

# Monitoring and evaluation plan

# E2DRIVER H2020 project

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Table 2: Document History

# **ABBREVIATIONS**

EA: Energy assessment
EE: Energy efficiency
EnMS: Energy Management System
EQF: European Qualifications Framework
HVAC: Heating, Ventilation and Air Conditioning
ISO: International Organization for Standardization
KPI: Key Performance Indicator
M&E plan: Monitoring and evaluation plan
PDCA: Plan-do-check-act
SME: Small and Medium Enterprise
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 GR: MERIT Consulting House – Olokriromenes Symvouleftikes Ipiresies Epixeiriseon Idiotiki

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# PUBLISHABLE SUMMARY

The E2DRIVER project will develop a collaborative-cooperative training platform boosting the automotive sector collective intelligence on energy efficiency by making SMEs fully aware of the multiple benefits resulting from energy audits, while providing them with the required skills and information to implement their recommendations. The main objective of work package 3 (WP3) "Development of the training methodology and E2DRIVER platform" is it to develop the E2DRIVER training methodology together with the necessary training material, as well as the platform gathering all the information and tools of the project. To this end, the repository and different modules of E2DRIVER will be developed and integrated in the final E2DRIVER platform.

Task 3.6 "Monitoring and evaluation plan definition" is carried out under WP3 "Development of the training methodology and E2DRIVER platform" of the E2DRIVER project. The specific goal of task 3.6 is to develop an evaluation framework that will be put in place for the continuous monitoring of the results obtained at the pilot and replication companies.

The task will address the following points of investigation:

- Definition of KPIs for the evaluation
- Development of intervention targets and a plan to monitor and evaluate the impact of the interventions in order to guide the actual data collection in WP4 and WP5.

The results of this task will be used as a plan for the results monitoring in task 4.5 and to evaluate the E2DRIVER methodology in WP5 "E2DRIVER evaluation and exploitation".

Content wise the monitoring plan covers different aspects of importance for the evaluation. Since E2DRIVER will not only address technical issues like energy practices, energy-saving measures and energy management, but will also increase awareness, energy culture and behaviour towards energy use and consumption, three different main aspects influencing energy efficiency in a company are addressed: Socio-cultural aspects, organizational aspects and technical aspects. Due to differences in monitoring and evaluating these aspects, each one is treated separately in the evaluation and monitoring plan.

The deliverable is structured as following: First chapter 2 points out the concept of the monitoring and evaluation plan. In chapter 3, the main objectives to be achieved by the E2DRIVER methodology are described. Building up on this, suitable indicators for the evaluation of these aims are defined in chapter 4. In chapter 5, it is described how the data will be collected, what the formats will look like and how to prepare the collected data for the evaluation. Furthermore, in chapter 6, corresponding roles and responsibilities for the data collection and the monitoring and evaluation plan are described.

# TABLE OF CONTENTS

1	Introduction	8
2	Design of the monitoring and evaluation plan	9
3	Aim and goals of the Evaluation	13
3.1	Socio-cultural aspects	13
3.2	Organizational aspects	13
3.3	Technical aspects	14
4	definition of suitable indicators	15
4.1	Socio-cultural aspects	15
4.2	Organizational aspects	15
4.3	Technical aspects	16
5	Data collection	17
5.1	Socio-cultural aspects	17
5.2	Energy assessment	19
5.2.1	Organizational aspects	20
5.2.2	Technical aspects	21
5.3	Overall energy savings	23
6	Roles and responsibilities	25
6.1	Socio-cultural aspects	25
6.2	Organizational and technical aspects	26
7	REFERENCES	27
8	ANNEXES	28
8.1	Questionnaire to evaluate the impacts of the trainings on socio-cultural aspec	ts28:
8.2	Template for energy assessment (incl. organizational and technical aspects)	34
8.3	Learning outcomes of E2DRIVER according to the levels of EQF	38
8.4	EQF Reference Levels	46

### **1 INTRODUCTION**

As mentioned in the proposal E2DRIVER will establish links with previous EU projects related to capacity building programmes on energy audits and saving measures in industry. Thus, the monitoring and evaluation plan of E2DRIVER is based on the methodology applied in the INDUCE project which deals with capacity building programmes in energy efficiency in the food and beverage sector.<sup>1</sup>

The monitoring and evaluation plan (M&E plan) is crucial for a following structured data collection and finally for the evaluation of the E2DRIVER methodology. The M&E plan can be considered as a document or guideline that contains information about what kind of relevant data shall be collected by whom to what time. The M&E plan will therefore outline what kind of questions should be answered later on in the course of the evaluation and what the corresponding relevant data and indicators are. It will outline the process how the data will be collected and the indicators will be tracked and also determines responsibilities for the different steps. Finally, the M&E plan will demonstrate how the monitoring data will be analysed. According to the explained purpose and contents of a M&E plan, this task 3.6 report addresses and follows the following steps:

- Outlining of the aim of the evaluation
- Defining of suitable indicators
- Process of data collection
- Assignment of roles and responsibilities
- Analysis plan and reporting templates

According to the listed main issues of the M&E plan, each topic will be addressed in a specific chapter in the following. Since the E2DRIVER methodology is considered as a rather holistic training methodology, addressing social-cultural aspects, organizational aspects as well as technical aspects. As such, the overall methodology is quite complex and all aspects have to be taken into account for the evaluation. Also the final impact of the project is based on an interaction of all aspects, for the ease of providing a better overview what aims are addressed, what data is collected and by whom, all aspects (social-cultural aspects, organizational aspects as well as technical aspects) will be explained in a separate subchapter. The M&E plan will therefore distinguish in each chapter between sociocultural aspects, organizational aspects or technical aspects and for each aspect different aims, indicators, ways to collect and analyse the data are explained, also knowing that the overall impact of E2DRIVER is based on the synergy of all three aspects. The M&E plan will therefore also finally be used to measure the impact of training interventions as a whole considering all training aspects.

<sup>&</sup>lt;sup>1</sup> see <u>https://www.energyefficientfoodindustry.eu/</u>

# 2 DESIGN OF THE MONITORING AND EVALUATION PLAN

This chapter will first line out the general concept of the monitoring and evaluation plan and how it is organized. It will briefly give an overview of the project aims to be evaluated and which data will be used therefore. Furthermore, it will be briefly summarized how the data will be collected and analysed.

The following Figure 1 provides an overview of the key elements for the monitoring and evaluation plan as well as of the process itself. The three different aspects mentioned before are thereby depicted separately as horizontal lines, while two measurements used to estimate the influence of the trainings as well as the resulting specific and overall results are listed as columns (following a timeline).



Figure 1: Key elements and process for the evaluation

For the **socio-cultural aspects**, the socio-cultural dimensions that the trainings intend to change (e.g. energy efficiency awareness) are measured by standardized and open questions in a survey conducted with the training participants and the trainers. The survey measures the perceptions directly after the trainings and thus the anticipated impact of the trainings in the pilot and in the replication companies. The contents of the European Qualifications Framework (EQF) are considered.

Based on the specific results regarding training impacts on socio-cultural aspects potential energy savings triggered by a change of these socio-cultural aspects will be estimated as overall result.<sup>2</sup>

#### **European Qualifications Framework (EQF)**

E2DRIVER training sessions will be classified according to the European Qualifications Framework (EQF) according to their learning outcomes (what individuals know, understand and can do at the end of a learning process) in order to ensure its replication. The EQF is a common European

 $<sup>^2</sup>$  Due to the short timeframe between the training and the evaluation, there might not be enough time for radical changes. On the other hand, trainees might be highly motivated and behavioural changes might take place immediately after the training. Therefore, the estimation should measure both the medium and long-term impact by also considering the "change of mind" or the awareness of trainees additionally to the physical effects.

reference framework whose purpose is to make qualifications more readable and understandable across different countries of Europe. It covers qualifications of all levels and in all sub-systems of education and training and its core is the eight reference levels defined in terms of learning outcomes, i.e. knowledge, skills and autonomy-responsibility.

In order to make the E2DRIVER training programme comparable with other similar training packages across Europe, one way would be to align the learning outcomes of the E2DRIVER training programme with the EQF, in line with EU recommendations. With this classification, the replicability and transferability of E2DRIVER will become easier as employers, employees, etc. will more easily understand the potential gains they would likely receive from such a programme compared to other similar programmes.

In the preparation and development of the training material, a table, as shown in Figure 2, was created where the educational content and the training goals of the E2DRIVER are presented using the learning outcome descriptors of the EQF. The fully completed table can be found in Annex 8.3. In the context of monitoring, the achievement of these training goals will be evaluated using the questionnaire on socio-cultural aspects.

Once the trainings and their evaluation is completed, the E2DRIVER training can be classified according to the respective EQF level. A reference table with the eight (8) available EQF levels and their respective description can also be found in Annex 8.4.

Learning outcomes of the capacity building program expressed in the EQF descriptors							
Trainee Profile	Training sub- sections	<b>Knowledge</b> He/she has gained knowledge in the following fields:	<b>Skills</b> He/she is able to:	Responsibility & Autonomy (to apply the mentioned knowledge and skills he/she has acquired during the training)	E2DRIVER Training Units undertaken		

Figure 2: Exemplary table to match the different learning outcomes of E2DRIVER with the levels of EQF

For the **organizational aspects**, the number of measures regarding energy management will be counted that were generally improved by the trainings (even they are not considered to be fully implemented). Furthermore, therein those measures are counted which are planned to be fully implemented or are already implemented due to the E2DRIVER training. These values are hereby not a final result for the evaluation but can be considered as an important input for later questions regarding the overall energy savings, because it helps the contact person to reflect about the achievements by the training.

