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Impact of measures in at least 65 enterprises based on interviews, online survey, web statistics and monitoring

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IMPAWATT
IMPlementAtion Work and Actions To change the energy culTure

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Contents

1 Executive summary

After the design and creation of the IMPAWATT platform with its more than 200 capacity content elements, the IMPAWATT program was launched in the 6 participating countries. The program consisted on several actions such as small energy audits, capacity building workshops and webinars. The impact was assessed with interviews/surveys performed at the end of the project, results from the energy audits registered on the platform, recordings from each IMPAWATT partners and finally web statistic of the platform.

More than 187 companies participated in the IMPAWATT pilot program. And even more benefited from the capacity building actions. Thanks to this, almost 1500 persons were trained on energy efficiency, energy culture and sustainable supply chain. Half of them were through webinars.

Especially the small energy audits and specific workshops allowed to discover 238 additional energy efficiency measures with a potential energy savings of 12 GWh/a.

More than 300 users subscribed to the platform essentially to access the capacity building content. The other parts of the platform as the energy monitoring part were less used.

The main lessons learnt were:

- There is a need of training in companies for the above cited topics,
- The platform is a good capacity building tool if used together with other services such as energy audit or capacity building actions done by an external consultant,
- Even for companies that were already interested in energy efficiency before the program, an interesting potential of energy savings can be found.

2 Introduction

The IMPAWATT program aimed to increase energy efficiency in companies and especially in SME, mainly through capacity building activities. Several actions such as energy check-ups, capacity building workshops, webinars and more were organized for this purpose. Those different actions were organized during the last twenty months of the project in a pilot phase with companies. Different actions were performed by the partners in each of the six countries (France, Italy, Germany, Finland, Austria and Switzerland).

This deliverable describes the impact of the IMPAWATT program and actions on quantitative and qualitive sides. Feedbacks from users are also given. First, the general methodology for the impact assessment is described. Then, the results of the impact assessment interviews and survey are presented. The next section describes how the platform was used, based on web statistics. After that, the results of the implemented energy efficiency measures are presented. Finally, the global impact is presented and discussed.

3 Impact assessment methodology

3.1 Project performance indicator

The project performance indicators were defined in the grant agreement as following:

- Energy savings triggered by the project within its duration
- Renewable Energy production triggered by the project within its duration
- Cumulative investments made by European stakeholders in sustainable energy
- Market stakeholders with increased skills/capability/competencies on energy issues

Moreover, the number of companies participating to the program was a relevant indicator too. It is described in detail in deliverable 6.4. The way the platform was used, and the number and type of

IMPAWATT actions were also assessed thanks to web statistics and the survey. Finally, more qualitative data as interest, relevance and quality of the platform were collected from the survey.

3.2 Methodology

3.2.1 Energy savings from measures

The energy savings triggered by the project within its duration, the renewable energy production triggered by the project within its duration and the cumulative investments made by European stakeholders in sustainable energy were calculated with a bottom-up approach based on energy efficiency measures. During the IMPAWATT actions, new energy efficiency measures including renewable energy production were proposed/found to/by the companies. For each measure, the characteristics (see annex 12 Measure characteristics of the IMPAWATT Platform p.23) were entered on the IMPAWATT portal. With those figures, the energy savings, renewable energy production and investment triggered can be estimated for the planned and implemented measures. The energy savings are based on the calculation based on the numbers collected during the energy check-ups. The French partner had its own energy efficiency measure system and did not use the platform. However, type and effect for most measures were recorded.

The energy savings and costs of the actions were recorded thanks to those numbers. Note that only measures planned or implement due to the IMPAWATT project, hence since October 2019, are taken into account. The advantage of this methodology is that the energy savings are independent of the general energy consumption. Hence, no baseline scenario should be calculated. See 7 Energy efficiency measures for more information.

3.2.2 Market stakeholders with increased skills/capability/competencies on energy issues

The number of people with increased skills/capability/competencies on energy issues was collected as following:

- Each partner kept track of each capacity building workshop and webinar with the number of persons participating and topics presented.
- The impact assessment survey filled either during interviews or online by the company itself also asked at the end of the project how many people had increased skills.
- The webinars were recorded and made available for free later views on the Internet (e.g. Youtube channel). View statistics were then used to determine how many people were trained thanks to this channel.

3.3 Summary

Four different sources were used to assess the impact of the project:

- Impact assessment from survey interviews/survey :
    - Qualitative feedback on the platform and the program such as usage of the platform, interest and relevance
    - Precising the performance indicator (e.g. number of people with increased skills, etc.)
- IMPAWATT platform measure section:
    - Energy savings, type/number of measures, implementation status and investments
- Record from project partner
    - Record of activities and related key numbers (# of people attending …).
- Web statistics
    - How the platform is used
    - Number of registered companies

4 Actions

4.1 Introduction

In the last twenty months of the project, once the platform was operational, companies were acquired in each partners country to perform several capacity building actions and small energy audits. Those actions were built around the IMPAWATT platforms. A detailed description of the actions can be found in deliverable 6.5.

Each action was classified in one of those categories:

Short on-site audit or workshop for finding new energy efficiency measures

The goal of those two actions was to find new energy efficiency measures. All project partners visited the companies to perform either a small energy audit or to organize a workshop to find, together with the company, new **measures**. At the end the company received a list of energy efficiency measures with generally an estimation of energy/financial savings as well as investment costs. Those data were then inserted in the IMPAWATT platform[1]. At the end of the project, it was checked if the measures were implemented or not.

Capacity building Workshops

Workshops where the IMPAWATT partner trained the companies employee on one or several energy efficiency topics.

Webinars

Online capacity building actions.

Due to the COVID context some measure workshops and capacity building workshops were unfortunately done online instead of live. The energy culture survey is treated in a separated deliverable (see D3.2).

The companies were sorted in two groups (see D6.4):

IMPAWATT+: Companies with a closer follow up leading to new energy efficiency measures (the **"** Short on-site audit or workshop for finding new energy efficiency measures." Category). At the end of the project those companies were interviewed personally.

- IMPAWATT: The minimum requirement was that they subscribed to the platform. Several companies in this group received a training (workshop) or/and participated to the webinars.

Note that capacity building actions were performed in companies independently of the IMPAWATT group. Moreover, there were a few companies that benefited of IMPAWATT actions such as webinars and workshops without registering to the platform, despite the fact that they were encouraged to register. Those companies are therefore not in the IMPAWATT group but are counted as participants in the activities.

4.2 Results

This section quantifies the different actions done with companies in the IMPAWATT program. The data were collected manually by partners who kept record of all actions.

[1] Except for France where a separate data collection was used

4.2.1 Counts of companies engaged at the end of March 2021

As seen in the table below in total more than 187 companies participated in the IMPAWATT program. The target defined in the grant agreement is reached.

Partner	IMPAWATT + group		IMPAWATT standard group		TOTAL	
	Target	31.03.21	Target	31.03.21	Target	31.03.21
AEA	15	15	10	13	25	28
VTT	5	6	5	9	10	15
CCI	30	30	35	47	65	77
SENERCON	5	12	15	7	20	19
PLANAIR	15	17	15	16	30	33
ENV	5	6	15	11	20	17
TOTAL	**75**	**86**	**95**	**103**	**170**	**189**
% reached		115%		106%		110%

Table 1 : Counts of companies engaged at the end of March 2021

4.2.2 Counts of actions

The total registered companies on the platform is higher (225, see 6 Platform and content use) because here only companies explicitly identified by the partners in the IMPAWATT or IMPAWATT+ group are counted.

Partner	Short on-site audit	Company uses the platform
AEA	7	32
VTT	0	9
CCI	67	77
SEN	12	11
PLA	18	28
ENV	1	15
TOTAL	**105**	**172**

Table 2 : Counts of actions per companies end of march 2021

4.2.3 People with increased capacity

Partner	# people with increased capacity		
	Workshop	Webinars	**Total**
CCI	67	252	**319**
AEA	102	204	**306**
VTT	21	31	**52**
SEN	22	32	**54**
ENV	318	48	**366**
PLA	28	324	**352**
TOTAL	**558**	**891**	**1449**

Table 3 : People with increased capacity per country from capacity building workshop and webinars (during the live events and replays),

See deliverable 6.5 for more explanations on training/capacity building actions.

