European Commission

Assessment and Communication of Relevant EU-funded Projects Supporting the Market Uptake of Energy Efficiency Measures in Industry and Services

Final Report

Louise Evans, Alexander Kauffman, Duncan Woods, Honj Kwon, Heather Haydock, Samantha Morgan-Price and James Tweed
May 2021

European Climate, Infrastructure and Environment Executive Agency

RICARDO

EUROPEAN COMMISSION

The European Climate, Infrastructure and Environment Executive Agency (CINEA)
CINEA.D - Natural resources, climate, sustainable blue economy and clean energy
CINEA.D.D1 - LIFE Energy + LIFE Climate

Contact: Filippo Gasparin

E-mail: filippo.gasparin@ec.europa.eu

European Commission
B-1049 Brussels

Assessment and Communication of Relevant EU-funded Projects Supporting the Market Uptake of Energy Efficiency Measures in Industry and Services

Final Report

The European Climate, Infrastructure and Environment Executive Agency
Horizon 2020

2021 EUR EA-03-21-101-EN-N

The printed version of this report is printed by Fine Print Services Ltd in United Kingdom

PRINTED ON RECYCLED PAPER

PRINTED ON PROCESS CHLORINE-FREE RECYCLED PAPER (PCF)

Manuscript completed in May 2021

1st edition

Note: Issue 1 was updated on 05/08/2021 to create a print ready version, which involved changing the front cover picture. No other material changes occurred at this point.

LEGAL NOTICE

BOOK	ISBN 978-92-9460-430-9	doi: 10.2826/299768	EA-03-21-101-EN-N

Luxembourg: Publications Office of the European Union, 2021

Executive summary

The aim of this study, which has been prepared by Ricardo on behalf of the European Climate, Infrastructure and Environment Executive Agency (CINEA), is to evaluate the impact of 41 projects receiving funding from the Intelligent Energy – Europe II (IEE-II)[1] programme (2007-2013) and the Energy Efficiency calls within the Horizon 20202 programme (2014-2020).[2] The 41 projects sought to increase the market uptake of cost-effective energy efficiency measures within the industry and services sectors.

Ricardo evaluated 41 energy efficiency, coordination and support activity projects based on data from the submitted reports and publicly available information. For each project, the study team established and examined the intervention logic i.e. mapping the activities of the projects, the outputs and the achievements. This involved a review of the projects' own estimates of the Key Performance Indicators (KPIs) that resulted from projects' activities. The KPIs that were examined across the projects included primary energy savings, greenhouse gas savings, investment triggered, market stakeholders with increased skills on energy issues and (for some earlier projects) renewable energy generated. These KPIs were examined both for 'during project lifetime' and 'after project lifetime' impacts.

Alongside this work, an online stakeholder survey was conducted, focusing on current and future priorities. The survey sought to identify market stakeholder views on the market priorities and content gaps to accelerate the energy transition of the industry and service sectors, with a particular focus on Small and Medium Enterprises (SMEs).

This study describes the findings from the quantitative evaluation of the impacts and achievements of the 41 energy efficiency projects, combined with the learnings from the survey, and the stakeholder interview phase of the work. Here is presented the final results, lessons learned and conclusions and recommendations.

At the end of 2020, 33 of the selected projects were complete (26 IEE, 7 H2020), and 8 H2020 projects were ongoing. This study draws on the reported activities of the completed projects and the latest available information from the ongoing projects up to end December 2020.

Over 4.5 million people across Europe were reported to have been reached by the 41 projects. More direct interaction was achieved through over 1,100 workshops and events run, involving over 32,000 participants. The projects produced 368 good practice guides, case studies and fact sheets, 598 written articles, 51 tools and platforms and 59 roadmaps/strategies. Furthermore, the projects trained over 10,000 people and undertook over 3,500 energy audits.

The aggregated key performance indicators of the project portfolio that had reliable and acceptable calculations (36 projects) were that through activities conducted within the project lifetime, such as the provision of audits, training courses, the creation of benchmarks, these projects achieved:

- 1,754 GWh/year primary energy savings
- 586 ktCO_2/year greenhouse gas reduction
- €232m investment triggered
- 39.2 GWh/year of energy was saved per €m of funding.

Including additional non-energy benefits in pay back calculations could heavily reduce the overall payback period(potentially halve it), increasing total annual cost savings from €89.4m to €178.8m

Aggregated project impacts generated after the project lifetimes, revealed similar levels of impacts, but from only 12 projects for which reliable or acceptable estimates could be made.[3] The projects had achieved, or are expected to achieve:

- 1,737 GWh/year primary energy savings

[1] See https://ec.europa.eu/energy/intelligent/projects/
[2] See https://ec.europa.eu/programmes/horizon2020/en
[3] These 12 projects with reliable and acceptable after project lifetime impacts are likely to have selection bias and to be not fully representative of the full cohort.

- 511 ktCO_2/year greenhouse gas reduction
- €225m investment triggered
- 68.9 GWh/year of energy saved per €m of funding.

It must be borne in mind that calculating the impacts of these market up-take type of projects, where activities include provision of training, benchmark development, knowledge sharing and policy development, is challenging. Such calculations often rely on incomplete implementation data from participating companies and each project will likely have a wide variety of impacts. The real-world savings achieved are likely higher, as only activities that could be potentially quantified have been included in the calculations. Activities including awareness raising achieved through events, websites and knowledge building and sharing has been excluded as unquantifiable for example, but will likely have had a positive impact. Policy projects may have large after project lifetime impacts but there was often insufficient evidence available to enable assessment of these impacts as reliable or acceptable. In general, although most projects expected significant activity to continue after the end of the funded project and based their after project lifetime impact estimates on this expectation, evidence from interviews suggests this was rarely the case, and hence only a relatively small number (12) were judged as reliable or acceptable and included in the after project lifetime impacts.

Lessons Learned and Conclusions

The study has identified a number of lessons learned and conclusions resulting from the investigation of the achievements and impacts of the 41 evaluated projects, including from the project participant interview phase. Key ones are outlined below.

Projects found it challenging to engage SMEs in exploring their energy efficiency potential, both the initial recruitment to participate and then ongoing involvement. This may be due to a lack of knowledge and awareness of the benefits of energy efficiency, due to a lack of appropriate energy data, but may also stem from energy efficiency improvements not being considered as a strategic investment by decision makers.