For the **technical aspects**, the number of energy efficiency measures already considered during the first in-deep measurement but not yet considered for implementation are counted. This means, the company knows about a specific improvement measure but has not yet decided to implement it or still has doubts to implement it (perhaps due to costs). As well as those which were not considered before the training and are now intended to be implemented. This information is used to calculate the overall energy efficiency measures leveraged by the E2DRIVER training in the pilot and replication companies. Based on the E2DRIVER methodology, at least 100 measures are to be proposed in the participating companies, with the aim of unlocking the implementation of about 65 measures.

One major issue for the evaluation of the project are the **overall energy savings** due to the E2DRIVER trainings. In total by considering the organizational and the technical aspects a potential for energy savings up to 13 GWh/year are intended to be leveraged. For quantifying the effect of the trainings on the energy consumption of a company, there are different possibilities:

- One possibility would be to make an additional measurement of the energy consumption after all intended measures leveraged by the E2DRIVER training are implemented in the company. By doing so, a possible evaluation would be far out of the project lifetime. Furthermore, the whole company might change in this time regarding the product portfolio, number of productions, size of the buildings etc. Also, external parameters like temperature, raw material quality etc. might influence the energy consumption. Thus, the measured energy consumption underlies a high degree of uncertainty and it is not feasible to give a clear statement that the savings are achieved due to the E2DRIVER methodology.
- Another possibility would be at least for the technical measures to calculate saving potentials based on the different measures intended to implement after the E2DRIVER training. This would make it feasible to evaluate the effect of the E2DRIVER training during the project lifetime. On the opposite, such a calculation would hardly be feasible for the organizational aspects. Even for the technical measures, the potential savings may vary in a big range according to the framework conditions, how and where these measures are implemented. Thus, such a procedure would also not be goal leading.

Considering the before mentioned challenges in quantifying the saving potentials, it is assumed that the best way to gather the information during the project lifetime and under consideration of the specific framework conditions in the company, is to ask the contact person in the company for his opinion. Supposing that he or she knows best what effect a measure might have on the energy consumption under the specifics of his or her company.

Thus, besides the evaluation of specific indicators regarding the organizational, socio-cultural and technical aspects, it will also be asked for an estimation regarding the overall effect of the trainings regarding energy savings. Furthermore, it is asked for a distribution of the savings on the effect of organizational (also incl. social aspects) and technical measures. By knowing this saving potential due to the E2DRIVER training and by knowing the energy consumption of the company the savings (in kWh) can be determined. Due to the COVID-19 pandemic in 2020, 2019 is selected as the reference year for the estimated energy savings as it is a representative year with normal operation (for further explanation see chapter 5.3).

The briefly explained concept and approach seems to be able to catch the high diversity and complexity going along with the evaluation of such training methodology addressing not only one but three different aspects influencing the energy saving on different levels. Anyhow, before explaining the monitoring and evaluation plan in more detail, some main **potential restrictions** going along with this approach shall also be named:

- One point is that companies are not static. The amount of production and the products change as well as other factors like weather, that all have an influence on the energy consumption. In addition, there might occur events (e.g. layoffs) that might affect the social climate in the organization and the socio-cultural dimensions addressed by the trainings.
- Furthermore, also new machineries or production facilities might be installed after the first measurement, which are not triggered by the trainings.

Going along with the points mentioned before:

- The estimation of the energy saving is quite subjective and also by addressing the person in the company who should know best (contact person), it is not guaranteed that he or she considers the points mentioned before in a proper way.
- It is also not sure whether the responsible trainers and partners gather and deliver the data in the intended way, which may lead to an incomplete picture. In addition, the participation of trainees in the survey for the measurement of socio-cultural aspects is voluntary/cannot be enforced. Therefore, non-response might be a problem for the evaluation of socio-cultural effects of the trainings.

Finally, the evaluation based on the quantitative and qualitative data will allow for a general assumption regarding the impact of the trainings and the share of the three different aspects in it. But an in-depth analysis is due to the named uncertainties not feasible within the project lifetime.

## 3 AIM AND GOALS OF THE EVALUATION

At first it is necessary to identify the overall aim of the evaluation. In the case of the E2DRIVER project the overall aim is to increase the companies' energy efficiency. The main output of the project will be the E2DRIVER methodology itself, as well as the platform that brings it life. It will be tested in 12 pilot companies and rolled out to 28 replication companies. It is intended to engage 650 employees, implement 65 energy efficiency measures and to achieve 13 GWh/year of energy savings. These aims shall be enabled by company specific improvements regarding socio-cultural behaviour, technical changes due to energy efficiency measures and organizational improvements based on improvements in the energy management system.

#### 3.1 Socio-cultural aspects

Energy efficiency in the (automotive) industry also includes a socio-cultural component. It is important that employees at all levels of the hierarchy are aware of and recognize the potential for increased energy efficiency and that they contribute to achieve this goal. Energy efficiency measures are not necessarily always introduced top-down, but can also be driven forward by employees at lower levels of the hierarchy. Furthermore, energy efficiency in the workplace is also strongly related to everyday behaviour. This means, in the worst case, energy efficiency measures at the organizational level (e.g. energy-efficient lighting) can be counteracted by rebound effects in everyday activities (e.g. if the lighting is no longer switched off because the lamps are so economical).

E2DRIVER therefore also addresses these aspects. Training sessions are intended to raise awareness among employees for the importance of energy efficiency. Beyond that, concrete measures to increase energy efficiency in everyday activities at the workplace are communicated. In addition, the employees' ability to recognize and evaluate potentials for greater energy efficiency and to promote these within the company is to be improved. This also includes the development or improvement of appropriate incentive systems. Trainings and other interventions that aim at employee behaviour can be regarded as successful if they have a (lasting) positive effect on the energy efficiency of everyday activities.

The objective of the socio-cultural evaluation is to analyse the impact of the trainings regarding the awareness and behaviour of the workforce in terms of energy efficiency. The target persons of the evaluation surveys are the participants of the trainings as well as the trainers.

#### 3.2 Organizational aspects

Energy audits and the implementation of an energy management system, as described in the ISO 50001 standard, support the implementation of an energy efficient organization but do not take into account the existing organizational culture and behavioural aspect to the full. Anyhow, since those aspects are already addressed before under the socio-cultural aspects, the focus of the organizational aspects rather concentrates on the energy efficient organization and thus on the status of the energy control and management in the companies. Therefore, the basic check of energy control, which was already used for the pilot companies' energy assessment in D2.2, will also be considered here to monitor and evaluate the status of energy management strategies in the different training companies.

E2DRIVER is intended to support the companies to undergo energy audits and to implement the recommended energy-saving measures. It is the aim of the E2DRIVER project to provide companies with the required technical skills and capabilities needed to implement the most economically viable energy efficiency measures at their companies. Moreover, by adapting the training to each company and trainee requirements, E2DRIVER will include competency related, behavioural, organizational and awareness perspectives so that SMEs realize about the potential for improvement arising from energy audits.

#### 3.3 Technical aspects

The use of available, cost-effective techniques can also lead to high energy savings. E2DRIVER will therefore provide all the information required for companies to be aware of these techniques and will provide them support to select and implement these measures.

Therefore, it is the aim of the section regarding the technical aspects to evaluate if the E2DRIVER training has any positive effect on the number of energy saving measures considered by a company and on the energy savings achieved by those measures. It is a major target of the E2DRIVER project to unlock the implementation of 65 measures on energy efficiency in the automotive sector.

### 4 DEFINITION OF SUITABLE INDICATORS

In order to design training modules and units as effective as possible, the findings of the stocktaking in the pilot companies from WP2 were taken into account. The indicators of the evaluation are based on the objectives that were identified and defined as the purpose of the training. These can be objectives at the level of employee attitudes and behaviour, organizational or technical objectives.

#### 4.1 Socio-cultural aspects

The socio-cultural evaluation aims at analysing the impact of the trainings regarding the awareness and behaviour of the workforce regarding energy efficiency. These can also be measures carried out at management level (e.g. development of a communication strategy to better communicate the company's energy efficiency goals to lower hierarchical levels). For the socio-cultural evaluation the European Qualifications Framework is considered. The target persons of the evaluation surveys, however, are in any case the participants of the training courses for the workforce. In addition, the trainers will be also be asked for their opinion, i.e. if they expect the trainings to achieve their intended goals. The questions that are used as indicators for training success result from the objectives of the training (see Annex 8.1).

The indicators are derived from the goals of the trainings. We use statements about behaviours and attitudes related to the training goals as indicators. The training participants can express their opinion by agreement or disagreement with these statements. For each statement there are seven answer options: "I totally agree", "I mostly agree", "I rather agree", "I rather disagree", "I mostly disagree", "I totally disagree" and "Not applicable/ I prefer not to say".

#### 4.2 Organizational aspects

The main issue for evaluating the organizational aspects are improvements in the energy control and management of the companies. For the pilot companies, the current status of the energy management has been assessed during the energy assessment in WP2. For the replication companies, the initial energy assessment will be performed in the context of WP4 together with their characterization and the adjustment and execution of the trainings.