5 Impact assessment from survey/interviews

5.1 Methodology

The aim of the impact assessment survey was to assess how the project impacted the companies. In particular we wanted to know of which action the company has benefited from the IMPAWATT program and how this action was rated/useful for the company. Finally, the company could directly, if wanted, enter the energy savings, number of people that benefited from a capacity building action and investment triggered by the program. Those last data could then be compared to the other sources such as feedback from partners and platform data.

For the IMPAWATT+ group, each partner interviews a company representative by asking the question of the survey. The answers were then entered by the partner or together with the company. The personal contact allowed to have a more precise feedback. Those were also recorded as text.

For the IMPAWATT group an email with the link to the survey was sent.

5.2 Impact assessment survey

See appendix for the survey. Some actions related questions were only asked if the user had this action.

5.3 Results

5.3.1 Sample

Finally, we had 73 complete answers. Half of them were SME's (see Figure 1. Even if the activity sectors were relatively well distributed, offices and human health activities where more represented (see Table 4 Activity sectors of the companies that answered the survey. Note that those data are generally related to one company' site and not to the whole company. The next tables/figures show the sample characteristics:

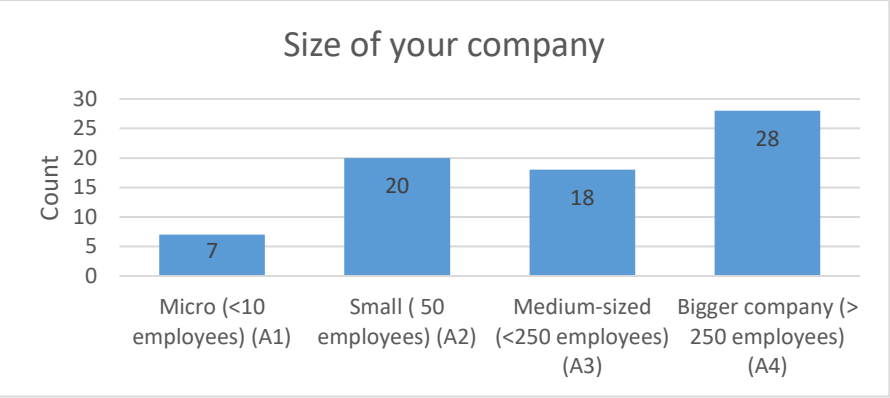


Figure 1 Number of companies that answered the impact assessment survey as function of their sizes,

Answer	Count
Offices (education, insurances, Financial,..) (A2)	12
TRANSPORT AND STORAGE (H) (A5)	1
ACCOMODATION AND FOOD SERVICE ACTIVITIES (I) (A7)	4
MANUFACTURE OF FOOD PRODUCTS AND BEVERAGES (C/10-11-12) (A8)	3
Manufacture of textiles, wearing apparel, leather and related products (C/13/14/15) (A9)	1
Manufacture of wood and of products of wood and cork (C/16) (A10)	4

MANUFACTURE OF CHEMICALS AND PHARMACEUTICAL PRODUCTS (C/20-21) (A13)	1
MANUFACTURE OF RUBBER AND PLASTIC PRODUCTS (C/22) (A14)	4
MANUFACTURE OF METALS AND METAL PRODUCTS and Mineral Products (C/23-24-25) (A15)	3
MANUFACTURE OF MACHINERY AND EQUIPMENT (C/27-28) (A17)	9
Human health activities (Q) (A18)	11
Other	19
MANUFACTURE OF PAPER AND PAPER PRODUCTS (C/17) (A11)	1

Table 4 Activity sectors of the companies that answered the survey.

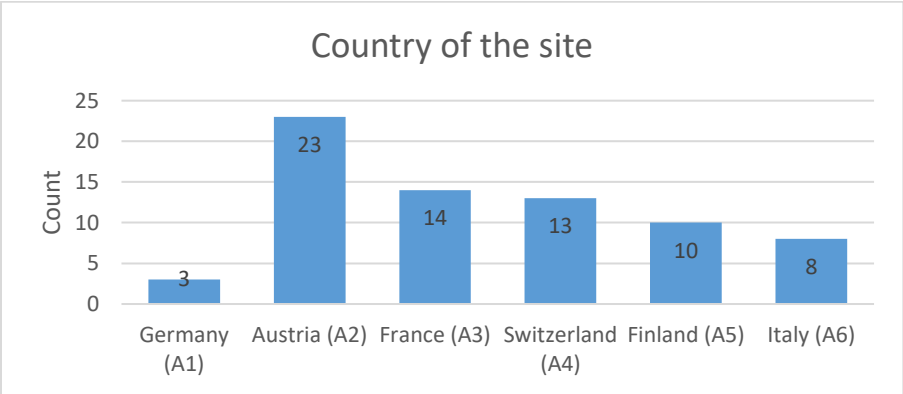


Table 5 Answers per country.

5.3.2 Actions

The companies benefited from following actions:

Action	Count
Registered on the IMPAWATT platform (SQ001)	64
Had an energy check or small audit in your company (SQ005)	21
Participated to or watched a webinar (SQ002)	21
Had a capacity building action and/or energy awareness raising session in your company (SQ003)	13
Used the content of the platform for self-training (SQ008)	32
Participated in an online workshop on energy efficiency measures and/or energy culture (SQ010)	14
Had a capacity building action and/or energy awareness raising session in a common training session with other companies (SQ004)	13
Deployed the survey on energy culture in your company (SQ007)	16
Participated in a workshop in your company on energy efficiency measures and/or energy culture (SQ006)	15
Used the content of the platform to train other employees (SQ009)	9

Table 6 Companies response regarding the actions they benefited from.

As expected, most companies registered on the platform. Then most of them benefited from an energy check. This can be explained by the fact that companies in the IMPAWATT+ group (with mostly in

general an energy check-up) were interviewed, hence had a much higher answer rate than the other ones (almost no answers).

We note that:

- 20 % used the platform for self-training
- 12 % to train colleagues

5.3.3 IMPAWATT online platform

Users were asked to rate the correspondence of the following statements (from 0 not at all to 5 totally) with the following results:

Question	Mean	Standard deviation
I found the information I needed	3.8	0.8
The content was useful	3.6	0.8
The proposed content by default corresponded to my needs/profile	3.4	0.9
The navigation is easy	3.5	0.9

Table 7 Impact assessment survey responses regarding the usability of the platform.

The users were asked to order by priority of usefulness the different parts of the platform, website and other project channels.

PowerPoint presentations were ranked as first by 26 % of the responses followed by Factsheets and Tools (by about 14 % each).

5.3.4 Capacity building actions

Only users that checked one of the capacity building action accessed to those questions (28). Following the survey answers, 491 persons had a higher knowledge.

The usefulness of the capacity building action was rated as following:

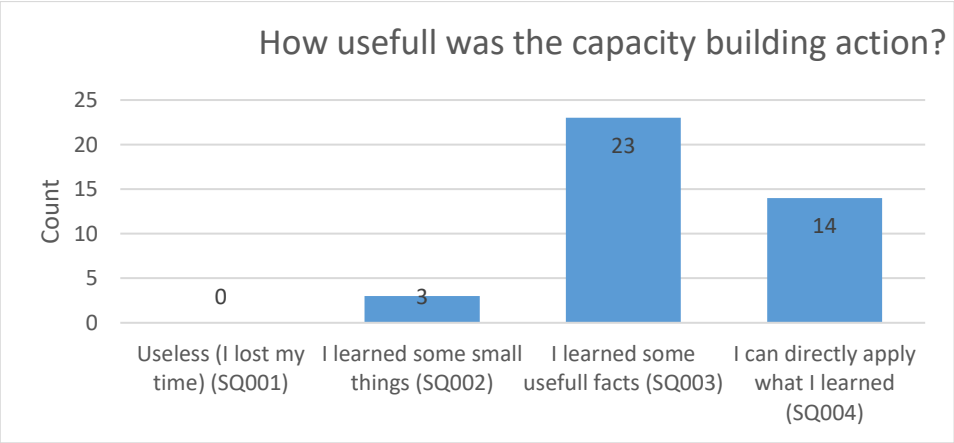


Figure 2 Impact assessment survey responses regarding usefulness of the capacity building actions.