Projects often did not have detailed information on impacts achieved after the end of the project. This was in some cases due to challenging project timetable, a lack of reported data and also a reflection that the timelines over which companies to make investment decisions did not align with project timelines.

Economic incentives alone are often not sufficient to incentivise companies to act, and more recent projects show a shift in focus from purely cost savings to seeking to understand behavioural barriers and other motivations in SMEs. Projects highlighted that to achieve successful implementation someone within a company must be responsible for taking the energy efficiency strategy forwards, and that SMEs may need considerably more support over a longer period of time to facilitate actual implementation of measures.

Project consortia indicated that they benefitted greatly from collaboration with partners that have different expertise, work in different sectors, have knowledge from different parts of the value chain or different geographies. It was strongly felt that long standing partnerships were the core of successful project delivery, with innovative partners bringing new elements. Projects also benefit from knowledge sharing and synergies between themselves.

These 41 projects have had a significant impact on the energy efficiency and energy audit market in Europe by addressing many of the barriers outlined in Section 3, and the lessons presented above indicate that there is significant potential for further improvement. A key market barrier, often underpinning the challenges highlighted above, is the lack of information or knowledge in specific sectors. Many projects sought to address such gaps, building on direct interaction with the sector and energy efficiency experts to develop benchmarks and tools that enable companies to identify their potential for energy savings.

A further barrier is the lack of financing available and this has been addressed through projects establishing performance benchmarks for energy efficiency measures alongside best available techniques which can provide Energy Service Companies (ESCOs) and banks with more certainty over the potential return on an investment. This facilitates the financing of energy efficiency measures within

SMEs and creates sustainability of the project impacts. The long payback time of some energy saving measures was addressed, with a recent focus on recognising non-energy benefits, such as reduced maintenance costs, improved safety and the potential for revenue growth through having a stronger value proposition potentially having a significant positive impact on payback period.

Behavioural barriers hindering companies from investing in becoming more sustainable include a lack of commitment or resource from senior levels, a lack of interest and a reluctance to disrupt current operations. Essentially these reflect that energy efficiency's strategic value is not recognised. More recent projects have particularly focused on developing detailed insights into the wider benefits of improving energy efficiency and forging an energy culture within a company that generates a willingness to continue pursuing energy efficiency beyond a momentary project interaction.

The drivers for action seen within companies included the desire to save energy and the associated costs, as well as responding to the need to stay competitive within their field, providing the company with a green USP (unique selling point), responding to supply chain pressures and in some cases recognising the wider non-energy benefits. Many projects revealed that participating companies had reported benefits of recognising energy efficiency beyond a financial decision.

Recommendations

This study has also developed project level and programme level recommendations for the consideration of project participants, programme managers and policy makers. These recommendations outline steps to address the aforementioned barriers and propose additional approaches that may have a positive impact on encouraging the uptake of energy efficiency measures in industry sector SMEs and other companies.

Recommendations at project level

Good impact data is necessary to reliably measure success. While this is challenging, both in terms of what is available from the companies involved, and in terms of project timelines, it has been shown to be possible from some projects reviewed here. Projects that had identified the data requirements at the outset, and then implemented the data collection pathway as planned were better placed to demonstrate a reliable impact. Good data starts from the companies involved in projects having the appropriate metering solutions in place, smart meters able to extrapolate timely, disaggregated and reliable energy consumption data, and extends through to projects knowing their data needs to be able to illustrate their impact.

The quality of impact data collected by projects has improved over the period these projects were implemented. Additional guidance and clarification will aid further improvements, as would sharing the common factors established and a period of discussion over impact data at project kick off with potential evaluators. Ensuring projects have their intervention logic clearly set out will help ensure the data strategy is in place, and that there is a long-term vision for how outputs will be carried forward beyond the project lifetime. A preliminary business plan of how activities will continue after the project lifetime should be outlined at proposal stage and further elaborated during the implementation phase.

Project participants noted difficulties in supporting SMEs through the implementation of measures, due to scope, budget and time constraints. This meant in some cases that valuable work done by the project did not result in energy savings. Projects should consider if they can design a mechanism that will encourage SMEs to consider energy efficiency at points after the project completion, particularly if this involves continued use of project outputs. Connecting SMEs with relevant information hubs, national funding programmes or procurement options could help to drive a higher implementation rate after the project lifetime, and offers a way to facilitate companies to the next stage of support.

Capacity building programmes continue to be an effective tool in addressing the behavioural, information and financial barriers outlined above by building awareness for energy efficiency and in supporting the implementation of measures. There are often existing methods or tools for SMEs to overcome these barriers and these should be leveraged by building capacity within and across an organisation, encouraging SMEs to take the initiative and improve their own energy efficiency and energy culture.

Recommendations at programme level

As was done through this study, evaluating projects on a programme level provides important insights into what has worked well or what could be improved in future programmes. An effective evaluation requires both good data from the projects themselves, as well as timely monitoring and evaluation. Providing clarification to projects with regards to what data should be collected would benefit both project and programme in monitoring progress and success. In parallel, a monitoring and evaluation strategy conducted by the individual projects or by a third party on a programme level could be introduced. To ensure smooth functioning, a pilot for such an approach may be useful. It is recommended that monitoring design is a focus at project/programme outset, and that evaluation is undertaken once all individual project data is available, potentially a set time after project completion through a defined data collection phase.

The value that success stories bring can be further leveraged by gathering these on a regular, pre-determined timetable, ideally within two years of the project's conclusion to ensure all the relevant information is still accessible, yet sufficient time has passed that implementation of measures has progressed.

Continued expansion of the topic of the wider benefits of energy efficiency may help to address a number of the identified behavioural barriers, and would yield further insights to expand the knowledge base.

The implementation phase of energy efficiency measures is crucial to ensure a successful outcome from a project's interaction with an SME, yet often this phase occurred after the timeline of the original project had completed. One approach to address this at a programme level is to consider a dedicated follow-up phase, either as part of the project from the outset, or as a funded extension for certain projects. This could serve to both deliver implementation advice to SMEs and to obtain accurate implementation rates. An alternative would be to consider a parallel programme that is dedicated to implementation support. This could be a collaborative effort by bodies such as chambers of commerce, for example, to link SMEs in each country to local funding programmes or relevant procurement routes. Such a programme could support SMEs in their next steps including securing funding, procurement, implementation and optimisation of the energy efficiency measures recommended by the original project effort.