Based on the method of the INDUCE project the assessment of organizational measures consists of two subject areas - firstly, the general evaluation of energy management and KPIs and secondly, the basic check of energy control including measures in the area of policy, procedures in place, training and actions. For each of the 24 organizational measures in the energy assessment, it is reported whether the measure has been implemented by the pilot company at the time of the data collection in WP2: yes (green), no (red), or partially (yellow) (for an example of the template see Annex 8.2). During the training some or all of these measures identified as relevant for the trainings will be addressed. 3 months after the training the same measures will be questioned again. The changes in scores regarding the addressed measures will work as an indicator for the success of the trainings regarding the organizational aspects. Thereby each change in status of the measures will be monitored, which means that it will be considered if a measures was before not or partially implemented and how its status changed by the trainings.

Thus, the key indicator for the organizational aspects is the number of improved measures divided by the number of addressed measures during the training. Thus, this indicator will provide the following result:

"Due to the E2DRIVER trainings a process to improve the status of X% of the addressed measures was or is started." Thus, they are or will be considered for implementation in the near term"<sup>3</sup>.

#### 4.3 Technical aspects

Besides the change in energy management also the technical equipment plays a major role for energy efficiency. For the evaluation it will be considered how the awareness and the will to implement energy efficiency measures is influenced by the E2DRIVER trainings. As a basis for determining this change, the energy assessment from WP2 is again used for the pilot companies, while the initial assessment for the replication companies is carried out during WP4.

The assessment of technical measures is carried out on the basis of the company survey on energy efficiency measures (for an example of the template see Annex 8.2). Based on the given information, the effect of the E2DRIVER training should be measured in number of energy efficiency measures willing to implement in the company<sup>4</sup>. The evaluation will therefore address two aspects:

- "Did the E2DRIVER training help you to convince you in the implementation of a measure you already have considered before the training (during the first energy assessment)?"
- "Did you become aware of any new measures you didn't consider before and is the company planning to implement it in the medium-term (which means there is a clear commitment or a process already started)?"

It is a major aim of the E2DRIVER project to unlock the implementation of 65 measures on energy efficiency. The implementation of energy efficiency measures can thereby be monitored by using the two previous listed indicators, while the potential energy savings are rather a combination of all three (organizational, cultural and technical) aspects.

<sup>&</sup>lt;sup>3</sup> It is intentionally not asked for measures implemented, since the timeframe between the training and the evaluation is not sufficient for this change. Thus, it is rather the "change of mind" or the awareness of trainee evaluated than the physical effects.

<sup>&</sup>lt;sup>4</sup> See previous comment.

## 5 DATA COLLECTION

The section for the data collection is supposed to give information about what methods will be used to gather the data and how often the data will be gathered.

#### 5.1 Socio-cultural aspects

Figure 3 illustrates the design of the evaluation of socio-cultural aspects and the links to the tasks regarding the design and implementation of the trainings. The evaluation survey will be conducted at the end of the training sessions and the content is identical in the pilot and replication companies.

The results of the evaluation survey in the pilot companies feed in the methodology fine tuning of the trainings (task 4.4).



Figure 3: Basic design of socio-cultural evaluation and links to the tasks regarding the design and implementation of the trainings in pilot and replication companies. T=Task

The following target groups are included in the evaluation survey. These are the same target groups identified for the trainings (see D3.3) plus the trainers:



Figure 4: Target groups for evaluation survey of social-cultural aspects

In particular, the surveys will comprise the following parts:

- At the beginning of the evaluation survey there will be questions on the company, the trainer, the group and the participation in the trainings (questions 2 5).
- Afterwards, the awareness regarding energy efficiency before the trainings as well as the anticipated impact of the trainings in terms of this dimension is surveyed: "This training will make [me/the participants] think more often about ways to do [my/their] job in a more energy efficient manner."). These questions will be answered by participants and trainers (questions 6 and 7).
- Then, the respondents will be asked on their behaviour in terms of energy efficiency before the trainings as well as the anticipated impact of the trainings in terms of this dimension: "This training showed [me/the participants] practical ways to do [my/their] work tasks in a more energy efficient manner."). These questions will also be answered by participants and trainers (questions 8 - 11).
- This is followed by some more detailed questions about the training contents that relate to the EQF, e.g. the gained knowledge on energy audits, monitoring and legislation. These questions are again formulated as statements that respondents can agree or disagree with. The questions will be answered by different groups of training participants, i.e. managers, science and engineering professionals / technical managers and change agents (questions 12 - 14).
- In addition, there will be open ended questions to enable the training participants to provide direct feedback on possible improvements, things they did not understand, acquirements and planned implementation of the learning content. These questions help to improve the trainings and subsequently enhance the likeliness of improved impact (questions 15 - 19).
- At the end of the questionnaire a few open and closed questions on the perception of the virtual reality sessions are asked (question 20-21).

The complete survey can be found in Annex 8.1. In the replication companies the same survey will be applied.

#### Procedure of data collection

After the last training session (this will be the virtual reality session) will be completed, the evaluation survey (paper-pencil questionnaire if the pandemic situation allows the trainings to be face-to-face or, if not, a link to an online survey) will be distributed to all participants of the trainings and to the trainers. This is to be done by the training partners (see section 6.1).

Completing the questionnaire will take approximately 10 minutes.

If there will be paper-pencil questionnaires, the completed questionnaires are to be collected by the trainers. Afterwards, the trainers will translate the answers into English and send the files to FRAUNHOFER ISI who will analyse the questionnaires.

#### Data collection materials

If the pandemic situation allows the final training session to be a face-to-face session, paper-pencil questionnaires will be used. The paper-pencil questionnaires will be translated in the national languages. For the transfer of the collected data, the answers in the completed paper-pencil questionnaires are to be inserted by the trainers in an online tool, provided by FRAUNOHER ISI.

If the trainings will be virtually, the evaluation survey will be conducted in the form of an online survey. FRAUNHOFER ISI will provide the tool for this survey and collect the data. The trainers will distribute the links to the survey to the training participants and motivate them to take part in the survey.

In addition to the questionnaires (paper-pencil or online), data protection consent forms from the participants are required. These consent forms will be provided by FRAUNHOFER ISI and are to be signed by the respondents before completing the questionnaire.

#### 5.2 Energy assessment

Figure 5 illustrates the design of evaluation of organizational and technical aspects. The design for the data collection is identical and both will be processed at one time with the same person.

For the pilot companies the first energy assessment has already taken place in WP2. A second energy assessment is planned three months after the training. The formal content of the second assessment will be the same as for the first. This allows to a certain degree for a comparison regarding the status of measures before and after the E2DRIVER training (under consideration of the restrictions listed previously). It is crucial at this point that the data is collected with the same person of the company who completed the first measurement before the training.

For the replication companies no energy assessments are available so far. The experience from the sister project INDUCE showed that the first and second energy assessment would be much closer to each other than for the pilot companies due to the given project structure. The companies need a certain amount of time to implement possible measures and changes that are to be stimulated by the E2DRIVER training. This period of time might be too short to capture the impact of the training on the before mentioned KPIs - both on the part of the replication companies and the impact monitoring by the consortium. For this reason, the plan for replication companies is to conduct only one energy

assessment after the training sessions and replace the initial energy assessment with retrospective questions.

Moreover, it may be necessary to measure expected impacts (pilot and replication companies may only be able to estimate their savings, etc.). Especially for replication companies, where the trainings will occur at the very end of the project. If necessary, the monitoring process for replication companies can be adapted during the course of the project. The content of the measurement in the replication companies will be the same as for the pilot companies, which allows for a comparison between both, once again considering the given restrictions.



Figure 5: Basic design of organizational and technical data collection for evaluation in pilot and replication companies

#### 5.2.1 Organizational aspects

The kind of data collected for evaluation of organizational aspects is given by the before mentioned general evaluation of energy management and KPIs and the basic check of energy control including measures in the area of policy, procedures in place, training and actions. The following Figure 6 shows this in an exemplary evaluation template. The structure of the template also indicates how the status of the different 24 measures may change due to the E2DRIVER training and how this influences an overall indicator ("scoring") for organizational aspects.

		Please complete for 2nd EA	Ent	ered by Fraunhofer due to 1st EA	P	lease complete for 2nd EA
		+	Da	ata acquesitio	n	+
Com	pany ID and Name	Measures influenced/adressed by trainings?		Company 1st measurement		Company 2nd measurement
		Enter an "x" if so		Scoring before trainings	Γ	Scoring after trainings
	Energy management & KPIs			1		2
1	Do you manage energy consumption in your company?	х		3		3
2	Does your location use key performance indicators (KPIs) for energy management?	х	0	2		3
3	Are there specific targets for reducing energy consumption or for improving energy efficiency (e.g. % / per unit produced)?	х	•	1	0	2

Figure 6: Exemplary extract of template for data collection of organizational measures (1<sup>st</sup> and 2<sup>nd</sup> energy assessment)

#### Procedure of data collection:

After having used the template to conduct the first in-deep measurement the responsible partner uses this template again three months after the training to ask the same person how the training influenced the status of the 24 organizational measures (note that only those measures will be asked which also were subject of the trainings). In case one measure was not fulfilled at all before (first measurement) it had a status red, which counted for zero points. If this status turns after the training into yellow the value of the measure will be one point (measure partly fulfilled), while when it turns into green it is two points (measure fully fulfilled). In the case of the example above, 3 measures were addressed in the training and thus could potentially be improved. After the training (second measurement) the measurement indicates, that in the case of 2 (out of 3) measures the results improved (red signal turned to yellow or green and yellow signals turned to green). In 1 (out of the 2) cases the measure can even be intended to be fully implemented (signals turned from yellow/red to green).