As seen in Figure 3 below, energy managers and technicians have benefited the most from capacity building activities:

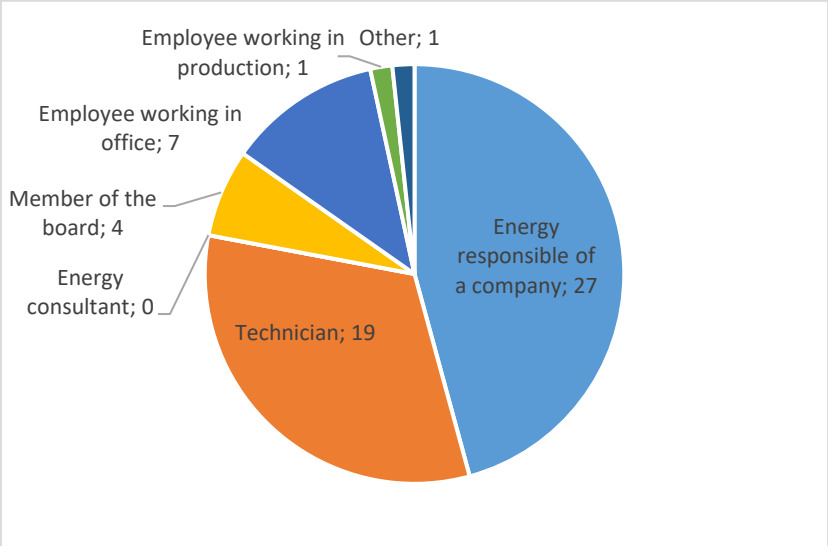


Figure 3 Impact assessment survey responses regarding the type of persons that benefited from the capacity building actions.

5.3.5 Impacts

In average 2.5 new energy efficiency measures were found per Company/site thanks to the IMPAWATT program. The standard deviation value was 2.1.

The energy check-up was also considered as useful with an average rating of 4.2 on scale from 0 to 5. Almost the same average ranking (4.1) was found for the rating if the company was encouraged to be more active in energy efficiency.

An average of 0.7 measures were implemented thanks to the IMPAWATT program.

5.3.6 Comments and general feedbacks from the interviews

Switzerland

All companies were satisfied of the energy audit and found it very useful. Some measures could be directly applied. However, especially because of the COVID context, measures with investment were not implemented in 2020

Regarding the platform, several users said that they had no time to use the content of the platform even if they found the concept useful. A feedback was that on such topic they prefer to subcontract specialized companies which already have this knowledge and therefore not necessarily need to use the IMPAWATT platform.

One user found the Webinars very interesting.

Germany

In Germany, the platform and its content have been accepted quite well by the companies that took part to the survey. Especially the presentations were considered as very useful followed by the best practices and checklists. Regarding the usability of the platform, the following improvements were suggested by participants of the survey:

- Platform could be slimmed down a bit, especially the landing page and the text on the energy culture and energy efficiency pages. Direct hyperlinks in the text leading to measures would be useful.
- Assistant guiding through the platform would be good instead of the “get started box” with pdf guidance.
- Summary of parameters which are most important for each technology.
- Overarching registration and benchmarking for all sites in the monitoring section would be desirable.
- Energy efficiency in medical practices would be another topic.
- Monitoring section somewhat complicated, especially to fill in the energy savings of single measures and their return times as very often a bundle of measures is implemented and only the summary of savings is available in the energy bill. The buttons (measures) “planned” or “implemented could be supplemented by new category "recommended”.

Finland

Finland will be investing big efforts to ensure that the country is carbon neutral by 2035 and carbon negative soon after that. The Government is committed to reforming the climate policies of the European Union and Finland to limit the rise in temperature. Regarding EU’s long-term climate measures Finland will tighten the emission reduction obligation for 2030 to at least 55 per cent below the 1990 emissions level (https://valtioneuvosto.fi/en/marin/government-programme/carbon-neutral-finland-that-protects-biodiversity#:~:text=Finland%20will%20achieve%20carbon%20neutrality%20by%202035&text=Finland%20aims%20to%20develop%20the,below%20the%201990%20emissions%20level.)

During the workshops, the company staff were quite aware of the need for energy efficiency and gave positive feedback that the platform was a good initiation for widespread knowledge distribution. Some of the received feedback is as follows:

- The produced material could be beneficial for schools and training institutions.
- The Energy Culture survey received very positive comments, perhaps because the people were very eager to find the end result and also assess their own lifestyles.
- The navigation of the platform takes time to understand but it is easy to learn.
- It is easy to download the material and read it later.

Austria

The platform is considered as a useful tool for providing information on efficiency in general terms to better understand specific problems, especially for technicians and management on site. This is important for motivating for ongoing monitoring and optimization and not just repairing afterwards. Comprehensibility for everyday life is important!

Especially the quizzes were highly welcome because the combine training content with fun elements.

Several companies used the platform material for their own use and distributed to employees. They considered as very powerful.

One big company developed a company-wide training based on IMPAWATT content with an internal training platform. In general, this contributed significantly to the standardized maintenance and repair plans and procurement specifications within the framework of energy management.

On the other hand, another big company considers the platform itself as not necessarily suitable for the general public or for a lot of people in a big company.

But all companies, believe that the on-site activities made a lot of sense. Therefore, the on-site training is essential for the success of this project and should be intensified. Specific suggestions as made during the on-sight visit are of more help than general platform recommendations.

One company stated, that it is difficult to organize a central capacity building activity (as quizzes) for different kind of personal: energy manager, technician, office workers and cleaning personal.

In several cases, the difficulty to find the documents was mentioned and that the navigation on the platform is not easy. In one case it was suggested to improve the powerpoint presentations, esp. the wording**.**

Italy

The companies which answered to the survey were quite satisfied of the energy check-up received (50%) and declared that the support received encouraged them to work on the energy efficiency topic (60% of respondents). PowerPoint presentations, fact sheets and energy culture survey were considered as the main interesting and useful documents available on the platform.

The IMPAWATT platform was considered easy to use.

The webinars and workshops were in general more welcome and popular than the direct access and use of the platform, even for the enterprises which registered and created their account. This leads us to believe that it could be appropriate to take in account the possibility to use multimedia tools also to transfer and introduce the most technical contents. Such users looked for direct use contents without the need for further content processing.

France

On the one hand, the vast majority of companies found the platform helpful. They considered that the overall content was pertinent, and found the information they were looking for.

As for the type of content they rated as most helpful, power-points and information sheets stand out.

However, people were more critical about the default content suggested by the platform, and thought the navigation on the website could be improved.

On the other hand, each company that answered the survey has found on-site energy audits, and/or workshops to be very helpful. They also thought it was a good way to encourage people to do more for energy management.

Finally, in general, we can see that companies that both registered on the platform and were accompanied enjoyed the audits and workshops better than their experience on the platform.

6 Platform and content use

In order to download most of the content, users had to register. About 325 users registered on all national portals. 225 of them filled in the company profile (which would be the regular registration process). Finally, 42 companies filled the additional data part where they can add energy consumption data and indicators. The country repartition of the users that registered with company profile are showed on Figure 4. We see that most users came from the partners countries. This number is higher than in Table 2 (172) where only companies that were in one of the two pilot groups were counted. Here all registered users are counted[2] including energy consulting companies, universities and companies that registered without explicit invitation from the partners.