Recommendations for national policy makers

Financing is a key barrier and feedback demonstrated this is a topic to be addressed at the national level. One approach that has proved promising is energy service companies (ESCOs). ESCOs can support the financing of energy efficiency measures and profit from the cost savings achieved. Such arrangements would be most effective on a national, regional or municipal level, with a focus on building trust in the approach

A financial tool that could unlock large scale investments could be the securitisation of energy efficiency loans by SMEs. The considerable risk associated with loans to SMEs results in high interest rates for SMEs. Combining the risk of these loans across a large number of SMEs can lower the overall risk profile and unlock more investment at a lower interest rate. Supporting such an initiative on a national level could be a key driver for developing the market.

Recommendations for EU policy makers

The efforts to strengthen the incentive for SMEs to implement energy efficiency measures, with knowledge and finance support, continue to be identified as necessary. One approach to providing implementation support would be to strengthen the synergies between EU programmes, including the LIFE programme, through structural funds to foster the specific implementation of the recommended energy saving measures identified during a project. Financial support to SMEs may be most appropriate at the MS level, and the EC could support this by sharing best practice examples from the national level as it has for other energy efficiency priorities,[4] and through targeted support from the European

[4] Feasibility study to finance low-cost energy efficiency measures in low-income households from EU funds, 2016, https://ec.europa.eu/energy/sites/default/files/documents/low_cost_energy_efficiency_measures_-_final_report.pdf

Investment Bank (EIB).[5] This might involve partnerships between the EIB and commercial banks in Member States to offer credit lines specifically targeting energy efficiency in SMEs, enhancing existing EIB activities.[6] For example, low or zero interest rate loans could be made accessible to SMEs that have had an audit, and the support could be delivered as part of a revolving fund to ensure the sustainability of the finance.

A further aspect to consider is how to leverage large companies' aims for sustainable supply chains and recent projects consider this and will likely yield interesting results.

One of the key findings was that although projects generate a large amount of outputs and learnings, these are not always readily accessible after the project lifetime. Creating a knowledge hub to hold such outputs would ensure that outputs remain accessible to a wide audience. The benchmarks and best practice guides developed for different sectors could be offered through such a hub, as could the success stories. Providing a centralised hub would offer companies and wider institutions, such as chambers of commerce, a one-stop-shop for energy efficiency information, all generated by the projects to date.

[5] SMEs and mid-caps, https://www.eib.org/en/about/priorities/sme/index.htm and When 'low-energy' is not an insult https://www.eib.org/en/cartoons/smes-energy-efficiency-finance#

[6] Cleaner laundry for the Czech Republic, https://www.eib.org/en/podcasts/czech-energy-efficiency-laundries-pragoperun.htm

Table of Contents

Table of Figures

Table of Tables

1 Introduction

The objective of this project was to collect evidence on the role that the IEE-II programme (2007-2013) and the Energy Efficiency calls within the Horizon 2020 played in supporting the policy implementation of the Energy Efficiency Directive as well as in fostering the market uptake of cost-effective energy efficiency measures within the industry and services sectors.

All 41 projects focused on supporting the market uptake of cost-effective energy efficiency measures among companies operating in the industry and services sectors across Europe; mainly through the implementation of capacity building programmes to overcome the existing market information barriers and to facilitate investments in energy efficiency measures. The total EU contribution granted to the 41 projects was €57.7 million, with IEE projects funded at 75% of eligible costs, and H2020 projects at 100% of eligible costs. Figure 1-1 below shows the timeline of the 41 projects considered within this evaluation, with the individual project duration, the level of funding received and the relevant programme.

To fully assess the impacts of the 41 energy efficiency projects selected by EASME, we have performed a comprehensive evaluation, largely ex-post, taking into account energy, environmental, social, economic and policy dimensions.

This is the Final Report for this work, and as such briefly describes the data gathered and methodology used for the evaluation. It focuses on establishing justifiable statements for the main achievements and impacts, together with lessons learned at project and programme level, based on evidence provided by the projects through reports and interviews.

A brief overview of the policy context is given in Section 2, followed by a literature review of energy efficiency in the industry and services sectors, focussing on barriers and drivers to energy efficiency in SMEs, as well as the role of policymaking in addressing these barriers in Section 3. Section 4 then provides very short summaries of all 41 Projects considered for context. The methodology overview is presented in Section 5 detailing the data gathering phase, the approach to assessments of reliability and the use of interviews to fill specific data gaps with the intention of promoting projects to better reliability for the final analysis.

Section 6 details our findings from the assessment performed on each of the 41 projects. Section 6.1 describes the characteristics of the different projects, discussing their activities, targeted sectors, stakeholders and geographical areas and Section 6.2 describes the activities and outputs of the full 41 projects. The impacts of these projects, clustered by completed projects and those currently underway, and further clustered by individual actions type projects and policy type projects is detailed in Section 6.3. A detailed assessment of the key performance indicators (KPIs, namely “common performance indicators” (CPIs) within the IEE programme and “project performance indicators” (PPIs) for H2020)[7] and other key outputs at project and programme level, are reported in Section 6.4, detailing the energy savings, GHG reductions, investment triggered and renewable energy triggered of those project which had been assessed as reliable and acceptable in terms of their reliability. These findings are split for impacts achieved from activities that occur within project lifetimes, and those achieved from activities after the project lifetimes. Next, Section 6.5 presents an analysis of the findings covering the common factors that can be elucidated from this analysis (Section 6.5.1) and a cross-sectional analysis of the types of activities undertaken and their impacts, as well as the geographical spread of impacts (Section 6.5.2). Finally, within the assessment work Section 6.6 details the assessment of benefits including consideration of the cost benefit analysis and multiple benefits.

Section 7 is the Success Stories, which strive to take the activities that are conducted within these CSA projects, and illustrate how these deliver their impact in reality. Most of the Success Stories profiled here focus on one project and one company that has used the project to achieve energy savings within their company. These stories give concrete examples of how the project methodologies deliver savings.