#### Data collection materials:

The data will be collected using the energy assessment template described previously. The template will be provided in Excel format and includes the assessment of both organizational and technical aspects. The results of the first energy assessment of each company will be pre-filled by FRAUNHOFER ISI. The digital template, which is provided to the partners responsible for the energy assessment, will be translated into national language by them. The collected data must then be translated back into English and sent to FRAUNHOFER ISI for evaluation. The complete template for energy assessment (incl. organizational and technical aspects) can be found in Annex 8.2.

#### 5.2.2 Technical aspects

The design for the technical data collection is identical with the one for the organizational data and both will be processed at one time with the same person. Thus, the same process as indicated in Figure 5 will be followed. The kind of data collected for evaluation of technical aspects is given by the company survey regarding energy efficiency measures, which is also included in the Excel template. The following Figure 7 shows an exemplary survey.



Figure 7: Exemplary extract of template for data collection of technical measures (1st and 2nd energy assessment)

#### Procedure of data collection:

After having used the template to conduct the first in-deep measurement the responsible partner uses this template again three months after the training to ask the same person, what he or she now thinks about the implementation of energy efficiency measures already considered before. Is he or she now more convinced to implement such a measure or did the training not affect this decision at all? Furthermore, it is of interest if the trainee now after the training even considers any new energy efficiency measures he or she didn't consider of before.

Therefore, the partner responsible for the energy assessment will use the pre-filled template, where all energy efficiency measures considered for implementation by the company from the first in-deep measurement are listed. One by one the partner asks if the training had any effect on the decision about implementing the specific measure e.g. due to the use of an investment tool (of course only for those measures which were also part of training material). After this the partner will ask for each specific category (e.g. measures in supply technologies - area of electric drives) if the trainee/company now considers any additional new measures for implementation, which he or she hasn't listed during the first in-deep measurement.

Thus, the number of energy efficiency measures leveraged by the E2DRIVER training can be evaluated to a certain degree and a distinction be made whether the company has already thought of such a measure before and is now after the trainings reinforced in this thought or whether the training opened their eyes for completely new measures and saving potentials. Both may lead to potential energy savings.

#### Data collection materials:

The data will be collected using the energy assessment template described previously. The template will be provided in Excel format and includes the assessment of both organizational and technical aspects. The results of the first energy assessment of each company will be pre-filled by FRAUNHOFER ISI. The digital template, which is provided to the partners responsible for the energy assessment, will be translated into national language by them. The collected data must then be translated back into English and sent to FRAUNHOFER ISI for evaluation. The complete template for energy assessment (incl. organizational and technical aspects) can be found in Annex 8.2.

#### 5.3 Overall energy savings

As depicted in Figure 1, all three aspects are finally resulting in an overall energy saving. In chapter 2 different options to determine this value were already discussed and it was concluded that asking the responsible contact person (e.g. energy manager) might offer the best option to gain reflected information.

#### Procedure of data collection:

For this reason, the partners responsible for data collection are intended to ask the contact person (person who completed the first and second energy assessment and also participated in the training) for his or her opinion: "How much energy do you think you can save in your company when you consider all insights from the trainings, triggered changes in terms of energy management and measures you are intending to implement?".

Due to COVID-19 pandemic 2020 might not be a representative year in terms of the companies' energy consumption, e.g. due to unplanned production shut downs etc. This is why the pilot as well as replication companies will be asked to estimate their energy savings due to organizational and technical measures on the basis of normal operation for the reference year 2019.

Figure 8 exemplarily shows how this estimation is to be made by the companies for both the organizational and technical measures. On the basis of the company's energy consumption in 2019 (electricity and thermal) given during the first energy assessment the contact person should estimate the energy saving potential due to organizational and technical measures affected by the E2DRIVER training. Specifically, he or she should indicate how the measures would have impacted the company's energy consumption in 2019 by imagining that the measures would have been implemented this year and would have impacted the whole year 2019.

In addition, a second question asks the contact person to estimate the total investment, e.g. equipment and personnel costs, and the share of internal personnel costs required for the organizational and technical measures (assuming that these have already been implemented).

1) How much energy savings do you estimate can be achieved due to the <u>organizational measures</u> affected by the E2Driver training (assuming that these already have been or will be implemented in the near future)?

Imagine you have implemented the organizational measures in 2019 and they would have impacted the whole year 2019. How would the generated savings have affected your energy consumption of 2019? Based on your electricity and thermal consumption of 2019, please fill the following table (column F).

	Energy consumption in 2019	Estimated energy	Estimated energy saving	Further explanatory information
	[kWh]	consumption in 2019 if the	through organizational	(voluntary)
	(as reported)	above mentioned	measures	
		organizational measures	(automatically	
		would have been	calculated)	
		implemented	[%]	
		[kWh]*		
Electricity				
Gasoil				
Fuel oil nº1				
Natural gas				
Propane gas				
Butane				
Biomass				
Other, please specify				

\* assuming the organizational measures would have impacted the whole year 2019. Baseline year is 2019, since we have only one energy assessment and 2020 may have highly impacted the company's energy consumption.

2) Please estimate the corresponding total investment necessary for the <u>organizational measures</u> (assuming that these already have been or will be implemented in the near future).

Please give your estimation in €.

Total investment for organizational measures in €	
of which, internal personnel costs in €	

Figure 8: Exemplary extract of template to estimate overall energy savings and investment by organizational and technical measures

#### Data collection materials:

The data will be collected using the energy assessment template described previously including the above mentioned two additional questions. The template will be provided in Excel format and includes the assessment of both organizational and technical aspects. The results of the first energy assessment of each company will be pre-filled by FRAUNHOFER ISI. The digital template, which is provided to the partners responsible for the energy assessment, will be translated into national language by them. The collected data must then be translated back into English and sent to FRAUNHOFER ISI for evaluation. The complete template for energy assessment (incl. organizational and technical aspects) can be found in Annex 8.2.

### 6 ROLES AND RESPONSIBILITIES

Crucial for the success of a monitoring and evaluation plan is a clear determination of roles and responsibilities for the data collection. In this chapter the major roles and responsible institutions for this process will therefore be defined.

#### 6.1 Socio-cultural aspects

#### FRAUNHOFER ISI:

- Providing the paper-pencil questionnaires or programming the online questionnaires (optimized for mobile devices) for the evaluation survey in pilot and replication companies in English, Spanish, French, Italian and German (input needed from scientific partners, cf. task 1 of project partners)
- 2. Providing scientific partners with an excel-template for questionnaire translation (cf. task 1 of project partners)
- 3. Providing leaflets with information on how to conduct the evaluation survey in the pilot and replication companies (including login data and data privacy information, translation by scientific partners required)
- 4. For paper-pencil questionnaires: Providing a template for partners responsible for training implementation that allows easy reporting of answers to open and closed ended questions in the evaluation survey questionnaire for pilot and replication companies (e.g. via an online tool, e.g. EFS survey)
- 5. Analysing the data and providing an overall evaluation report including information gathered in pilot and replication companies during project (input from scientific partners necessary, cf. task two for scientific partners) (D5.1)

#### Responsible project partners from Germany, Spain, France and Italy:

- 1. Translation of the questionnaire
- 2. Translation of answers to open ended questions for evaluation report
- 3. Translation of the leaflet with practical and background information on the implementation of the evaluation surveys (cf. task 3 of FRAUNHOFER ISI)
- 4. Distribution of paper-pencil / link to online survey to training participants (leaflet with explanations and login data will be provided, cf. task 3 of FRAUNHOFER ISI) in pilot and replication companies and if paper-pencil questionnaires are used collection of completed questionnaires (→ explanation of evaluation process shall be part of training the trainers; leaflet with explanations and login data will be provided, cf. task 3 of FRAUNHOFER ISI)
- 5. Paper-pencil questionnaires: Aggregating and anonymizing feedback from open ended questions as well as reporting statistics of answers to closed ended questions in the evaluation survey for pilot and replication companies (with a template, cf. Task 4 for FRAUNHOFER ISI).
- 6. Taking into account the feedback from the evaluation survey for refining the training methodology (results of questionnaires will be emailed to the trainers directly, shortly after the questionnaires were completed and results documented)

#### 6.2 Organizational and technical aspects

The roles and responsibilities for the organizational and technical aspects are quite similar and therefore presented together. Furthermore, the roles and responsibilities also show a great overlap to the socio-cultural ones.

#### FRAUNHOFER ISI:

- Providing the Excel-template for the second energy assessment in English including both organizational and technical aspects.
- Pre-filling of the template with results from the first energy assessment.
- Providing a one-pager with information how to conduct the second energy assessment in pilot and replication companies (included in Excel-template).

#### Responsible project partners for energy assessment from Germany, Spain, France and Italy:

- Translation of the pre-filled Excel-template.
- Ensuring that the necessary relevant data from the first energy assessment (Task 2.2) is for all companies fully available (energy management results and energy efficiency measures).
- After training: Identify the person at the company with whom the first energy assessment was conducted (pilot companies) and make an appointment (personal interview recommended) for the second energy assessment (pilot and replication companies).
- Checking data validity to ensure that questions were answered correctly.
- Translating completely filled template back into English and sending it to FRAUNHOFER ISI.

#### Responsible training entities from Germany, Spain, France and Italy:

 Providing an overview (per pilot company) which measures will be addressed during the training based on the Excel-template for organizational and technical aspects (e.g. by deleting those not relevant or by highlighting the relevant ones).

# 7 **REFERENCES**

European Union, 2017. Council Recommendation of 22 May 2017 on the European Qualifications Framework for lifelong learning and repealing the recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning (2017/C 189/03).