[2] Except test accounts

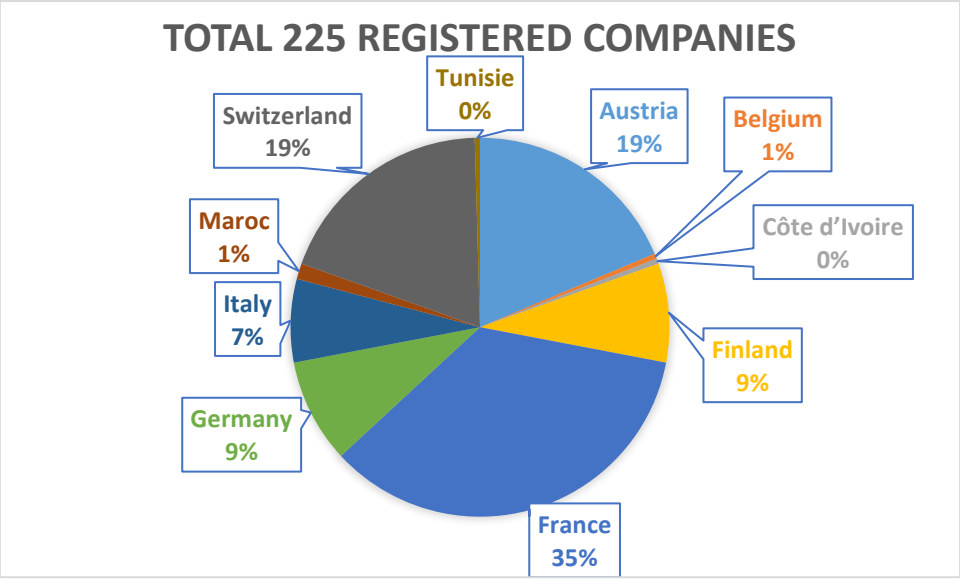


Figure 4 Country repartition of the IMPAWATT users that registered with company profile.

Figure 5 shows the cumulated content downloaded since the launch of the platform per national portal. It is interesting to see that since the lockdown in Spring 2020, the downloads rate increased. Switzerland had most of the downloads especially thanks to 3 single users who together downloaded more than 800 content items as seen at the top of Figure 6. The median downloaded content per user was 3, however the mean was 13. This means that half of the users downloaded 1 to 3 content and a smaller part downloaded a lot of contents. A detailed analysis revealed that those "high content consumers "worked either in an academic or an engineering company.

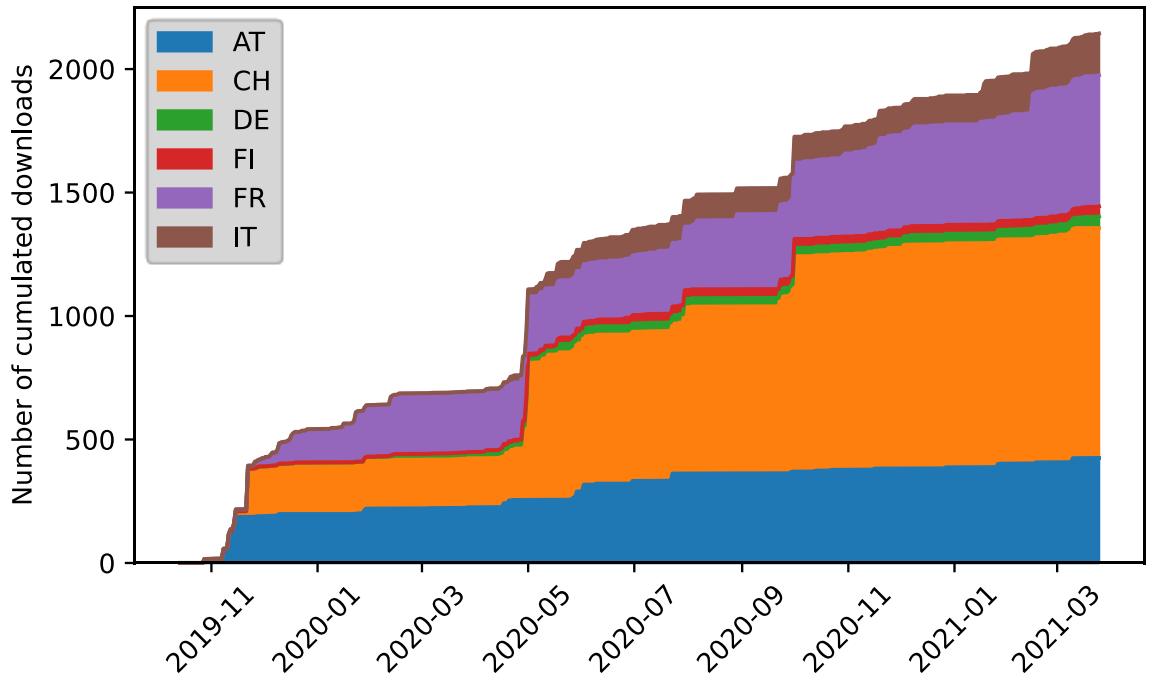


Figure 5 Cumulated content downloads

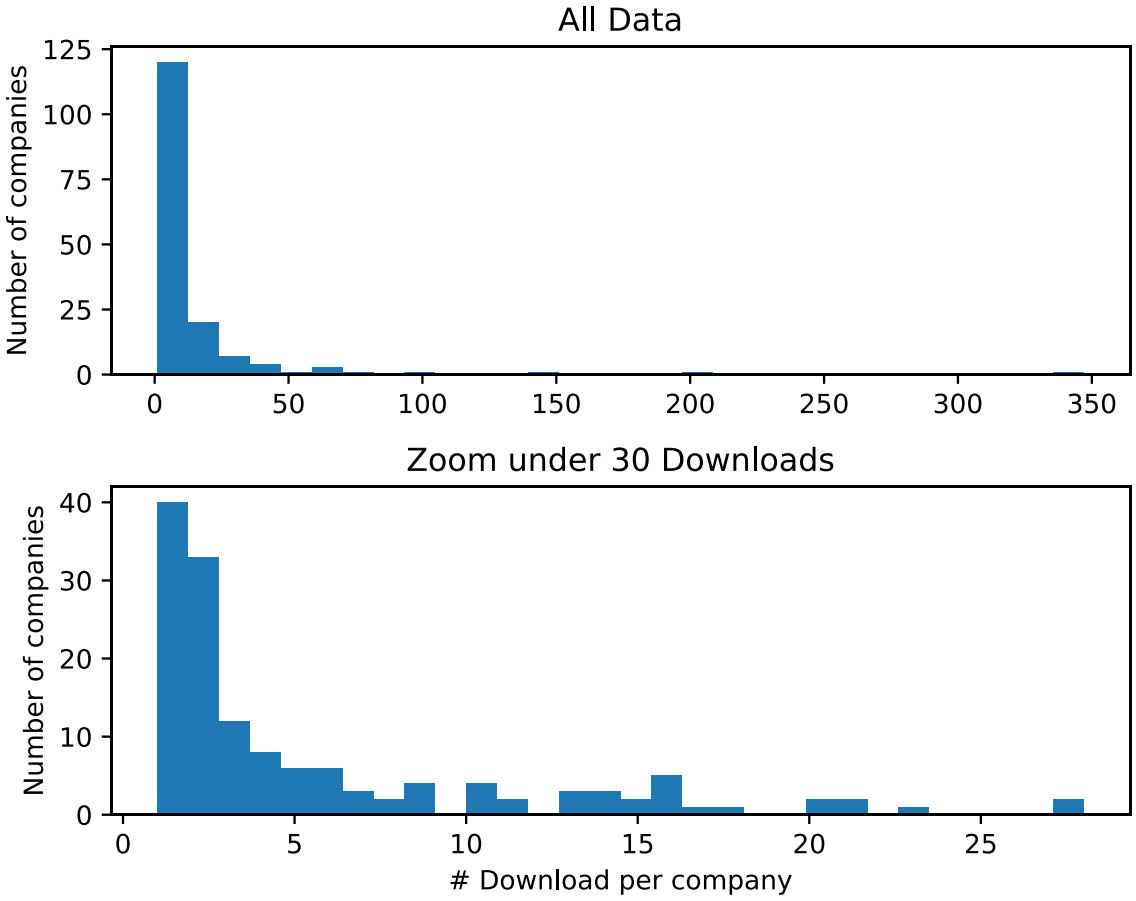


Figure 6 Download statistics per company. On top the whole sample and on the bottom a zoom for under 30 downloads.