[7] CPIs measure energy-related impacts of IEE projects, namely primary energy savings, investment triggered, renewable energy triggered, and GHG emissions reductions. See https://ec.europa.eu/easme/sites/easme-site/files/guidelines-iee-common-performance-indicators.pdf
Similarly, PPIs measure energy-related impacts as well as impacts pertaining to policy and strategy development, trainings, stakeholder reach, etc. See https://ec.europa.eu/easme/sites/easme-site/files/guidelines-for-the-calculation-of-performance-indicators.pdf

Where possible detailed information has been included, although there are a number of confidentiality constraints.

Section 8 provides a summary of the Stakeholder Consultation that was conducted over the early summer of 2020, and sought to identify market priorities and content gaps to accelerate the energy transition of the industry and service sectors, with a particular focus on SMEs, to determine priority areas in the forthcoming LIFE programme (2021-2027).

Section 9 details the lessons learned, particularly from project final reporting, from the interviews and follow up discussions conducted and the learnings from the EASME Contractors Event held in 2020.

Finally, conclusions and recommendations for future projects and funding programmes are provided in Sections 10 and 11, with recommendation split between those focused at the project and programme level and those focused at the broader policy development level.

Please note that the data used in this report was collected up to the end December 2020.

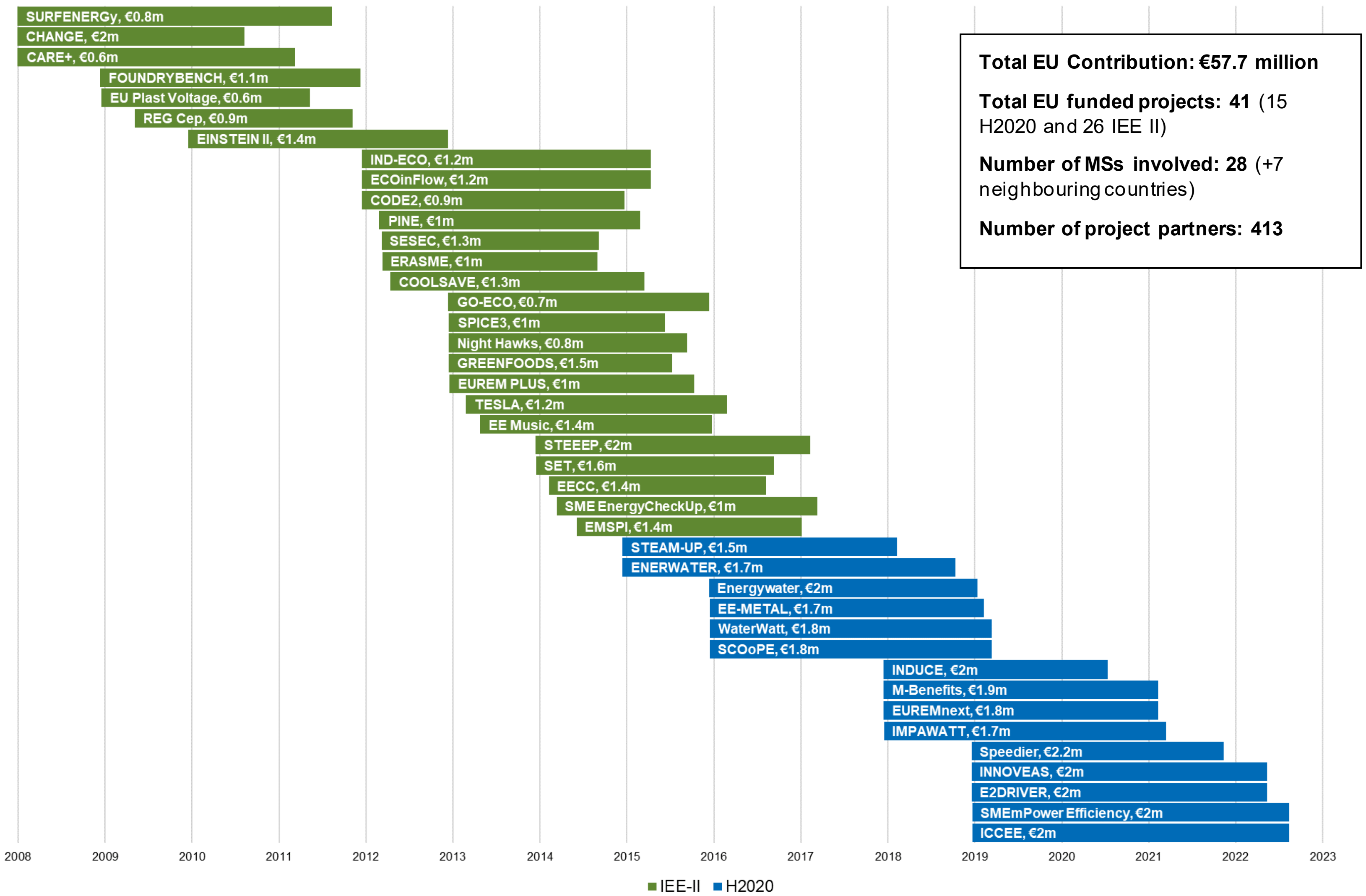


Figure 1-1: Timeline of the 41 Projects, illustrating the funding programme and the level of EU grant.

2 EU policy for Energy Efficiency in Industry

2.1 Policy context

According to its 2030 climate & energy framework, the EU aims to achieve at least 40% cuts in greenhouse gas (GHG) emissions from 1990 levels, at least a 32% share of renewable energy, and at least a 32.5% improvement in energy efficiency.[8] Meanwhile, as part of the European Green Deal, the Commission seeks to raise the 2030 target to 50-55% cuts in emissions, and to reach net-zero emissions by 2050.[9]

The EU has also adopted an industrial strategy with strong interlinkages with these ambitions, in which industry will lead the transition towards climate neutrality through increased digitalisation and competitiveness. This strategy specifically targets SMEs, which account for 50% of Europe's GDP, nearly 20% of business energy use, 2 out of 3 European jobs, and nearly all (99.8%) of the enterprises in the EU's non-financial business sector, and thereby are critical for the overall performance of EU industry.[10]

Energy efficiency in industry has a key role to play in the EU meeting its 2030 and 2050 climate targets and fulfilling its objectives under the Paris Agreement. The Energy Efficiency Directive (EED) includes requirements for Member States to implement policy measures to achieve energy savings and to develop programmes encouraging SMEs specifically to undergo and implement recommendations from energy audits[11]. In 2018, industry and services made up about 40% of the total EU-27 final energy consumption. In terms of emissions, industry and services were responsible for about 20% of total EU emissions related to fuel combustion activities.[12] However, this figure does not include the additional emissions consumed in the industry and services sector for the production of electricity.