FRAUHOFER ISI, 2019. D3.6: Monitoring and evaluation plan. INDUCE project (<u>www.induce2020.eu</u>). Horizon 2020 - EE 15-2017. Grant Agreement No. 785947.

### 8 ANNEXES

#### 8.1 Questionnaire to evaluate the impacts of the trainings on socio-cultural aspects

Remarks regarding the questionnaire in this appendix:

- The questionnaire in this appendix is the English version. The questionnaires will be implemented in further languages, i.e. the national languages of the countries in which the trainings take place.
- The questionnaire will be answered by training participants and trainers (trainers will be asked questions 2-4, 7, 9, 16-17)
- All items formulated as statements are answered on a scale from "I strongly disagree" to "I strongly agree" and "not applicable / I prefer not to say"

#### 1. Please select your preferred language:

English

Italiano

Deutsch

Francaise

Espanol

#### Welcome to the evaluation survey!

We look forward to your feedback on this training! By providing your feedback, you will contribute to designing effective trainings that aim at reducing CO<sub>2</sub> emissions in the automotive industry.

Completing this questionnaire will take approx. 10-15 minutes. Your data will be treated confidentially. Results of this survey will only be published in an aggregated way, this means that conclusions about individual answers are not possible. In particular, under no circumstances data will be passed on to your employer that would allow conclusions to be drawn about your answers in this survey.

#### 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.

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 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.

□ I have been informed about the treatment of my data by the Consortium Partners and I authorize their use.

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 via email at the email address: <u>mail@E2DRIVER.eu</u>. More information in the link: <u>http://e2driver.eu/data-pro-</u> tection-information/

If you have any questions about this survey, please feel free to ask the trainer or contact Fraunhofer ISI in Karlsruhe (Germany) as a host of this survey: Dr. Uta Burghard, +49 721 6809-433, email: <u>uta.burghard@isi.fraunhofer.de</u> and Dr. Josefine Tröger, +49 721 6809-433, email: <u>Josefine.troeger@isi.fraunhofer.de</u>

# 2. Since the survey is anonymous, we would like you to fill in the following code so that we can match your answers from this survey to a survey from our project partner POLITO on the virtual reality experience.

The first and last letter of your first name: e.g. PETER:

Your birthday: e.g. 0721: \_\_\_\_\_

The survey can be started only after entering this code.

#### 3. At which company / location did the training take place?

[Include names of the companies as a selection list]

#### 4. Who was the trainer of this course?

[Include names of the trainers as a selection list]

- 5. What is the group you were assigned for the trainings?
- Managers
- Science and Engineering professionals
- Technical managers

**E2DRIVER** project (847038) D3.6 Monitoring and evaluation plan

- Technicians
- Change agent
- Trainer
- I don't know

#### 6. [Only participants] Have you completed all the training sessions?

Yes - no I missed one session/class - no I missed several sessions/classes.

# 7. [Only participants] To what extent do you agree with the following statements *regarding the time before this training*?

I often think about ways to do my job in a more energy efficient manner.

#### 8. To what extent do you agree with the following statement?

This training will make [me/the participants] think more often about ways to do [my/their] job tasks in a more energy efficient manner.

# 9. [Only participants] To what extent do you agree with the following statement *regarding the time before this training?*

I did my work tasks in a very energy efficient manner.

# **10.** To what extent do you agree with the following statements about the effectiveness of this training?

This training showed [me/the participants] practical ways to do [my/their] work tasks in a more energy efficient manner.

If yes:

These are the following work tasks:

- technical work tasks (e.g. production-related, incl. operation and maintenance)
- marketing or sales-related work tasks .
- financial or administrative or organizational work tasks
- strategic work tasks
- other work tasks : \_\_\_\_\_\_ (please name them)

# **11.** [Only participants] To what extent do you agree with the following statement *regarding the time after this training?*

I will do my work tasks in a very energy efficient manner.

In the following some more detailed questions about some of the training contents are asked.

#### 12. [Only managers] To what extent do you agree with the following statements?

Through the training, I feel empowered to perform of an <u>energy audit</u> in the company under the supervision of a <u>professional energy auditor</u> and jointly evaluate its results and devise relevant action plans to improve energy efficiency in the company.

Through the training, I feel empowered to confidently apply **ISO 50001** principals and procedures to the company I work for to improve its energy efficiency.

Through the training, I feel empowered to use the outputs of <u>monitoring systems</u> to plan and implement energy efficiency improvements in the company.

Through the training, I feel I have gained enough tools and knowledge to search for and identify relevant energy efficiency legislation and subsidy opportunities that can benefit the company.

Through the training, I feel empowered to confidently call for a **managerial review**, assess its results and devise relevant action plans.

# **13.** [Only science and engineering professionals / technical managers] To what extent do you agree with the following statements?

Through the training, I feel empowered to perform of an <u>energy audit</u> in the company under the supervision of a <u>professional energy auditor</u> and jointly evaluate its results and devise relevant action plans to improve energy efficiency in the company.

Through the training, I feel empowered to identify and modify parameters, equipment, or processes in order to **optimise energy consumption** at the company.

Through the training, I feel empowered to use the outputs of <u>monitoring systems</u> to plan and implement energy efficiency improvements in the company.

Through the training, I feel I have gained enough insight and knowledge to search for and identify relevant <u>energy efficiency/energy auditing legislation</u> that apply to the company.

#### 14. [Only change agents ] To what extent do you agree with the following statements?

Through the training, I feel empowered to perform of an <u>energy audit</u> in the company under the supervision of a <u>professional energy auditor</u> and jointly evaluate its results and devise relevant action plans to improve energy efficiency in the company.

Through the training, I feel empowered to confidently apply **ISO 50001** principals and procedures to the company I work for to improve its energy efficiency.

Through the training, I feel empowered to use the outputs of <u>monitoring systems</u> to plan and implement energy efficiency improvements in the company.

Through the training, I feel I have gained enough insight and knowledge to search for and identify relevant energy efficiency **legislation and subsidy opportunities** that can benefit the company.

Through the training, I feel empowered to successfully raise and promote energy efficiency awareness within the company.

Through the training, I feel empowered to negotiate, verify and control supplier offers to optimize the company's <u>energy costs</u>.

**15. [Only participants] What did you learn from the training?** Please name the most important learnings for you

**16.** [Only participants] Was there something you did not understand in this training? If yes, please explain.

17. Would you suggest to improve this training?

Yes - no – I don't know

18. If yes, please explain.

**19.** [Only participants] Please briefly write down three things you will do in the coming months to implement what you have learned in the trainings.

You have almost reached the end of the survey. In the following a few questions about your perception on the virtual reality session are asked.

20. I would rate the fidelity of the VR simulation as:

□ very unsatisfactory □ unsatisfactory □ neutral □ satisfactory □ very satisfactory

21. To what extent do you agree with the following statement?

I think that VR is a valuable approach to training.

22. Please list at least one negative and one positive aspect of the VR system and the training experience overall.

Negative aspect(s): \_\_\_\_\_

Positive aspect(s): \_\_\_\_\_

You have finished the evaluation survey.

Thank you very much for your valuable feedback!

#### 8.2 Template for energy assessment (incl. organizational and technical aspects)



- 2) Identify the person from the corresponding company with whom the 1st EA was conducted. In case this person should not be available anymore, look for a substitute.
- 3) Make an appointment for the 2nd EA.
- 4) Make sure you have the necessary Excel-template ready. If needed you can translate the template in another language. But please provide a final English version for evaluation.

#### **During 2nd Energy Assessment**



Open the Excel file on a tablet or as printed version. It should already contain the results from the 1st EA (provided by Fraunhofer) to give you an indication about the status of organizational and technical aspects before the training.

#### **Organizational Aspects (Excel)**

- Ask for each org. measure if the E2DRIVER training addressed/influenced it. If so, please make a cross in the foreseen column "H" and ask how this specific measure changed. Use the same indication ("1" red = not implemented; "2" yellow = partly implemented and "3" green = fully implemented) as for the 1st EA to complete
- 2) Once you have gone through all aspects, take a final look on the overall changes and ask the contact person about his or her estimation on how much energy savings can be achieved by the org. measures: Based on the pre-filled energy consumption of 2019 (column "E": complete this data if necessary!), the contact person should estimate the energy consumption with the new org. measures differentiated by final energies in column "F" (baseline year is 2019). The energy saving is then calculated automatically and may be negative in the case of a fuel switch. Please note, that the energy saving only refers to savings through org. I measures (production-related downtimes or similar should not be taken into account). We are well aware, that the interviewee might struggle to define a value here, thus please
- Please also ask for an estimation about potential investments needed for the implementation of the org. measures, e.g. equipment and personnel costs, and the share of internal personnel costs required for the org. measures.

#### **Technical Aspects (Excel)**

- Ask for each technical measure if the E2DRIVER training helped to strengthen the intention to implement an already considered techn. measure (column "M"). Then ask if in this area now any new techn. measures are considered for implementation due to E2DRIVER training (column "N"). Write down the named techn. measures.
- 2) Once you have gone through all aspects, take a final look on the overall changes and ask the contact person about his or her estimation on how much energy savings can be achieved by the techn. measures: Based on the pre-filled energy consumption of 2019 (column "D": complete this data if necessary!), the contact person should estimate the energy consumption with the new techn. measures differentiated by final energies in column "E" (baseline year is 2019). The energy saving is then calculated automatically and may be negative in the case of a fuel switch. Once again, we are well aware, that the interviewee might struggle to define a value here, thus please ensure him or her to make an assumption, since it is crucial for a later estimation of the overall project effects.
- Please also ask for an estimation about potential investments needed for the implementation of the techn. measures, e.g. equipment and personnel costs, and the share of internal personnel costs required for the techn. measures.