Table 8 shows the 20-platform content that where most downloaded. The 4 first content are PowerPoint presentation.

Content title	# downloads
Benefits of energy efficiency - How to convince management/employees - Energy Efficiency as strategic decision	54
Benefits of energy efficiency - How to convince management/employees - WHY ENERGY SAVING IS IMPORTANT	46
Compressed air	39
Organize workshops where employees learn to know the energy targets of company	36
Reduction of compressed air leakages	36
Benefits of energy efficiency - How to convince management/employees - DIFFERENCE BETWEEN ENERGY AUDIT AND ENERGY MANAGEMENT SYSTEM	34
Benefits of energy efficiency - How to convince management/employees - ADVANTAGES OF ENERGY MANAGEMENT SYSTEMS	29
Use visualization to inform about energy waste or increased energy consumption	29
Establish procurement criteria	26

Reduction of cooling load	26
Allow easy ways to save energy	25
Benefits of energy efficiency	25
Heat recovery (compressed air)	24
Photovoltaic plant	24
Benefits of energy efficiency - HOW TO CONVINCE MANAGEMENT AND FINANCIAL DEPARTMENT OF ENERGY EFFICIENCY PROJECTS	23
Cooling Systems	23
Lighting Systems	23
Monitor energy consumption	22
Office	22

Table 8 Most downloade content

The two first content were classified such that they were proposed at first in the list.

We note that:

- if a content is proposed first, it is also more likely downloaded (the case for the Benefits of energy efficiency series).
- PowerPoint presentations on technical subjects such as compressed air attracted interest.

The most downloaded PowerPoint presentation has the title: “How to convince management/employees - Energy Efficiency as strategic decision”. Which could for instance be a hint that this is a major concern for platform users (which are mostly energy responsible of companies or technicians) and hence, the management could be a barrier for measure implementation.

7 Energy efficiency measures

7.1 Methodology

The efficiency measure part of the platform allows for each company to build a list of measures as shown in Figure 7.

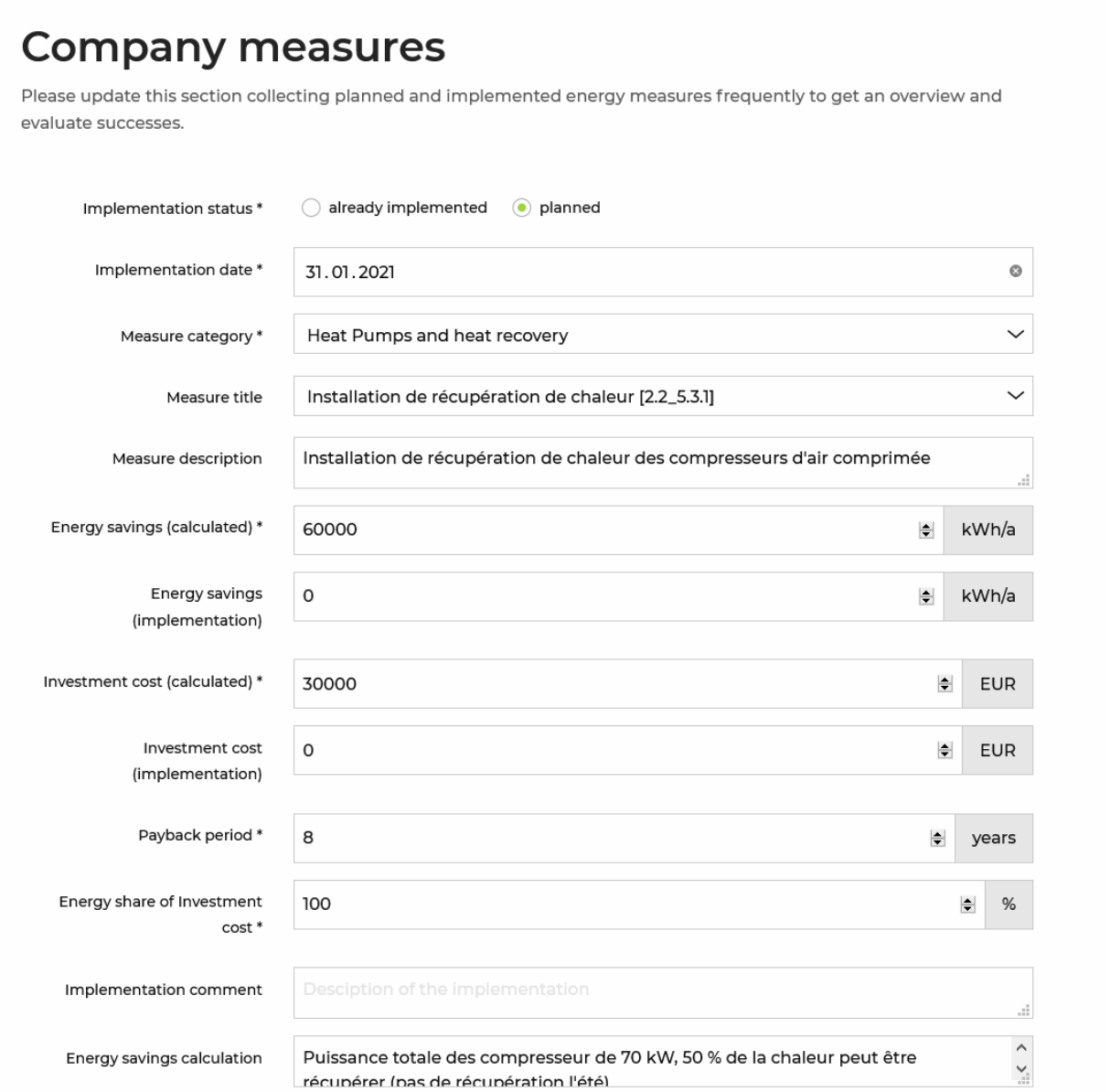


Figure 7 Energy efficiency measure input form

For each measure, energy savings and investment can be entered for the planned state ("calculated") and for implementation as sometimes savings changes during implementation. In general, the energy auditor or the IMPAWATT project partner calculates the impact of those measures. However, some companies filled themselves those data. If the implementation status is "already implemented" the energy savings are counted as impact, otherwise as potential impact. During the analysis, it was seen that some companies entered measures that were already planned and implemented before the project. Hence those measures were removed manually.

The precision of those calculation depends on the information available and the type of measure. It ranges from relatively precise estimations in the range of less than 20 % of incertitude (e.g. reduction of compressed air pression) to higher uncertainties (e.g. adding an energy monitoring systems with savings calculated as 2 % of the total energy consumption). However, the calculation is always based on the specific case.

This methodology was applied to all countries except for France which had his own system.

7.2 Results

7.2.1 Planned measures

Country	Number of measures	Calculated energy saving [kWh/a]	Investment [€]
AT	17	989 471	278 104
CH	37	1 539 950	3 178 855
DE	4	271 600	162 850
FI	16	4 173 040	5 532 048
IT	18	3 386 706	2 234 058
FR	118	1 381 433	-
Total	210	11 742 200	11 385 915

Table 9 Planned energy efficiency measures per country.

For France, investment cost was generally not recorded.