The majority of energy efficiency measures in industrial SMEs relate to heating/ventilation/air conditioning (HVAC), compressed air and lighting. In most cases, savings by technology area range from 17-20%, with HVAC systems presenting savings values sometimes greater than 40% and averaging at about 30%.[13] However, the uptake of energy efficiency among SMEs is rather limited, with only about 33% investing in energy efficiency measures in 2019, and with higher uptake figures reported for larger companies.[14]

2.2 The IEE-II and H2020 programmes

Although a wide range of cost-effective energy-saving measures are currently available for companies, many have yet to be sufficiently deployed and taken up by relevant market stakeholders. In this regard, the lack of expertise, time and capital often prevents companies from implementing energy-saving measures or from gaining access to the energy services market. SMEs in particular face significant barriers in implementing these measures, as explored in Section 3 in greater detail. EU Programmes such as Intelligent Energy – Europe II[15] (IEE-II), Horizon 2020[16] and LIFE[17] have therefore been shaped

[8] See European Commission. 2014a. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. *A policy framework for climate and energy in the period from 2020* (/* COM/2014/015 final */). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0015

[9] See European Commission. 2019a. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. *The European Green Deal.* Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588580774040&uri=CELEX:52019DC0640

[10] See European Commission. 2019. Annual report on European SMEs. Available at: https://ec.europa.eu/growth/smes/business-friendly-environment/performance-review_en#annual-report; European Commission. 2020. Unleashing the full potential of European SMEs. Available at: https://ec.europa.eu/commission/presscorner/detail/en/fs_20_426

[11] A further description of the Energy Efficiency Directive is in Section 3. This is in the context of a review of the level of penetration of energy efficiency measures/ policy in SMEs in the industry and services sectors.

[12] See European Commission. 2019c. EU energy in figures. Available at: https://op.europa.eu/en/publication-detail/-/publication/e0544b72-db53-11e9-9c4e-01aa75ed71a1

[13] See Thollander, P. et al. 2015a. International study on energy end-use data among industrial SMEs and energy end-use efficiency improvement opportunities. *Journal of Cleaner Production 104,* 282–296.

[14] See European Investment Bank (EIB). 2020. Going green: Who is investing in energy efficiency and why it matters. Available at: https://www.eib.org/attachments/efs/eibis_2019_report_on_energy_efficiency_investments_en.pdf, and Accelerating investments in industrial energy efficiency, https://unece.org/fileadmin/DAM/energy/se/pp/geee/Copenhagen_May2018/2._S._Buttner_Accelerating_Investments_in_industrial_EE.pdf

[15] See https://ec.europa.eu/easme/en/section/energy/intelligent-energy-europe

[16] See https://ec.europa.eu/programmes/horizon2020/en

[17] See https://ec.europa.eu/easme/en/life

in response to the challenge of speeding up the market uptake of low-carbon technologies and services among companies, including SMEs, operating in the industry and services sectors.

The Horizon 2020 programme. Horizon 2020 was the EU Research and Innovation programme with nearly €80 billion of funding available over seven years (2014 to 2020). In the field of energy, the Horizon 2020 Energy Challenge was designed to support the transition to a secure, clean and efficient energy system for Europe.

Based on the ambitious EU Energy and Climate targets for 2020 and 2030, Horizon 2020 Energy Efficiency provided support for innovation through research, demonstration and commercialisation of more energy-efficient technologies and solutions. Moreover, it supported the market uptake of measures aiming at removing market and governance barriers by addressing financing, regulations and the improvement of skills and knowledge. Furthermore, the H2020 programme provided funding to support energy-efficient processes, products and services, and improve attractiveness of investments in energy efficiency.

The Industry and Services sub-area of Horizon 2020 Energy Efficiency was aimed at improving the energy efficiency of operational processes and technologies in support of the competitiveness of EU Industry and Services, taking into account the EU's energy and climate objectives. Within the industry sector, energy efficiency investments can lead to important productivity and operational benefits for companies such as the reduction of maintenance costs or the lifetime extension of equipment.

The H2020 topics designed as a response to the challenge of fostering energy efficiency within the industry and services sector were the following Coordination and Support Actions (CSA):

- H2020 Work Programme 2014-2015: EE-16-Organisational innovation to increase energy efficiency in industry *(Topic opened in 2014 and 2015)*.
- H2020 Work Programme 2016-2017: EE-15-Increasing capacities for actual implementation of energy efficiency measures in industry and services *(Topic opened in 2017)*.
- H2020 Work Programme 2018-2020: EE-08-Capacity building programmes to support implementation of energy audits. *(Topic opened in 2018 and 2019)*.

IEE-II programme (2007-2013). The Intelligent Energy – Europe II programme (IEE-II, 2007-2013) was part of the EU's Competitiveness and Innovation framework Programme (CIP). Its 7-year budget of €730 million was used to support actions contributing to secure, sustainable and competitively priced energy in all EU Member States, plus Norway, Iceland, Liechtenstein, Croatia, and the Former Yugoslav Republic of Macedonia. Most parts of the programme had been managed by the Executive Agency for Competitiveness and Innovation (EACI), now EASME.

The IEE-II programme supported actions which have EU added-value, and which aimed to develop, apply, share and replicate sustainable energy solutions with a high leverage factor in EU sustainable energy markets across disciplines and levels of governance. The overarching priority for IEE-II was to accelerate progress towards the 2020 energy targets (20% reduction in GHG emissions, 20% improvement in energy efficiency and 20% share of renewable energy).