#### After 2nd Energy Assessment



1) Send the template to Fraunhofer (lisa.neusel@isi.fraunhofer.de) via mail.



Input for 2nd Energy Assessment required Entered by Fraunhofer according to 1st Energy Assessment

		Please complete for 2nd EA	Frau	Entered by Inhofer due to 1st	Please complete for 2nd EA	
		L	Da	EA ta acquesitio	1	
_		Measures		Company 1st	Company 2nd	
Comp	vary ID and Name	influenced/adressed by trainings?		measurement	measurement	
		Enter an "x" if so		Scoring before trainings	Scoring after trainings	Remarks for filling in:
	Energy management & KPIs			1	0	No action needed in this line!
1	Do you manage energy consumption in your company?		•	3		
2	Does your location use key performance indicators (KPIs) for energy management?		0	2		
3	Are there specific targets for reducing energy consumption or for improving energy efficiency (e.g. % / per unit produced)?		•	1		
	General assessment energy management			1	0	No action needed in this line!
4	Has there been any interest in conducting energy audits in your company?		0	2		
5 6	Is your company interested in implementing a management system if it doesn't already have one (e.g. ISO 9001/ISO 14001/ISO 50001)? 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		•	2 3		If influenced by trainings: Enter x in line 14. No further action needed in this line
	A. Energy Energy C. Quality. D. Production. E. Maintenance.	-		x		Line 15-21: Set an x according to the status after the training
7	D. Other, please specify: E. None Which department is leading these efforts? Is there an energy committee in place? (single choice)	-				No further action needed in this line
	A. Energy. B. Environment. C. Quality: D. Production. E. Maintenance.	-				Line 23-30: Set an x according to the status after the training
	F. Energy committee G. None	-				
	H. Other, please specify: Energy Savings Group Basic check energy control			х		
	Internal policy			2	0	No action needed in this line!
•	Devous know the regulation that apply in your country and region about energy officiency?			1	Ū	No action needed in this line!
	to province and the second state of the			-		
3	The investment existence an exist (e.g. payheads time of 2 years) and (as intermediate of seture)			2		
10	Are investment criteria based on risk (e.g. payback time < 3 years) and / or internal rate of return?			3		
	Procedures in prace			4	U	No action needed in this line!
	is the energy use known and available (e.g. in an energy Savings Plan, Energy enriciency plan, or from your monitoring information)?			3		
12	Has the organization determined the main energy aspects based on energy use? Is this information up to date?			1		
15	is there a measuring, evaluation and monitoring concept on energy consumption:					
14	Un which level(s) is data on energy consumption collected? Un the level of			3		If influenced by trainings: Enter x in line 40. No further action needed in this line
	the entire production site a single building			x		
	individual production areas or production lines individual machines or systems	-				Line 41-45: Set an x according to the status after the training
15	no data collection on energy consumption If energy consumption indicators are used; on which levels are they used? On the level	-	•	1		If influenced by trainings: Enter x in line 46. No further action needed in this line
	the entire production site 	-				Line 47-51: Set an x according to the status after the training
16	no data collection on energy consumption	-		x		
10	According to the requirements of the energy management policy obligations of energy efficiency, is there a 'plan of		0	2		
	execution', to improve energy performance? Training			1	0	No action needed in this line!
18	Is the necessary knowledge and information in the field of efficient energy use known? Have the employees who are			3		No action needed in this line:
19	able to influence energy use been instructed or educated? Have you identified concrete needs in the energy training of employees? Please specify (for example: specific		0	2		
	processes or utilities, energy audit procedures, measurement equipment, etc.) Actions			3	0	
20	Are there regular internal information exchanges about the energy performance and energy management			1		No action needed in this line!
21	obligations at executive and board level? And is there agreement on in what way and to whom the energy Are sufficient financial means made available for managing and improving the energy performance (use and		0	3		
22	efficiency)? Do γου monitor areas of Significant Energy Use (SEUs)?		•	1		
23	In case of deviating energy use, is the cause investigated and are measures taken to prevent repetition?			3		
24	Do you perform an annual (or more frequent) internal evaluation of energy performance? Do you report on the			3		
	functioning to the board? Total number of fully implemented aspects			12	0	No action needed in this line!

Important: Final two questions have to be answered (an estimation has to be made, otherwise the contact person has to be adressed again)! To give you a first overall overview of the E2Driver training impocts, you can find a summary of the results on the four diagrams below. These might help to answer the following two questions.

How much energy savings do you estimate can be achieved due to the <u>organizational measures</u> affected by the E2Driver training (assuming that these already have been or will be implemented in the near future)?
 Imagine you have implemented the organizational measures in 2019 and they would have impacted the whole year 2019. How would the generated savings have affected your energy consumption of 2019? Based on your electricity and thermal consumption of 2019, please fill the following table (column F).

	Energy consumption in 2019	Estimated energy	Estimated energy saving	Further explanatory information
	[kWh]	consumption in 2019 if the	through organizational	(voluntary)
	(as reported)	above mentioned	measures	
		organizational measures	(automatically	
		would have been	calculated)	
		implemented	[%]	
		[kWh]*		
Electricity				
Gasoil				
Fuel oil nº1				
Natural gas				
Propane gas				
Butane				
Biomass				
Other, please specify				
* assuming the organizational	I measures would have impacte	d the whole year 2019. Baselin	e vear is 2019, since we have	only one energy assessment and 2020 may

aseline year is 2019, since we have only one energy assessme hole year 2019 have highly impacted the company's energy consumption.

Please estimate the corresponding total investment necessary for the <u>organizational measures</u> (assuming that these already have been or will be implemented in the near future).

Please give your estimation in €.

Total investment for organizational measures in €	
of which, internal personnel costs in €	



		Input from 1st Energy Assessment (entered by Fraunhofer)						Please complete for 2nd EA			
Measures in		Is the technology used in the plant?	the EE measures nology considered or ed in implemented during plant? the last 2 years		What kind of measurses were	Exper improvem (cł	ted potenti ent in the n eck one opti	al for ext 2 years on)	What kind of measurses are planned	Already considered measures, now more	New considered measures for
	Supply Building Production technologies process	[ <u>only tick</u> <u>and</u> proceed if <u>yes]</u>	no	yes	implemented (i) during the last 2 years?	low	med	high	to be implemented within the next 2 years?	implement or already implemented due to E2Driver training	implementation affected by E2Driver training
s	Measures in the area of electric drives (e.g. high efficiency IE motors, speed control, efficient transmissions)										
inologi	Measures in the area of compressed air systems (e.g. leakage removal, substitution of compressed air, pressure reduction)										
ply tech	Measures in the area of <b>pump systems</b> (e.g. hydraulic balancing, highly efficienct pumps)										
dns uj :	Measures in the area of process cooling (e.g. adjustment of temperature levels, demand-dependent controls)										
easures	Measures in the area of process heating (e.g. insulation of heat pipes, highly efficient steam generators)										
Ŵ	Measures in the area of <b>logistics</b> (e.g. electric fork-lifting trucks, shortening of routes)										
15	Measures in the field of <b>building heating/cooling</b> (e.g. mini-CHP, highly efficienct heat pumps, nightime lowering of the heating)										
uilding	Measures in the area of the <b>building envelope</b> (e.g. thermal insulation, new windows, removal of thermal bridges)										
res in b	Measures in the area of lighting (e.g. use of motion and brightness sensors, LED bulbs)										
Measu	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)										
process	[Please complete relevant measures]										
ductior											
in pro											
sasures											
Ŵ											
two ye	other energy ethiciency measures have been implemented during the last ars?										
In whi years i	ch other areas can energy efficiency be improved further in the next two										
What next to	other energy efficiency measures are planned to be implemented in the vo years?										

Important: Final two questions have to be answered (an estimation has to be made, otherwise the contact person has to be adressed again)! To give you a first overall overview of the E2Driver training impacts, you can find a summary of the results on the four diagrams below. These might help to answer the following two questions.

How much energy savings do you estimate can be achieved due to the <u>energy efficiency measures</u> affected by the E2Driver training (assuming that these already have been or will be implemented in the near future)?
 Imagine you have implemented the EE measures in 2019 and they would have impacted the whole year 2019. How would the generated savings have affected your energy consumption of 2019? Based on your electricity and thermal consumption of 2019, please fill the following table (column E).

	Entered by Fraunhofer due to 1st EA complete if necessary)	Please complete for 2nd EA		
	Energy consumption in 2019 [kWh] (as reported)	Estimated energy consumption in 2019 if the above mentioned EE measures would have been implemented [kWh]*	Estimated energy saving through EE measures (automatically calculated) [%]	Further explanatory information (voluntary)
Electricity				
Gasoil				
Fuel oil nº1				
Natural gas				
Propane gas				
Butane				
Biomass				
Other, please specify				

\* assuming the organizational measures would have impacted the whale year 2019. Baseline year is 2019, since we have only one energy assessment and 2020 may have highly impacted the company's energy consumption.

2) Please estimate the corresponding total investment necessary for the energy efficiency measures (assuming that these already have been or will be implemented in the near future).

Please give your estimation in €.

	Please complete for 2nd EA
Total investment for EE measures in €	
of which, internal personnel costs in €	

### 8.3 Learning outcomes of E2DRIVER according to the levels of EQF

	Learning outcomes of the capacity building program expressed in the EQF descriptors						
Trainee Profile	Training sub- sections	Knowledge He/she has gained knowledge in the following fields:	<b>Skills</b> He/she is able to:	Responsibility & Autonomy (to apply the mentioned knowledge and skills he/she has acquired during the training)	E2DRIVER Training Units undertaken		
	General con- cepts about energy	<ul> <li>General knowledge about the main concepts related to energy and energy au- dits</li> </ul>	<ul> <li>Acquire new skills on energy and under- stand the influence of these concepts on the daily life of the com- pany.</li> <li>Generate awareness at high level positions in the company.</li> </ul>	He/she can decide inde- pendently and on his/her own responsibility to what extent actions are needed for the optimisation and im- provement of energy use in the company and delegate actions to employees.	Units: 1.1.1 Con- cepts about energy		
Man- agers	Energy Au- dits	<ul> <li>The European standard that establishes parame- ters for conducting an en- ergy audit.</li> <li>The procedure steps of an energy audit.</li> <li>The required outcomes of an energy audit.</li> <li>Measurement and Verifi- cation issues to determine the energy and cost sav- ings.</li> <li>How to devise specific Ac- tion Plans for Improve- ment</li> <li>The internal and external resources that are re- quired to conduct an en- ergy audit.</li> </ul>	<ul> <li>Plan and prepare the necessary internal and external resources for the auditing procedures.</li> <li>Verify collected data and analyse them to support energy efficiency improvement decision making.</li> <li>Understand the energy analyses that are included in an energy audit.</li> <li>Define an action plan for future years with energy and costs information and how this information influences the evolution of the company.</li> <li>Use this information to plan future interventions.</li> </ul>	He/she can act under the supervision of a professional energy auditor/ quality consultant.	Units: 3.1.1 How to do energy au- dits? 3.1.2 Checklist relevant infor- mation. 3.1.3 Main en- ergy audit steps. 3.1.4 Develop- ment of an ac- tion plan; 3.1.5 Meas- urement and verification; 3.1.6 EN16247:2015		
	Energy Cul- ture	<ul> <li>Objectives and benefits of an EnMS based on the ISO 50001:2018 standard</li> <li>The quality management approach of the PDCA Cy- cle and the structure of an EnMS that complies with the requirements of ISO 50001:2018 Standard.</li> <li>The input and output re- quirements of the Mana- gerial Review according to ISO 50001:2018</li> </ul>	<ul> <li>Order and manage information on the energy consumption of the company.</li> <li>Update existing or devise new Energy Performance Indicators for the EnMS.</li> <li>Regularly monitor progress in energy consumption and estimate future consumption.</li> </ul>	He/she acts independently and on his/her own respon- sibility to address the re- quirements of ISO50001 within the company.	Units: 3.2.1 Targets and goals 3.2.2 High- level positions 3.2.3 ISO 50001:2018		

		•	The high-level structure of the ISO 50001 standard. Targets and goals of the EnMS in a company.	•	Define action plans and energy objectives that will enable the company to improve its energy perfor- mance. Identify all the neces- sary resources needed to implement the ac- tion plans that has been defined		
	Monitoring	•	Knowledge of: • Monitoring levels • Devices • Usefulness • Benefits Steps to follow to imple- ment a monitoring sys- tem	•	Make use of the out- put of a monitoring system to support de- cision making related to plant equipment operation, mainte- nance and plant en- ergy consumption. Define the necessary resources to imple- ment a monitoring system in the com- pany, or to improve the current one.	He/she can act inde- pendently and on his/her own responsibility to assess input from a monitoring sys- tems and devise necessary changes.	Units: 3.3.1. Best practice on Monitoring and Bench- marking
	Legisla- tion/Subsi- dies	•	An overview of energy au- dit legislation in his/her country, and tools to help identify sources of legisla- tion and/or subsidy op- portunities	•	Identify additional regulations and subsi- dies that he/she al- ready knows in other fields that can be also applied in the com- pany	He/she can act inde- pendently to identify which tools can be included in the action plan of the company to be used to implement measures	Units: 2.1 Legislation and 6.1 Subsi- dies (the country that applies)
Science and En- gineer- ing Profes- sionals	General con- cepts about energy	•	General knowledge about the main concepts that should be known in rela- tion to energy and energy audits	•	Understand the influ- ence of energy con- cepts on the daily life of the company and how they can be ap- plied in their area or department. Generate awareness at employees' level.	He/she can act inde- pendently and on his/her own responsibility to decide to what extent action is needed for the optimisation and improvement of energy use in his/her area or de- partment or process.	1.1.1 Con- cepts about energy
	Energy Effi- ciency: - in Electri- cal De- vices - in Ther- mal De- vices - in Hori- zontal Utilities - in Build- ing enve- lope	•	The science and engineer- ing professionals can have the possibility to learn about the different fields of energy efficiency that can be applied to their company. The particulari- ties of each company, ac- cording to their produc- tion processes, will allow them to select which fields apply to them, as well as within the area in which the professionals work: Opportunities to increase energy efficiency in en- gines/motors.	•	Identify and execute the sizing of appropri- ate engineering modi- fications to increase efficiency, according to their area of work and the characteristics of the company.	He/she can act inde- pendently and on his/her own responsibility to identify in each of the areas the pos- sibility of modifying parame- ters, equipment, or pro- cesses to optimise energy consumption.	Units: - in Electri- cal De- vices (4.2.1; 4.2.2; 4.2.3; 4.2.4) - in Ther- mal De- vices (4.3.1; 4.3.2) - in Hori- zontal Utilities (4.4.1;

	<ul> <li>Opportunities to increase energy efficiency in cool- ing processes.</li> <li>Opportunities to increase energy efficiency in Trans- formers.</li> <li>Opportunities to increase energy efficiency in Boil- ers and/or Furnaces.</li> <li>Opportunities to increase energy efficiency in com- pressed air circuits.</li> <li>Opportunities to increase energy efficiency in Light- ing.</li> <li>Opportunities to increase energy efficiency in HVAC Systems.</li> <li>Opportunities to reduce the energy demand of the building in which the com- pany is placed.</li> </ul>			4.4.2; 4.4.3) - in Building envelope (4.5.1)
Energy Au- dits	<ul> <li>The procedure steps of an energy audit</li> <li>The required outcomes of an energy audit.</li> <li>Measurement and Verification issues to determine the energy and cost savings.</li> </ul>	<ul> <li>Plan, prepare and execute the necessary internal auditing procedures.</li> <li>Collect and provide to the audit team useful information about the systems in which the professional is involved.</li> <li>Verify collected data and analyse them to support energy efficiency improvement decision making.</li> <li>Understand the energy analyses that are included in an energy audit.</li> <li>Use this information to plan future interventions.</li> </ul>	He/she can act under the su- pervision of a manager, a change agent or a profes- sional energy auditor/ qual- ity consultant.	Units: 3.1.1 How to do energy au- dits? 3.1.3 Main en- ergy audit steps. 3.1.4 Meas- urement and verification;
Monitoring	<ul> <li>Knowledge of:         <ul> <li>Monitoring levels</li> <li>Devices</li> <li>Usefulness</li> <li>Benefits</li> </ul> </li> <li>Identify to what extent the processes or equipment involved in the area in which they work can be measured and controlled, as well as the utility in their day-to-day work.</li> </ul>	<ul> <li>Collaborate in the design of the monitoring system.</li> <li>Use the monitoring system to optimize the process or equipment that he/she controls</li> </ul>	He/she can independently and on his/her own respon- sibility in using the infor- mation provided by the monitoring system to opti- mize the use of energy ac- cording to the area to which the professional belongs.	Units: 3.2.1. Best practice on Monitoring and Bench- marking
Legislation	<ul> <li>An overview of energy au- dit legislation in his/her country.</li> </ul>	<ul> <li>To identify additional regulations that he/she already knows</li> </ul>	He/she can act inde- pendently but under a man- ager's or a legal counsellor's	Units: 2.1.1 Legisla- tion (the

					in other fields that can be also applied in the area or department.	responsibility to identify reg- ulations that apply to the equipment or processes to see new possibilities for opti- misation.	country that applies)
Tech- nical Man- agers	General con- cepts about energy	•	General knowledge about the main concepts that should be known in rela- tion to energy and energy audits	•	Acquiring new skills on energy and the in- fluence of these con- cepts on the daily life of the company and how to apply them to increase the energy performance of the equipment. Contribute to raising awareness.	He/she can act inde- pendently and on his/her own responsibility to decide to what extent action is needed for the optimisation and improvement of energy use in his/her area or de- partment or process.	1.1.1 Con- cepts about energy
	Energy Effi- ciency: - in Electri- cal De- vices - in Ther- mal De- vices - in Hori- zontal Utilities - in Build- ing enve- lope	•	The technical managers can have the possibility to learn about the different fields of energy efficiency that can be applied to their company. The partic- ularities of each company, according to their produc- tion processes, will allow them to select which fields apply to them. Some of them should be mandatory such as electri- cal devices (engines and transformers) or horizon- tal utilities: Opportunities to increase energy efficiency in en- gines/motors. Opportunities to increase energy efficiency in cool- ing processes. Opportunities to increase energy efficiency in Trans- formers. Opportunities to increase energy efficiency in Boil- ers and/or Furnaces. Opportunities to increase energy efficiency in com- pressed air circuits. Opportunities to increase energy efficiency in Light- ing. Opportunities to increase energy efficiency in HVAC Systems. Opportunities to reduce the energy demand of the building in which the com- pany is placed.		Identify and execute the sizing of appropri- ate engineering modi- fications to increase efficiency, according to the equipment and processes of the com- pany.	He/she can act inde- pendently and on his/her own responsibility to identify in each of the areas the pos- sibility of modifying parame- ters, equipment, or pro- cesses to optimise energy consumption.	Units: - in Electri- cal De- vices (4.2.1; 4.2.2; 4.2.3; 4.2.4) - in Ther- mal De- vices (4.3.1; 4.3.2) - in Hori- zontal Utilities (4.4.1; 4.4.2; 4.4.3) - in Building envelope (4.5.1)

	Energy Au- dits	•	The procedure steps of an energy audit The required outcomes of an energy audit. Measurement and Verifi- cation issues to determine the energy and cost sav- ings.	• • •	Plan, prepare and exe- cute the necessary in- ternal auditing proce- dures. Collect information about the equipment, systems and uses of the company. Verify collected data and analyse them to support energy effi- ciency improvement decision making. Understand all the en- ergy analysis that are include in an energy audit. Use this information for future interven- tions.	He/she can act under the su- pervision of a manager, the company change agent or a professional energy auditor/ quality consultant.	Units: 3.1.1 How to do energy au- dits? 3.1.3 Main en- ergy audit steps. 3.1.4 Meas- urement and verification;
	Monitoring	•	Knowledge of: O Monitoring levels O Devices O Usefulness O Benefits Identify to what extent energy uses and equip- ment of the company can be measured and con- trolled, as well as their utility in their day-to-day work.	•	Collaborate in the de- sign of the monitoring system. Use the monitoring system to optimize the process or equip- ment.	He/she can act inde- pendently and on his/her own responsibility in using the information provided by the monitoring system to op- timize the use of energy	Units: 3.2.1. Best practice on Monitoring and Bench- marking
	Legislation	•	An overview of energy au- dit legislation in his/her country.	•	Identify additional regulations that he/she already knows in other fields that can be also applied in the company.	He/she can independently but under the responsibility of a manager or legal coun- sellor to identify regulations that apply to the equipment or processes to see new pos- sibilities for optimisation.	Units: 2.1.1 Legisla- tion (the country that applies)
Change Agents	General con- cepts about energy	•	General knowledge about the main concepts that should be known in rela- tion to energy and energy audits	•	Acquire new skills on energy and under- stand the influence of these concepts on the daily life of the com- pany. Generate awareness at the company. Adapt his position by taking into account energy aspects. Transfer the available information in a com- prehensive way to the company employees	He/she can act inde- pendently to decide to what extent to act for the optimi- sation and improvement of energy use in his/company. He is responsible for the work of other employees re- lated to energy issues and improvements.	Units: 1.1.1 Con- cepts about energy
	Energy Au- dits	•	The European standard that establishes how to conduct an energy audit. The procedure steps of an energy audit.	•	Plan and prepare the necessary internal and external resources for the auditing proce- dures.	He/she can act under the su- pervision of a professional energy auditor/ quality con- sultant.	Units:

	•	The required outcomes of an energy audit. Measurement and Verifi- cation issues to determine the energy and cost sav- ings. How to devise specific Ac- tion Plans for Improve- ment The internal and external resources that are re- quired to conduct an en- ergy audit.	•	Actively participate in the audit process and coordinate all the stakeholders involved. Verify collected data and analyse them to support energy effi- ciency improvement decision making. Understand all the en- ergy analyses that are included in an energy audit. Use this information for future interven- tions. Define an action plan for future years with energy and costs in- formation and how this information influ- ences the evolution of the company.		<ul> <li>3.1.1 How to do energy au- dits?</li> <li>3.1.3 Main en- ergy audit steps.</li> <li>3.1.4 Meas- urement and verification.</li> <li>3.1.5 EN16247:2015</li> </ul>
Energy Cul- ture	•	Knowing what the ISO 50001:2018 standard is and what its objectives and benefits are. The quality management approach of the PDCA Cy- cle and the structure of an EnMS that complies with the requirements of ISO 50001:2018 Standard. The input and output re- quirements to implement ISO 50001:2018. The steps to implement ISO 50001 standard. Targets and goals of the EnMS in a company.	• • • • •	Establish a standard- ised procedure to help manage the energy consumption to be in- ternalised in the com- pany. Generate tools to help control energy con- sumption along with production. Update existing or de- vise new Energy Per- formance Indicators for the EnMS. Monitor progress in energy consumption and estimate future consumption. Define and carry out an action plan and en- ergy objectives that will enable the com- pany to improve its energy performance. Make use of available resources to imple- ment the action plan that has been defined. Give continuity in time to an energy manage- ment	He/she can act inde- pendently. He is responsible for the work of other em- ployees related to energy is- sues and improvements.	Units: 3.2.1 Targets and goals 3.2.2 Commu- nication& Co- operation in EnMS 3.2.3 ISO 50001:2018
Energy Awareness	•	Learn strategies and sim- ple messages about en- ergy efficiency to help raise awareness in the company.	•	Use tools and capaci- ties to generate awareness and trans- fer energy aspects within the company.	He/she can act inde- pendently and on his/her own responsibility.	Units: 3.3.1 Awareness in Energy Effi- ciency; Em-

		<ul> <li>Generate awareness and promote aware- ness measures among employees and at management level.</li> </ul>		ployee moti- vation for en- ergy
Monitoring	<ul> <li>Knowledge of: <ul> <li>Monitoring levels</li> <li>Devices</li> <li>Usefulness</li> <li>Benefits</li> </ul> </li> <li>Steps to follow to implement a monitoring system</li> </ul>	<ul> <li>Acquisition of skills in case of implementation of a monitoring system and use of it for decision making in aspects of the plant related to the operation and maintenance of the equipment and its energy consumption.</li> <li>See all the application possibilities in all areas of the company</li> <li>Use the information provided by the monitoring system to optimize the use of energy and support decision making.</li> <li>Research on system options that are best suited to the company's needs</li> </ul>	He/she can act inde- pendently and on his/her own responsibility.	Units: 3.4.1. Best practice on Monitoring and Bench- marking
Energy Con- tracting	<ul> <li>Learn everything about the energy market and the regulation of energy prices in the country that applies.</li> <li>Know types of rates and ways to contract energy.</li> </ul>	<ul> <li>Know what to look for and what to control in relation to energy contracting to opti- mize the company's energy costs.</li> <li>Explore options for contracting at lower costs, as well as con- trolling and verifying the savings obtained.</li> <li>Negotiate with energy supply companies.</li> <li>Control energy costs.</li> </ul>	He/she can act inde- pendently and on his/her own responsibility.	Units: 3.5.1 Energy Con- tracting (the country that applies)
Energy Effi- ciency	<ul> <li>Basic concepts on energy efficiency in industry, which can be comple- mented with training in specific fields of energy efficiency as applied in the company.</li> </ul>	<ul> <li>Transfer basic knowledge in the team and staff so that everyone is in some way, depending on their position, in- volved in maintaining energy efficiency in the company.</li> </ul>	He/she can act inde- pendently and on his/her own responsibility.	Units: 4.1.1. Energy Effi- ciency in in- dustries and examples
Legisla- tion/Subsi- dies	<ul> <li>An overview of energy au- dit legislation in his/her country, and tools to help identify sources of legisla- tion and/or subsidy op- portunities</li> </ul>	<ul> <li>Identify additional regulations and subsi- dies that he/she al- ready knows in other fields that can be also applied in the com- pany</li> </ul>	He/she can act inde- pendently and on his/her own responsibility.	Units: 2.1 Legislation and 6.1 Subsi- dies (the country that applies)

•	Identify which tools can be included in the action plan of the company to be used to implement	
	measures.	



#### 8.4 EQF Reference Levels

	🥌 Knowledge	🖺 Skills	😢 Responsibility and autonomy
	In the context of the EQF, knowledge is described as theoretical and/or factual.	In the context of EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments).	In the context of the EQF, responsibility and autonomy is described as the ability of the learner to apply knowledge and skills autonomously and with responsibility.
	Basic general knowledge.	Basic skills required to carry out simple tasks.	Work or study under direct supervision in a structured context.
	Basic factual knowledge of a field of work or study.	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and solve routine problems using simple rules and tools.	Work or study under supervision with some autonomy.
level 3	Knowledge of facts, principles, processes and	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and	Take responsibility for completion of tasks in work or study.
	general concepts in a field of work or study.	applying basic methods, tools, materials and information.	Adapt own behaviour to circumstances in solving problems.
Factual and theoretical knowledge in broad		A range of cognitive and practical skills required to generate solutions to specific problems in a field of	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change.
	contexts within a field of work or study.	work or study.	Supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities.
Level 5	Comprehensive, specialised, factual and theoretical knowledge within a field of work or study, and an awareness of the	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract	Exercise management and supervision in contexts of work or study activities where there is unpredictable change.
	boundaries of that knowledge.	problems.	Review and develop performance of self and others.
Level 6	Advanced knowledge of a field of work or study, involving a critical understanding of	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts.
	theories and principles.	in a specialised field of work or study.	Take responsibility for managing professional development of individuals and groups.
Level 7	Highly specialised knowledge, some of which is at the forefront of knowledge, in a field of work or study, as the basis for original thinking and/ or research.	Specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures, and to integrate knowledge from different fields.	Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches. Take responsibility for contributing to professional knowledge and practice, and/or for reviewing the strategic performance of teams
	and at the interface between different fields.		
Level 8	Knowledge at the most advanced frontier of a field of work or study, and at the interface between fields.	The most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/ or innovation, and to extend and redefine existing knowledge or professional practice.	Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts, including research.