7.2.2 Implemented measures

Country	Number of measures	Calculated energy saving [kWh/a]	Investment [€]
AT	10	132 540	54 294
CH	8	370 576	675 000
DE	8	1 563	120
FI	1	66 905	101 400
FR	0	-	-
IT	1	132 540	-
Total	**28**	**571 584**	**830 814**

Table 10 Implemented energy efficiency measures per country.

7.2.3 Most planned and implemented measures

Data for France are shown separately.

Measure type	Counts
Compressed air	24
	24
Fans Heating of buildings and envelope	19
Lighting	17
Renewables	14
Energy management	13

Cooling	11
Pumps	10
Left empty	9
Mobility	8
Heat Pumps and heat recovery	3
Steam	3
Office	2
Hydraulic and insulation of pipes	1

Table 11 most planned and implemented measures.

7.2.4 Measures with highest savings (planned and implemented)

Only the measures with highest impact are described.

Measure type	Saving (kWh/a)	Counts
Renewables	4 436 428	14
Heating of buildings and envelope	4 058 219	24
Cooling	807 080	11
Fans	710 004	19
Lighting	587 458	17
Compressed air	527 157	24

Table 12 6 hight total IMPACT measures (planned and implemented).

7.2.5 Measure statistics for France

Measure type	Counts	Savings [kWh/a]
Energy management	43	898 878
Lighting system	20	214 250
Compressed air	16	130 620
Buildings	8	3 500
Cooling system	6	84 500
Hot water	5	210
Process	5	
Heating	4	36 400
Other equipments	4	3 225
Mobility	3	9 850

Ventilation	2	
Air conditioning	1	
Transports/handling	1	
Steam	0	
Total	**118**	**1 381 433**

Table 13 Separate statistics for France.

Note that here energy savings are only calculated for 70 % of the measures in this case.

7.2.6 Payback Time

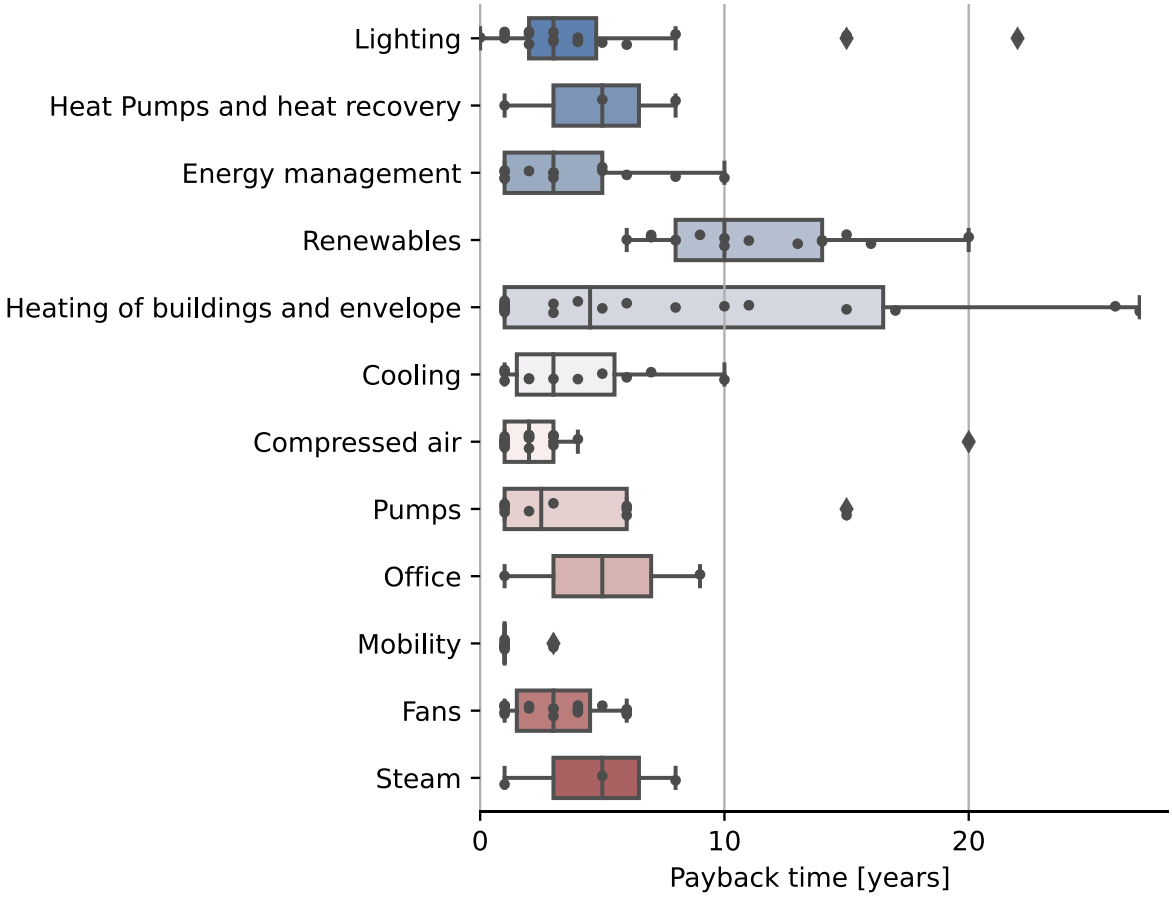


Figure 8 Boxplot: Payback time distribution of the energy efficiency measures entered on the IMPAWATT platform (no data for France) per technology. Note that for heating of buildings, 4 points have a higher payback time than 27 years (from 27 to 75 years). The line in the middle is the median. Each point represents one measure.

Low payback time measures are mostly actions that need only changes of set points. It is also important to know that some technologies have several measures. For example, heating of building and envelopes technology comprise measures such as insulation of buildings envelope (high payback) but also optimisation of setpoint (heating curve, timers, …).

7.2.7 Analysis

At the end of the project, about 12 348 MWh/a of energy savings were found. From them 571 MWh/a were implemented during project (from October 2019 to March 2021). In addition to classical barriers for implementation (see deliverables 1.1 and 1.2), the planning uncertainties due to COVID was a main

factor. However, as the median payback time value for all measures[3] reaches 3 years, it is foreseen that a higher part will be implemented soon.

Some key findings are:

- Compressed air was one of the most used measures. Compressed air was already a topic used in a lot of capacity building actions (see deliverable 6.5). The relatively low payback time of most measures (see Figure 8) contributes certainly to the success of this measure. For this technology the easy and low payback time measure "Optimisation of the pressure in the system (compressed air)" was the most used. However, in term of impact the effect is ranked at the 6th place.
- Heating of buildings and envelope was also a frequent measure. Moreover, it is the technology with the highest energy savings. Insulation of buildings envelope and optimisation of setpoints were the two most proposed measures for this technology. Due the diversity of measure types and nature of those, the span of the payback time was very large.
- Renewable was in the proposed measure with highest total energy savings. Almost all measures consisted of the installation of photovoltaic panels. Only one measure was adding a solar thermal plant. The median of the payback time reached 10 years.

Regarding renewables, 78 MWh/a of production could be implemented during the project duration.

8 Monitoring

Energy monitoring was only used in Switzerland. It was deployed 4 times. Energy meters were installed on several high consumers like production tools or CNC machine tools, but also on compressed air and cooling systems. The energy consumption was then recorded in 10 minutes timesteps for 1 week to some months depending on the case. The energy monitoring equipment was lent to the companies.

The data was then analysed to find energy savings measures. Most measures found were reducing the standby consumption. Figure 9 shows an example, in a company where 9 consumers were measured separately (cooling machine, compressor and 6 production machines). The figure shows the result in for the total site consumption.

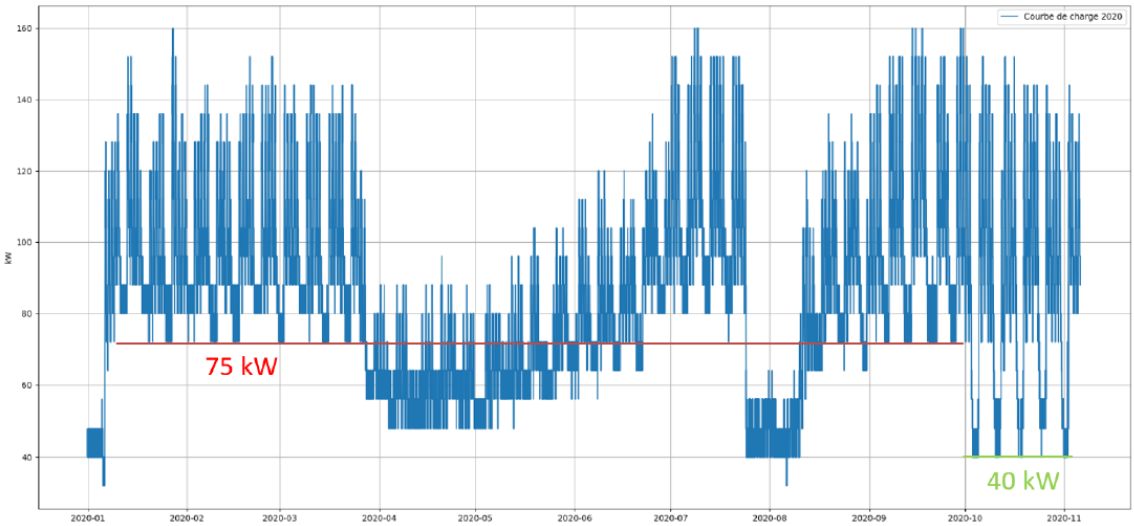


Figure 9 Result of energy monitoring action in a medical micro precision company. The standby could be massively reduced during the night thanks to the submetering results.

[3] Without France data.

Thanks to those measures 80 000 kWh/a could be saved with almost no investment. Energy savings were confirmed only for this case, in the other cases, either the measure was not implemented during the project or the monitoring material was removed before the implementation.

All measures found and calculated thanks to the energy monitoring were entered with the other measures on the IMPAWATT platform.

Energy monitoring allowed to find more measures than classical energy check-ups, specially to identify standby consumptions. Moreover, energy savings calculations were more precise thanks to the monitoring. The companies are very interested by those tools allowing them to visualise and quantify energy consumption. One company already equipped itself with an energy monitoring tool after the IMPAWATT actions.

9 Impact summary

Project Performance Indicators	Planned	Implemented
Energy savings triggered by the project within its duration[4]	12 348 MWh/a	571 MWh/a
Renewable Energy production triggered by the project within its duration	4 436 MWh/a	78 MWh/a
Market stakeholders with increased skills/capability/competencies on energy issues	1449	
Cumulative investments made by European stakeholders in sustainable energy	11 385 935 €	844 854

Table 14 Project performance Indicators results

The energy savings triggered by the project effectively implemented were lower than expected. Planned measures reached an interesting value of 12 GWh/a, about 20 % of the planned energy savings have payback times below 4 years and 50 % below 8 years. Taking into account that the biggest savings (65% of the energy) came from renewable production and heating of buildings and envelope, topics where higher payback time are acceptable, we are confident that a large part are interesting for the companies. Note that if the actions began in October 2019 and finished in March 2020, most audits were made in 2020, letting only short time to companies to implement the measures.

The number of people with increased skills on energy issues is almost two times higher than the objective. This success is particularly due to the webinars.

10 Lesson learned

The almost 1500 persons trained shows that there is an interest and real need from companies for a capacity building program in energy efficiency, energy culture and sustainable supply chain. Moreover, from the impacts and the survey results, and personal contacts with companies, we conclude that :

1. A capacity building program with a platform dedicated to support that task was considered as useful by most participant.
2. In companies, concrete actions with direct interactions with the IMPAWATT specialists such as small energy audits, capacity building workshops or webinars were the most appreciated

[4] Including renewable energy production on-site

initiatives by the companies. But due to a certain lack of time, the companies themselves used the platform less than expected, even if more than 300 registered users finally accumulated more than 2000 content downloads.

3. We can say that the platform remains an excellent and useful tool especially when it is used in the framework of complementary services such as energy check-up or capacity building programs.
4. It turned also out that the content and ease to access to customized content was relatively well rated, but did not receive an excellent grade. For a future project, more efforts should be attributed to quality than quantity.
5. The PowerPoint presentation was the most downloaded content type and was in some cases used for internal trainings.
6. The usage statistics shows that the users who download the most content tend to be specialist such as energy consulting companies or people from the training sector (e.g. university).
7. The recruitment of companies was not an easy task even if free energy audit and training were proposed. A good and professional communication is important, but even more helpful were existing contacts to companies.
8. Companies willing to participate to the IMPAWATT program were mostly already interested by energy efficiency and hence, their initial energy efficiency was already not so bad. Despite this fact, more than 12 000 MWh of additional energy savings could be found thanks to the IMPAWATT program.
9. Companies were very interested in the topics around energy culture.
10. Most platform users were either technicians or energy responsible of the companies. They were mostly interested in on “How to convince management/employees - Energy Efficiency as strategic decision”.
11. Sustainable supply chain did not generate much interest. This could be explained for instance by the fact that this topic is very specific to the type of company and the content perhaps too general and that there was only one partner with extensive knowledge on this topic.

11 Conclusion

The IMPAWATT project generated a capacity building platform with more than 200 content elements on energy efficiency energy culture and sustainable supply chain. All this content was created specifically for this project. This platform can also be used as an easy energy management tool allowing to keep track of energy consumptions and energy efficiency measures.

The IMPAWATT program was a success as 187 companies participated to the program and 1500 person were trained. The energy audits, capacity building workshops and webinars were most appreciated by the companies and rated as useful. Due to a certain lack of time, the companies themselves used the platform a little less than expected, even if more than 300 registered users finally accumulated more than 2000 content downloads.

Finally, an interesting potential of energy savings of 12 GWh/a was identified thanks to the program and 5 % already implemented, including production of renewable energy.

ANNEX

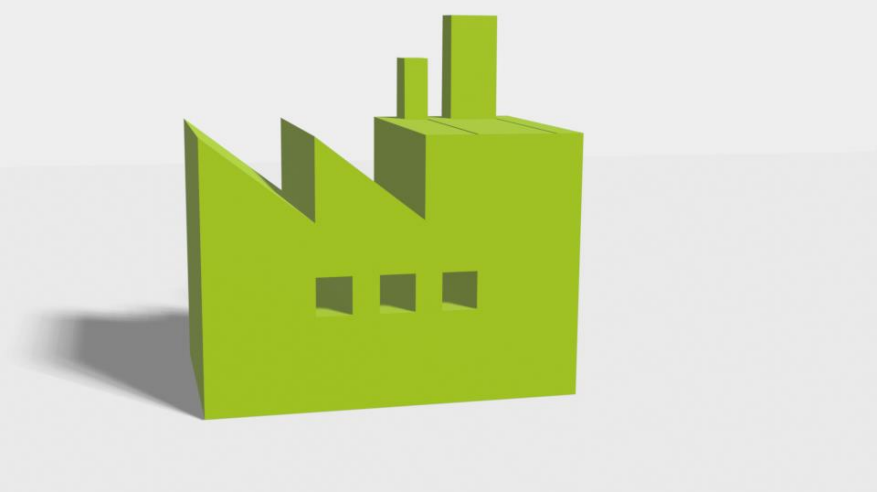
12 Measure characteristics of the IMPAWATT Platform

Following attribute were entered on the IMPAWATT platform in the measure part:

- Measure status (planned or implement)
- Implementation date
- Implementation comment
- Measure category (compressed air, cooling, …)
- Measure title
- Detailed description
- Description of the energy saving calculation
- Investment cost
- Energy part of the investment
- Planned energy savings
- Energy savings after implementation
  Planned investment cost
- Investment cost after implementation
- Payback time

13 Survey

IMPAWATT Impact assessment survey



Welcome to the IMPAWATT impact assessment survey. We would be very grateful if you can answer those question.

This survey aims to understand how IMPAWATT was used, quantify the impact on energy efficiency and capacity building as well as collect improvement suggestion.

Data policy : Only aggregated and anonymized data will be published. No personal data is asked, only company name. You shall have the right to access, to rectificate, to erase, to restrict the processing, the right to data portability and the right to object, as granted in GDPR Article 15 -22 if the data can be attributed to you. This project is based upon Article 89 General Data Protection Regulation and Regulation (EU) 1291/2013 on establishing Horizon2020.

There are 19 questions in this survey.

Company

Name of your company : *

Please write your answer here:

Size of your company *

Choose one of the following answers
Please choose **only one** of the following:

- Micro (< 10 employees)
- Small (< 50 employees)
- Medium-sized (< 250 employees)
- Bigger company (> 250 employees)

Sector activity of the site(s) that were impacted by the IMPAWATT programm *

Choose one of the following answers
Please choose **only one** of the following:

- Offices (education, insurances, Financial,..)

- DATACENTERS
- Laboratories
- TRANSPORT AND STORAGE (H)
- WHOLESALE AND RETAIL TRADE (G)
- ACCOMODATION AND FOOD SERVICE ACTIVITIES (I)
- MANUFACTURE OF FOOD PRODUCTS AND BEVERAGES (C/10-11-12)
- Manufacture of textiles, wearing apparel, leather and related products (C/13/14/15)
- Manufacture of wood and of products of wood and cork (C/16)
- MANUFACTURE OF PAPER AND PAPER PRODUCTS (C/17)
- Printing (C/18)
- MANUFACTURE OF CHEMICALS AND PHARMACEUTICAL PRODUCTS (C/20-21)
- MANUFACTURE OF RUBBER AND PLASTIC PRODUCTS (C/22)
- MANUFACTURE OF METALS AND METAL PRODUCTS and Mineral Products (C/23-24-25)
- Washing and (dry-)cleaning of textile and fur product (S96)
- MANUFACTURE OF MACHINERY AND EQUIPMENT (C/27-28)
- Human health activities (Q)
- Other

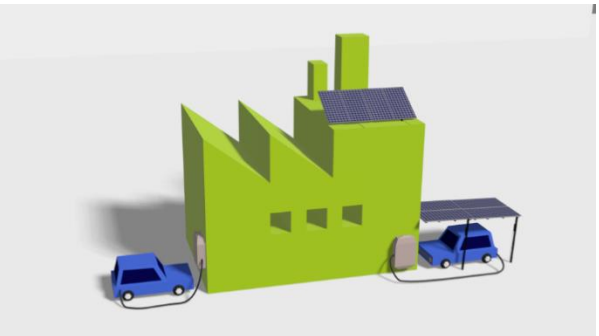
Country of the site

Choose one of the following answers
Please choose **only one** of the following:

- Germany
- Austria
- France
- Switzerland
- Finland
- Italy

IMPAWATT actions

In this group we want to know how you used or benefited from the IMPAWATT project



Which actions or activities regarding IMPAWATT did you benefits or used:

Check all that apply
Please choose **all** that apply:

- Registered on the IMPAWATT platform
- Participated to or watched a webinar
- Had a capacity building action and/or energy awarness raising session in your company
- Had a capacity building action and/or energy awarness raising session in a common training session with other companies
- Had an energy check or small audit in your company
- Participated in an workshop in your company on energy efficiency measures and/or energy culture
- Participated in an online workshop on energy efficiency measures and/or energy culture
- Deployed the survey on energy culture in your company
- Used the content of the platform for self-training
- Used the content of the platform to train other employees
- Other:

You can choose several answers

Registered on the IMPAWATT platform

Could you rate the correspondance of the following statements (from 0 not at all to 5 totally):

Please choose the appropriate response for each item:

	1	2	3	4	5
I found the information I needed					
The content was usefull					
The proposed content by default corresponded to my needs/profil					
The navigation is easy					

Please order by priority of usefulness the different parts of the platform, website and other project channels? (I you didn't use some parts juste don't add them),

All your answers must be different and you must rank in order.
Please select at most 8 answers
Please number each box in order of preference from 1 to 8

- PowerPoint presentation
- Factsheets
- Webinars
- Tools (quiz, checklists,...)
- Efficiency management part (where you can enter your own measures)
- Energy culture survey
- iESA Platform
- Energy consumptions history of your company

Any suggestions for improvements? Please describe them below.

Please write your answer here:

Had a capacity building action and/or energy awarness raising session

How many persons have a higher knowledge on energy efficiency or energy culture in your company

Your answer must be at least 0
Only an integer value may be entered in this field.
Please write your answer here:

-

How usefull was the capacity building action?

Check all that apply
Please choose **all** that apply:

- Useless (I lost my time)
- I learned some small things
- I learned some usefull facts
- I can directly apply what I learned

What was the category of person that were trained

Check all that apply
Please choose **all** that apply:

- Energy manager (or energy responsible of a company)
- Technician
- Energy consultant
- Member of the board
- Employee working in office
- Employee working in production
- Other:

Had an audits/energy checkup or workshop on measures.

How many new energy efficiency measures were found/added or improved thanks to the energy check/audit or the workshop?

Only numbers may be entered in this field.
Please write your answer here:

-

Rate the following statements from 0 not at all to 5 very

Please choose the appropriate response for each item:

	1	2	3	4	5
The energy check/audit or workshop was usefull					
The action encourage us to be more active in energy efficiency					

IMPACTS

If you don't have an answer to some of the question. Don't hesitate to contact your national IMPAWATT partner.

How many measures in energy efficiency, energy culture and LCA were discovered or updated thanks to the different actions of IMPAWATT. Please type the number of measures.

Only numbers may be entered in this field.
Please write your answer here:

-

How many measures were implemented thanks to the impawatt programm ?

Only numbers may be entered in this field.
Please write your answer here:

-

What was about the energy savings in GWh/years of all measures that were implemented

Only answer this question if the following conditions are met:
Answer was greater than '0' at question '15 [Q6]' (How many measures were implemented thanks to the IMPAWATT programm ?)
Only numbers may be entered in this field.
Please write your answer here:

-

Amount of renewable energy production triggered by IMPAWATT (did you install or plan to renewable production such as photovoltaics, solar thermal, biogas ,..), if no, add 0 otherwise how many energy will be produced in kWh/year?

Only numbers may be entered in this field.
Please write your answer here:

-

If you cannot answer this question don't hesitate to ask your IMPAWATT contact or leave it empty.

What was the total investment in sustainable energy (renewables and/or investments for energy efficiency measures) triggered by the project in €?

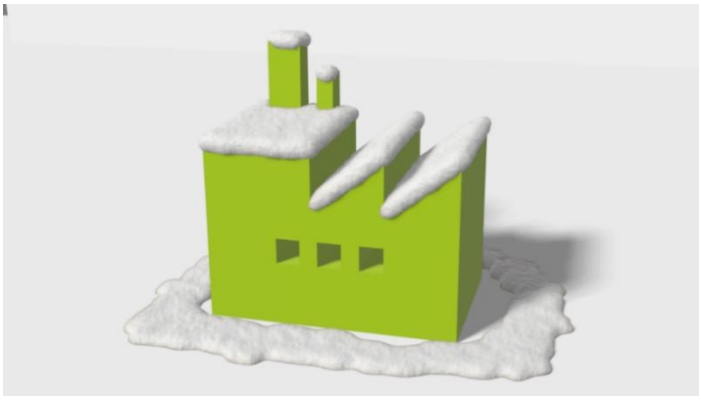
Only numbers may be entered in this field.
Please write your answer here:

-

General comment

Do you have an general comment ?

Please write your answer here:



Thank you for your time.

If you have question or additional comments don't hesitate to contact your national contact point:

https://www.impawatt.com/contact/

Submit your survey.
Thank you for completing this survey.