Overall, across all sectors and since 2007, the IEE-II programme supported more than 370 projects to tackle non-technological barriers to the efficient use of energy and the greater use of new and renewable energy sources. The operational objectives of IEE-II were mainly aimed at accelerating the market uptake of low carbon technologies by leveraging investment in sustainable energy technologies.

The 'Industrial excellence in energy' key action within IEE-II aimed at empowering European industry, in particular SMEs, to become more energy efficient and at the same time to reduce operational costs, thus contributing to increased competitiveness of European Industry and to the achievement of European energy and climate targets.

Several priorities were identified within IEE-II for the industry sector, ranging from energy efficiency training and capacity building programmes to the promotion of public private partnerships fostering energy efficiency investments for SMEs as well as removing barriers to energy service companies (ESCOs) and involvement of financial institutions.

2.3 The role of the forthcoming LIFE (post 2020) programme to support the market uptake of energy efficiency measures in the Industry sector

The Commission has initiated a clean energy transition stepping away from the current fossil fuel-based energy system to a competitive and sustainable European economy based on local, renewable resources and energy efficient technologies. This is in order to reduce import dependency as well as costs for consumers. Furthermore, following the onset of the COVID-19 pandemic, the EU has decided on a recovery package (totalling EUR 1.8 trillion) and adopted its 2021-2027 budget designed to help the EU rebuild from the crisis and support investment into green and digital transitions.[18] Regardless, significant socioeconomic changes and actions will be required from private and public stakeholders.

As laid down in the European Commission's proposal[11] for a Regulation establishing LIFE 2021-2027, the support currently provided under H2020 for the implementation of capacity building activities in favour of the clean energy transition will be moved into LIFE 2021-2027, which will provide a contribution to the EU's commitments under the Paris Agreement on Climate Change along with to the Energy Union and the 2030 energy and climate objectives.

The Clean Energy Transition subprogramme will specifically offer support for capacity building, knowledge-sharing, innovation, citizen engagement, and other forms of policy support to enable Member States to meet the new stricter EU climate targets. With regard to SMEs, actions linked to the transition will include decarbonisation of industry, investments in energy efficiency, support for innovation and competitiveness, development of renewable energy capacities and infrastructure, support to the uptake of other clean energy technologies, efficient district heating and cooling systems, power, and resilient smart grid and storage infrastructure.[19]

The proposal of integrating the Clean Energy Transition sub-programme into the forthcoming LIFE Programme will enable leverage of synergies with other EU Programmes (e.g. Horizon Europe). In this regard, the new LIFE programme will continue to act as a catalyst for implementing EU environment, climate and clean energy policy as well as for speeding up the market uptake of innovative solutions within the Industry and Services sectors.

Under the LIFE budget programme, EU funding is intended to act as a catalyst, providing leverage for the integration and mainstreaming of environmental and climate objectives. As such, the types of actions supported are typically small-scale and target:

- The development and exchange of best practice and knowledge
- Capacity building
- Testing small-scale technologies and solutions (pilots)
- The mobilisation of funding from other sources.

Under LIFE, the KPIs consider the impact during the lifetime of the project, and beyond it. The impact beyond the project duration and/or area is designed to capture where scaling up of activities has occurred. Similarly, the persons affected or influenced by the project also considers those affected during the lifetime of the project and beyond it.

3 Review of penetration level of energy efficiency measures/ policy in the industry and services sectors

This section provides a review of literature on the topic of energy efficiency in the industry and services sectors, focussing on barriers and drivers to energy efficiency in SMEs, as well as the role of policymaking in addressing these barriers.

[18] See Recovery and Resilience Facility | European Commission (europa.eu)
[19] See https://ec.europa.eu/info/sites/info/files/document_travail_service_part1_v2_en.pdf

Barriers to and drivers for adopting energy efficiency measures in SMEs. The EU industrial strategy, and other EU-wide and national policy frameworks, attempt to tackle the barriers that SMEs face in adopting measures to increase energy efficiency and/or incorporate renewable energy technologies. These barriers and challenges are often specific to SMEs in that, particularly in relation to larger companies, they often lack the resources necessary to support cost-saving energy efficiency measures from which they would otherwise benefit.

Limited financing sources, in particular, can present a major external issue for SMEs, as they often do not have access to capital markets, and banks and other financial institutions are often reluctant to provide loans due to the perceived risks. SMEs tend to offer limited prospects for growth and face relatively short life cycles. Relevant energy efficiency projects are often too large for microfinance initiatives but too small for commercial banks. Securing funding for scaling up innovations, therefore, can be very difficult.[20] Furthermore, as SMEs often lack detailed financial statements and long credit histories, they can have difficulty securing loans from banks and face higher premiums. SMEs that have already established relationships with banks often face high costs to switch, and thus can end up depending on specific banks.[21]

Internal barriers for SMEs, on the other hand, can depend highly on context. In particular, Trianni & Cagno (2012)[22] suggest that barriers arising due to the "principal-agent relationship", "split incentives" and "moral hazard"[23] relate to organisational factors and ways in which key decisions on energy efficiency are made. Lack of awareness and commitment from top management, for example, can pose significant barriers.[24] Meanwhile, Trianni et al. (2012)[25] have found that barriers tend to vary with firm size and complexity of production, with small enterprises tending to face greater barriers than larger ones due to organisational issues, and foundries with simpler production being more likely to perceive barriers to be higher. In fact, several studies suggest that organisational and institutional factors may be more prevalent than economic ones in influencing the adoption of measures.[26] Perceptions of risk, which can also be considered to be a barrier, can also vary according to country, sector, technology, etc. and will likely change over time.

Skill shortages are another possible barrier. SMEs, for instance, tend to experience problems with lack of time and/or internal skills more often than larger businesses, but on the contrary may benefit from a more agile decision-making structure. Still other barriers may arise from: a reluctance to invest in building energy efficiency improvements from SMEs leasing or renting their buildings (perhaps helping to explain the large untapped energy efficiency potential in European buildings); potential disruption of day-to-day routines; and deviation from standard practices.[27] Barriers therefore depend heavily on different aspects within a firm including its procedures, processes, incentives, and daily operations. The decision-making process in an organisation, in particular, relies heavily on its overall strategy and energy culture.[28]

The Carbon Trust reports (2020)[29] that many UK SMEs make the assumption that climate policies will not affect their business. Decreasing energy consumption and meeting environmental objectives were

---

[20] See European Commission. 2019. Annual report on European SMEs. Available at: https://ec.europa.eu/growth/smes/business-friendly-environment/performance-review_en#annual-report
[21] See Nouy, D. 2018. Financing the economy - SMEs, banks, and capital markets. *European Central Bank*. Available at: https://www.bankingsupervision.europa.eu/press/speeches/date/2018/html/ssm.sp180706.en.html
[22] See Trianni, A. & Cagno., E. 2012. Dealing with barriers to energy efficiency and SMEs: Some empirical evidences. Energy, 37(1), pp. 494-504. Available at: https://www.sciencedirect.com/science/article/pii/S0360544211007237
[23] Principal agent problem: Where there are conflicting priorities between ownership and management ; Split incentives: A principal-agent problem in which those responsible for costs and those responsible for making investment decisions are different entities; Moral hazard: Where an entity lacks an incentive to protect against a risk as it does not bear the full costs of that risk.
[24] See Johansson, I. et al. 2019. Designing Policies and Programmes for Improved Energy Efficiency in Industrial SMEs. *Energies, 12*(7), 1338. Available at: https://www.mdpi.com/1996-1073/12/7/1338/htm
[25] See Trianni, A. & Cagno., E. 2012. Dealing with barriers to energy efficiency and SMEs: Some empirical evidences. Energy, 37(1), pp. 494-504. Available at: https://www.sciencedirect.com/science/article/pii/S0360544211007237
[26] See DeCanio. 1998. The energy efficiency paradox: bureaucratic and organizational barriers to profitable energy-saving investments. *Energy Policy 26*(5), 441-454.; Solnørdal, M.T. & Thyholdt, S. B. 2019. Absorptive capacity and energy efficiency in manufacturing firms - An empirical analysis in Norway. Energy Policy 132, 978-990. Available at: https://www.sciencedirect.com/science/article/pii/S0301421519304392
[27] See UK Department of Energy & Climate Change (DECC). 2014. Research to Assess the Barriers and Drivers to Energy Efficiency. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/392908/Barriers_to_Energy_Efficiency_FINAL_2014-12-10.pdf; European Investment Bank (EIB). 2020. Going green: Who is investing in energy efficiency and why it matters. Available at: https://www.eib.org/attachments/efs/eibis_2019_report_on_energy_efficiency_investments_en.pdf
[28] See Paramonova, S., & Thollander, P. 2016. Energy-efficiency networks for SMEs: Learning from the Swedish experience. *Renewable and Sustainable Energy Reviews, 65,* 295-307. Available at: https://www.sciencedirect.com/science/article/pii/S1364032116303227
[29] See Carbon Trust. 2020. SMEs and energy efficiency. Available at: https://www.carbontrust.com/resources/smes-and-energy-efficiency

found to be important for survey respondents, but in many cases not as important as other objectives, such as complying with legislation and performing well financially. Along these lines, Henriques & Catarino (2016) [30] suggest that SMEs may overlook energy efficiency if other more cost-effective opportunities are available elsewhere, as they may have other priorities.

There is also evidence for misalignment between perceived and real barriers among SMEs. Trianni et al. (2013) [31] demonstrated that manufacturing firms in Northern Italy perceived economic and informational barriers to be of the greatest importance, neglecting the importance of behavioural barriers such as lack of interest and other priorities. Palm and Thollander (2010) [32] stated that perceived barriers created by social constructs may be strong among groups, for example one industrial sector may have the perception that energy efficiency measures are too costly to be broadly adopted, even though there may be a lack of real evidence that this is the case.

Economic models therefore do not always capture all of the factors at play in influencing the thinking of major decision-makers within SMEs. In terms of policy interventions to address the above barriers it is important to distinguish between economic and non-economic barriers, and to recognise that not all barriers may warrant the adoption of new policies. It is not always clear when policymakers should intervene, however, and this can be heavily contested depending on the school of thought.

Sorrell et al. (2011) [33] expand on this and consider two schools of thought. Mainstream economists consider policy interventions justifiable only in the face of clear market failures where the benefits of intervention outweigh the costs. Alternatively, bottom-up theorists may argue against this view and instead assume that individuals make satisfactory (rather than optimal) decisions and rely on “rules of thumb”, or general guidelines. For example, mainstream economists would argue that “hidden costs”, i.e. costs which are not typically included in the capital cost of an investment such as overhead costs for management, do not constitute a market failure and therefore do not necessitate a policy intervention. Bottom-up theorists might argue that these costs change according to market conditions and/or arrangements and therefore could be reduced by policy measures such as information programmes. Besides hidden costs, other non-economic barriers may include perceptions of risk, which may be highly context-dependent, and bounded rationality, in which constraints on time, attention, and other resources lead to decisions being made based on “rules of thumb” rather than full rationality.

Furthermore, motivating factors may vary considerably across different SMEs, depending on their characteristics, and the different steps in the decision-making process. Cagno et al. (2017) [34] found that: key drivers in the first step stem from policies and regulations; external drivers such as technical support and information have a more important role in the middle step; and internal drivers, such as information about real costs, are most relevant in the final step of the decision-making timeline. A DECC (2014) study[35] found cost savings to be a statistically significant driver in energy efficiency implementation, but that participants often had difficulty understanding and quantifying the savings from potential improvements. Depending on the technology and the area potential savings have been identified as greater than 40%.[36] In the UK experience, for instance, this led to a lower implementation rate (25%) than expected in relation to the available cost savings (£10,000 per year).[37] Other drivers identified in the DECC work include supply chain pressure, standardisation, internal business culture, and competition and benchmarking.

---

[30] Henriques, J. & Catarino, J. 2016. Motivating towards energy efficiency in small and medium enterprises. *Journal of Cleaner Production 139,* 42-50. Available at: https://www.sciencedirect.com/science/article/pii/S0959652616311519#bib34

[31] Trianni et al. 2013. Empirical investigation of energy efficiency barriers in Italian manufacturing SMEs. *Energy 49,* 444-458. Available at: https://www.sciencedirect.com/science/article/pii/S0360544212007748?via%3Dihub

[32] See Palm, J. and Thollander, P. 2010) An interdisciplinary perspective on industrial energy efficiency. Applied Energy 87, 10, 3255-3261, ISSN 0306-2619.

[33] See Sorrell, S. et al. 2011. Barriers to industrial energy efficiency: A literature review. *United Nations Industrial Development Organization.* Available at: http://sro.sussex.ac.uk/id/eprint/53957/1/WP102011_Barriers_to_Industrial_Energy_Efficiency_-_A_Literature_Review.pdf

[34] See Cagno et al. 2017. Drivers for energy efficiency and their effect on barriers: empirical evidence from Italian manufacturing enterprise. *Energy efficiency 10,* 855-869. Available at: https://link.springer.com/article/10.1007/s12053-016-9488-x

[35] See UK Department of Energy & Climate Change (DECC). 2014. Research to Assess the Barriers and Drivers to Energy Efficiency. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/392908/Barriers_to_Energy_Efficiency_FINAL_2014-12-10.pdf

[36] See Thollander, P. et al. 2015. International study on energy end-use data among industrial SMEs and energy end-use efficiency improvement opportunities. *Journal of Cleaner Production 104,* 282–296.

[37] See UK Department of Energy & Climate Change (DECC). 2014. Research to Assess the Barriers and Drivers to Energy Efficiency. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/392908/Barriers_to_Energy_Efficiency_FINAL_2014-12-10.pdf

The role of policy. In 2006, the EU launched its first directive promoting energy efficiency in SMEs, and a number of Member States subsequently initiated energy efficiency audit programmes specific to SMEs.[38] The Energy Efficiency Directive (EED) of 2012 established a set of binding measures to help the EU reach its 20% energy efficiency target by 2020. Article 7, arguably the most important part of the Directive, requires Member States to implement policy measures to achieve energy savings equivalent to annual reductions of 1.5% in national energy sales. To meet the target Article 7 encourages the implementation of energy efficiency obligation schemes (EEOs), or alternative policies, such as energy or carbon taxes, financial incentives, standards and norms, and other regulations. In 2018, the EED was amended to increase the EU's 2030 target to 32.5% and required Member States to deliver additional energy savings up to 2030, putting a greater emphasis on energy efficiency.[39]

Currently, the Commission's SMEs Strategy for a sustainable and digital Europe aims to support SMEs in sustainable and digital transitions, to support undertaking business activities in the Single Market, and to create better access to finance.[40]

According to Johansson et al. (2019)[41], attention in both research and policy is usually directed towards energy-intensive industries, while in fact there is a larger relative energy efficiency potential in SMEs and non-energy intensive industry. Evidence suggests that large companies, which also tend to be the most energy intensive, generally already have more of a vested interest in improving energy costs and therefore do not necessarily make changes in response to regulations.[42] Indeed, the results of the 2019 EIB Investment Survey seem to suggest that the share of firms investing in energy efficiency is positively correlated with the energy intensity of their sector.[43] For small companies and non-energy intensive SMEs, local and/or regional energy audit programmes, and local and/or regional energy efficiency networks, may be more effective in stimulating the learning process (Johansson et al., 2019).

Thollander et al. (2014)[44] highlight the general cost-effectiveness of energy audit programmes towards industrial SMEs. Energy audits are compulsory for larger firms and energy-intensive sectors and therefore tend to be conducted mainly for these organisations.[45] However, they have high potential to support SMEs in understanding their energy saving potential and conquering the informational barriers preventing take up of existing energy efficiency opportunities, such as those in support processes.[46] The EIB (2020)[47] study identified that three out of five European firms that conducted an energy audit invested in energy efficiency, and that firms undertaking investment decisions from 2017-2020 without having undergone an energy audit appeared to invest substantially in areas outside of energy efficiency. That being said, however, the success of energy audits programmes can depend on the quality and level of detail of the energy audits performed, which can vary significantly.[48]

Currently, Article 8 of the EED mandates EU Member States to promote the availability of high quality, cost-effective energy audits to all final energy consumers, to develop programmes encouraging SMEs specifically to undergo and implement recommendations from energy audits, and to encourage training programmes for energy auditors.[49] Energy companies can therefore offer measures falling under this

---

[38] See Johansson, I. et al. 2019. Designing Policies and Programmes for Improved Energy Efficiency in Industrial SMEs. *Energies, 12*(7), 1338. Available at: https://www.mdpi.com/1996-1073/12/7/1338/htm

[39] See European Commission. 2019. Energy efficiency directive. Available at: https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive_lv

[40] See European Commission. 2020. Unleashing the full potential of European SMEs. Available at: https://ec.europa.eu/commission/presscorner/detail/en/fs_20_426

[41] See Johansson, I. et al. 2019. Designing Policies and Programmes for Improved Energy Efficiency in Industrial SMEs. *Energies, 12*(7), 1338. Available at: https://www.mdpi.com/1996-1073/12/7/1338/htm

[42] See Thollander, P. et al. 2015b. A review of industrial energy and climate policies in Japan and Sweden with emphasis towards SMEs. *Renewable and Sustainable Energy Reviews 50,* 504-512. Available at: https://www.sciencedirect.com/science/article/pii/S136403211500372X

[43] See European Investment Bank (EIB). 2020. Going green: Who is investing in energy efficiency and why it matters. Available at: https://www.eib.org/attachments/efs/eibis_2019_report_on_energy_efficiency_investments_en.pdf

[44] Thollander, P. et al. 2014. Energy end-use policies and programs towards industrial SMEs – the case of Japan, Belgium, Spain and Sweden. IEA IETS Annex XVI Energy Efficiency in SMEs Task I. *IEA.* Available at: https://iea-industry.org/app/uploads/annex-xvi-task_1.pdf

[45] See European Investment Bank (EIB). 2020. Going green: Who is investing in energy efficiency and why it matters. Available at: https://www.eib.org/attachments/efs/eibis_2019_report_on_energy_efficiency_investments_en.pdf

[46] See Paramonova, S., & Thollander, P. 2016. Energy-efficiency networks for SMEs: Learning from the Swedish experience. *Renewable and Sustainable Energy Reviews, 65,* 295-307. Available at: https://www.sciencedirect.com/science/article/pii/S1364032116303227

[47] See European Investment Bank (EIB). 2020. