the Consortium Partners. In this sense, if you expressly authorize it by checking the corresponding boxes at the bottom of this form, your data may be processed by the Consortium Partners for the purposes indicated above. You have the right, among others, to oppose the processing of your data, revoke your consent at any time, access, limit, rectify and / or delete your data. You will find more detailed information about your rights and other privacy conditions in the Consortium Partners Privacy Policies indicated below.

- ☐ I have been informed about the treatment of my data by the Consortium Partners and I authorize their use.
- ☐ I authorize the use of the data resulting from the completion of the surveys that, where appropriate, are sent to me by the Consortium Partners.

You are entitled to exercise your rights of access, rectification, elimination, limitation, opposition, portability and to not be subject to a decision based solely on automated processing by contacting the corresponding Data Protection Officers of the Consortium Partners via email at the email address indicated below. You are also entitled to lodge a complaint with the competent Data Protection Agencies.

Data controller	VAT number	Address	Telephone	Privacy Policies	Data Protection Officer
Fundacion CIRCE	ESG-50556091	Avenida Ranillas, Edificio Dinamiza, 3D. Planta 1, 50018, Zaragoza, Spain	(+34) 976976859	http://www.fcirce.es/politica-de-privacidad-y-cookies http://www.fcirce.es/clause-protection-data-formation-activities-circe-foundation	protecciondatos@fcirce.es
Fraunhofer ISI	DE129515865	Hansastrasse 27C, 80686, Munchen, Germany	(+49) 8912052723	-	joachim.globisch@isi.fraunhofer.de
Politecnico Di Torino	IT00518460019	Corso Duca Degli Abruzzi, 24, 10129, Torino, Italy	(+39) 0110906300	https://www.polito.it/privacy/	dpo@polito.it
Eproplan GmbH	DE147852606	Schoettlestrasse 34 A, 70597, Stutgart, Germany	(+49) 711769880	http://www.eproplan.de/datenschutzerklaerung.html	datenschutzbeauftragter@eproplan.de
Sinergie	IT01548000387	Via Martiri Di Cervarolo 74/10, 42122, Reggio Emilia, Italy	(+39) 0522083122	http://www.sinergie-italia.com/images/PRIVACY/PRIVACY_POLICY.pdf http://www.sinergie-italia.com/im-	controller@sinergie-italia.com

				ages/PRIVACY/Informativa_corsi.pdf	
Engie	FR13542107651	Place Samuel De Champlain 1, 92400, Cour COURBEVOIE France	(+33) 144220000	https://engiegbs.service-now.com/gdpr_portal	dpo@engie.com
Sernauto	ESG28478725	Calle Castello 120, 28006, Madrid, Spain	(+34) 915621041	https://www.sernauto.es/politica-de-privacidad	sernauto@sernauto.es
Aen		Zahringerstr 65, 76133, Karsruhe, Germany	(+49) 7211337345	http://ae-network.de/en/privacy-policy/	info@ae-network.de
Mesap	IT01045950019	Via Fanti 17, 10128, Torino, Italy	(+39) 0115718462	https://www.mesap.it/privacy-policy/	dpo@ui.torino.it
Mov'eo	FR71491767257	Avenue Galilee, 76800, Saint Etienne Du Rouvray, France	(+33) 232915450	https://pole-moveo.org/charte-de-protection-des-donnees-personnelles-confidentialite/	moveo.rgpd@pole-moveo.org.
EPC	DE314775427	Rigaer Strasse 60, 10247, Berlin, Germany	(+49) 1781695803	https://www.e-p-c.de/en/impressum	info@e-p-c.de
MERIT	BE0667819264	Avenue de Fre 265, 1180, Uccle, Belgium	(+32) 26406521	http://www.meritconsulting-house.eu/privacy.html	n.kakardakos@meritconsultinghouse.eu

Signature:

_____

Occupational Profile

4.	What is your role in the company?
5.	Please indicate your occupation (ESCO) by selecting the appropriate. **1. Managers** • Chief executives, senior officials and legislators a. Legislators and senior officials b. Managing directors and chief executives • Administrative and commercial managers a. business services and administration managers b. sales, marketing and development managers • Production and specialized services managers a. Manufacturing, mining, construction, and distribution managers b. Information and communications technology service managers c. Professional services managers • Hospitality, retail and other services managers **2. Professionals** • Science and engineering professionals a. Physical and earth science professionals b. Mathematicians, actuaries and statisticians c. Life science professionals d. Engineering professionals (excluding electrotechnology) e. Electrotechnology engineers f. Architects, planners, surveyors and designers • Health professionals (Doctors / Nurses) • Teaching professionals (professors) • Business and administration professionals a. Finance professionals b. Administration professionals c. Sales, marketing and public relations professionals • Information and communications technology professionals a. Software and applications developers and analysts b. Database and network professionals • Legal, social and cultural professionals **3. Technicians and associate professionals**

- Science and engineering associate professionals
  a. Physical and engineering science technicians
  b. Mining, manufacturing and construction supervisors
  c. Process control technicians
  d. Life science technicians and related associate professionals
  e. Ship and aircraft controllers and technicians

- Health associate professionals (Doctor / Nurse)

- Business and administration associate professionals
  a. Financial and mathematical associate professionals
  b. Sales and purchasing agents and brokers
  c. Business services agents
  d. Administrative and specialized secretaries
  e. Regulatory government associate professionals

- Legal, social, cultural and related associate professionals

- Information and communications technicians
  a. Information and communications technology operations and user support technicians
  b. Telecommunications and broadcasting technicians

4. Clerical support workers

- General and keyboard clerks
  a. General office clerks
  b. Secretary

- Customer services clerks
  a. Tellers, money collectors and related clerks
  b. Client information workers

- Numerical and material recording clerks
  a. Numerical clerks
  b. Material-recording and transport clerks

- Other clerical support workers

6.	What is the highest degree or level of education that you have completed?

	☐ A. Less that a high school diploma ☐ B. High school degree of equivalent ☐ C. Bachelor's degree (e.g. BA, BS) ☐ D. Master's degree (e.g. MSc, MA, MEd) ☐ E. Doctorate (e.g. PhD, EdD) ☐ F. Other, please specify:
7.	Are you a chartered Engineer? ☐ A. Yes ☐ B. No If yes, in which field (e.g. mechanical engineer)?
8.	Have you obtained any certification (e.g. ISO, EEP, etc.)? ☐ A. Yes ☐ B. No If yes, please specify:
9.	How many years of experience do you have in your current occupation or related occupational areas? ____ years
10.	What is your responsibility? ☐ A. Management ☐ B. Auditing ☐ C. Planning ☐ D. Implementing / Monitoring ☐ E. Other, please specify:

11.	Which part of the automotive supply chain are you involved in[2] (more than one choices are allowed)? ☐ A. Design ☐ B. Manufacturing of Electrical Equipment ☐ C. Assembly and matching of Parts and Components ☐ D. Manufacturing of Spare parts / Components ☐ E. Manufacturing of car body ☐ F. Other, please specify ….
12.	What is your area of expertise (more than one choices are allowed)? ☐ Technical design ☐ Maintenance ☐ Economic issues (i.e. incentives, subsidies, etc.) ☐ Audit/measurement ☐ None of the above
13.	Which of the following are you familiar with at a professional working level (more that one choices are allowed)? ☐ Energy sources and carriers ☐ Relevant laws policies, rules regulations and contracts for energy ☐ Standards on energy efficiency and renewables ☐ Data collection methods ☐ Performance indicators, adjustment factors and energy balance ☐ Energy conversion process ☐ Technical tools, monitoring and measuring equipment for energy audits (such as data loggers, universal data recorders, light meters, sling psychrometers, psychrometric charts, flue gas analyzers, amp-probes, watt meters, volt meters, thermometers, or utility meters) ☐ Techniques of achievable / achieved energy savings ☐ Reporting, communication and marketing ☐ Economic assessment indicators ☐ Energy efficiency measures design, procurement of services and supervision

[2] For More see E2DRIVER D2.1 - p12

Involvement in energy efficiency measures	
14.	Are you aware of any energy measuring procedures in your company? ☐ A. Yes ☐ B. No ☐ C. I don't know If YES, how? Please specify …
15.	Are you involved in the calculation of the potential for energy savings in your daily job? ☐ A. Yes ☐ B. No ☐ C. N/A
16.	Is there any policy/procedure in place, for the identification and promotion of interventions to improve the operation, maintenance, or energy efficiency of process systems? ☐ A. Yes ☐ B. No ☐ C. N/A
17.	Do you systematically record energy use, energy loss, or calculate potential energy savings in your facilities? ☐ A. Yes ☐ B. No If yes please briefly explain: … If yes, please elaborate:

18.	How do you treat the collected data (more that one choices are allowed)? ☐ A. Prepare reports for statistical purposes ☐ B. Compare real data to theoretical figures and previous data ☐ C. Specific task/procedure for identifying potential improvements ☐ D. Provide recommendations for improvement as part of my job. ☐ E. Other, please specify….
19.	Do you perform tests on site to locate possible energy waste problems? ☐ A. Yes ☐ B. No ☐ C. N/A
20.	Do you inspect or evaluate mechanical systems, electrical systems, or process systems to determine the energy consumption of each system? ☐ A. Yes ☐ B. No ☐ C. N/A
21.	Are you inspecting newly installed energy-efficient equipment to ensure that it was installed properly and is performing according to specifications? ☐ A. Yes ☐ B. No ☐ C. N/A

Energy Management	
22.	Do you integrate your energy management into a certified management system, such as? ☐ ISO:14001: 2015 ☐ ISO: 50001:2018 ☐ ISO: 9001:2015 ☐ We don't have any ISO standard ☐ Other, please specify:
23.	Is there a written procedure for Quality Management? ☐ A. Yes ☐ B. No If yes, please specify:

24.	Are you involved in any technical cross-cutting energy efficiency measures (e.g. heating system, lighting, ventilation)? ☐ A. Yes ☐ B. No If yes, please elaborate:
25.	Are you involved in any organizational energy efficiency measures? (e.g. managerial measures) ☐ A. Yes ☐ B. No If yes, please elaborate:
26.	Are you involved in any process-specific energy efficiency measure (e.g. designing new process, suggest new equipment etc.)? ☐ A. Yes ☐ B. No If yes, please elaborate:
Training Information	
27.	Have you participated in any course/ seminar organized by your company about measures to increase energy efficiency associated with your tasks? ☐ A. Yes ☐ B. No If yes, please specify:

28.	What are your preferences about the formats of training material on energy audit? Multiple answers are possible. ☐ A. Formal training courses ☐ B. Workshops ☐ C. Coaching / Mentoring ☐ D. Digital content / courses ☐ F. Other, please specify:
29.	Based on your understanding and experience, which are the most effective ways to promote energy concerns and develop this energy efficiency culture and mindset? Multiple answers are possible. ☐ A. Formal training courses ☐ B. Workshops ☐ C. Coaching / Mentoring ☐ D. Digital content / courses ☐ F. Other, please specify:
30.	Have you ever been exposed to an educational initiative based on Augmented reality / Virtual reality before? ☐ A. Yes ☐ B. No If yes, which was the goal / topic of the initiative?
31.	Have you ever been exposed before to other kinds of non-typical / non-traditional educational initiatives (different than those above)? ☐ A. Yes ☐ B. No If yes, please specify in which form:

32.	Based on your experience, which are the concepts / activities which are more difficult to learn in typical / traditional education settings? Please specify:
33.	Assuming that with some new technology it is possible to improve the effectiveness of job tasks that require practical skills, which would be the tasks / skills (w.r.t. your job) that you feel would need / would benefit more from such technology? Please specify:
34.	According to your personal opinion, which particular topic/s of training do you think that would be valuable for you to promote energy efficiency? Please specify:
35.	According to your personal opinion, which particular topic/s of training do you think that would be valuable for your company in promoting energy efficiency? Please specify:

6.3 Annex C: Energy assessment interview

Interview:

Assessment of energy management and energy efficiency measures

The energy assessment consists of the following topics:

- **General information about the pilot.** This information should already have been gathered through each national association in previous tasks. Before starting the energy assessment, please check if this information is complete or additional information needs to be gathered during the energy assessment. More information can be collected through the interview.

- **Energy management & KPIs.** How the company currently manages its energy consumption, and the amount of energy and kind of energy sources the company consumes.

- **Energy efficiency measures.** This section is used to gather information on the measures that have probably been implemented or are under consideration for implementation. Open questions are listed at the end of the table to make sure no energy efficiency measures have been missed.

This information is very useful for improving the analysis of the sector already carried out in the E2DRIVER project, as well as being able to focus on the training needs and the material to be developed for this purpose.

GENERAL INFORMATION

General information	
Company name	
Address	
Annual Turnover (€)	
Parts of the supply chain in the Automotive sector the company is involved	□ Design □ Manufacturing of electrical equipment □ Assembly and matching of parts and components □ Manufacturing of spare parts □ Manufacturing of car body □ Other (please specify):
Number of employees	

Contact information		
Name		
Phone		
Email		
Function		
Production		
Select if you have an ISO standard:	☐ Company doesn't have any ISO standard	
	☐ ISO 9001	
	☐ ISO 14001	
	☐ ISO 50001	
	☐ Other (please specify):	
Description of main production processes		
Total Production in 2019 (specify units)		
Water consumption in 2019		
Consumption (m^3)**		
Cost (€)		
Electricity consumption in 2019**		
Consumption (kWh)		
Cost (€)		
Thermal consumption in 2019 (kWh)**		
Gasoil	(kWh)	(€)
Fuel oil nº1	(kWh)	(€)
Natural gas	(kWh)	(€)
Propane gas	(kWh)	(€)
Butane	(kWh)	(€)
Biomass	(kWh)	(€)
Other (please specify):	(kWh)	(€)
Other (please specify):	(kWh)	(€)

** It is only necessary to have approximate data.

ENERGY MANAGEMENT

Energy management & KPIs	
Do you manage energy consumption in your company? If yes, how?	
Does your location use key performance indicators (KPIs) for energy management? If yes, what are these KPIs?	
What are the variables or factors that affect your energy consumption? (the variables can be different depending on the process, so specify them according to the process)	
What has been the progress on these KPIs for the past 3 years? Or, in case you don't have any KPI identified, what has been the progress of energy consumption in your company?	
Are there specific targets for reducing energy consumption or for improving energy efficiency (e.g. % / per unit produced)?	
To which extent has your energy efficiency in the past 3 years improved or deteriorated?	

General assessment energy management	
Has there been any interest in conducting energy audits in your company?	
Is your company interested in implementing a management system if it doesn't already have one (e.g. ISO 9001/ISO 14001/ISO 50001)? How?	
If energy management is not integrated in certified management system, please specify which departments are related to energy efficiency initiatives and control in the organization	☐ Energy ☐ Environment ☐ Quality ☐ Production ☐ Maintenance ☐ Other (please specify):

Which department is leading these efforts? Is there an energy committee in place? (single choice)	A. Energy B. Environment C. Quality D. Production E. Maintenance F. Energy committee G. None H. Other (please specify):

Basic check energy control

An energy audit analyses the energy flows of a company to minimalize the use of energy and resources and to be aware of them. Its main goal is starting a process or system to reduce the amount of energy input into the system without negatively affecting the output. The following questions try to assess the procedures already and means already in pace to support this analysis and the correct implementation of the subsequent energy measures.

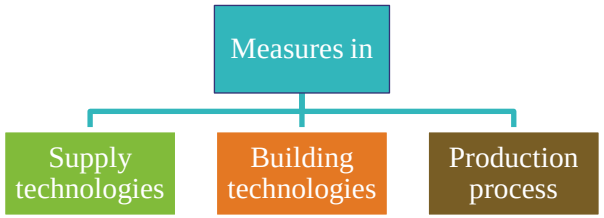
	Internal policy	Yes/No	Comments
1	Do you know the regulation that apply in your country and region about energy efficiency? Please mention the main ones.		
2	Is energy efficiency a decision criterion for purchasing new machines or systems (e.g. in the specification sheet)?		
3	Are investment criteria based on risk (e.g. payback time < 3 years) and / or internal rate of return?		
	Procedures in place	**Yes/No**	**Comments**
4	Is the energy use known and available (e.g. in an Energy Savings Plan, Energy efficiency plan, or from your monitoring information)?		
5	Has the organization determined the main energy aspects based on energy use? Is this information up to date? *Explanation: an energy aspect refers to something that causes or influences energy use. For example: outside temperature or draught for heating; compressors or leakages for compressed air; or occupancy rate and product type for a production machine.*		
6	Is there a measuring, evaluation and monitoring concept on energy consumption? If yes, please describe the main features		
7	On which level(s) is data on energy consumption collected?	On the level… □ …of the entire production site □ …of a single building	

		□ …of individual production areas or production lines □ …of individual machines or systems □ …no data collection on energy consumption	
8	If energy consumption indicators are used; on which levels are they used?	On the level… □ …of the entire production site □ …of a single building □ …of individual production areas or production lines □ …of individual machines or systems □ …no data collection on energy consumption	
9	Do you benchmark your energy consumption? And if so, how?		
10	According to the requirements of the energy management policy obligations of energy efficiency, is there a 'plan of execution', to improve energy performance?		
	Training	**Yes/No**	**Comments**
11	Is the necessary knowledge and information in the field of efficient energy use known? Have the employees who are able to influence energy use been instructed or educated?		
12	Have you identified concrete needs in the energy training of employees? Please specify. *For example: specific processes or utilities, energy audit procedures, measurement equipment, etc.*		
	Actions	**Yes/No**	**Comments**
13	Are there regular internal information exchanges about the energy performance and energy management obligations at executive and board level? And is there agreement on in what way and to whom the energy performance is communicated?		
14	Are sufficient financial means made available for managing and improving the energy performance (use and efficiency)? How much has been spent in the las 2 years?		
15	Do you monitor areas of Significant Energy Use (SEUs)?		

16	In case of deviating energy use, is the cause investigated and are measures taken to prevent repetition?		
17	Do you perform an annual (or more frequent) internal evaluation of energy performance? Do you report on the functioning to the board?		

6.4 Annex D: Energy efficiency measures

		Is the technology used in the plant?	EE measures considered or implemented during the last 2 years		What kind of measurses were considered (c) or implemented (i) during the last 2 years?	Expected potential for improvement in the next 2 years (*check one option*)			What kind of measurses are planned to be implemented within the next 2 years?
		[only tick and proceed if yes]	no	yes		low	med	high	
Measures in supply technologies	Measures in the area of **electric drives** (*e.g. high efficiency IE motors, speed control, efficient transmissions)*								
	Measures in the area of **compressed air systems** *(e.g. leakage removal, substitution of compressed air, pressure reduction)*								
	Measures in the area of **pump systems** (e.g. hydraulic balancing, highly efficienct pumps)								
	Measures in the area of **process cooling** *(e.g. adjustment of temperature levels, demand-dependent controls)*								
	Measures in the area of **process heating** *(e.g. insulation of heat pipes, highly efficient steam generators)*								
	Measures in the area of **logistics** *(e. g. electric fork-lifting trucks, shortening of routes)*								



		Is the technology used in the plant? [only tick and proceed if yes]	EE measures considered or implemented during the last 2 years: no	EE measures considered or implemented during the last 2 years: yes	What kind of measurses were considered (c) or implemented (i) during the last 2 years?	Expected potential for improvement in the next 2 years (*check one option*): low	Expected potential for improvement in the next 2 years (*check one option*): med	Expected potential for improvement in the next 2 years (*check one option*): high	What kind of measurses are planned to be implemented within the next 2 years?
Measures in buildings technology	Measures in the field of **building heating/cooling** *(e.g. mini-CHP, highly efficienct heat pumps, nightime lowering of the heating)*								
	Measures in the area of the **building envelope** *(e.g. thermal insulation, new windows, removal of thermal bridges)*								
	Measures in the **area of lighting** *(e.g. use of motion and brightness sensors, LED bulbs)*								
	Measures in **information and communication technologies** *(e.g. energy efficient PCs and servers, energy management of PCs)*								
	Measures in **air supply and climatisation** *(e.g. high efficient fans, free cooling)*								
Measures in production process	[Please complete relevant measures]								

What other energy efficiency measures have been implemented during the last two years?	
In which other areas can energy efficiency be improved further in the next two years?	
What other energy efficiency measures are planned to be implemented in the next two years?	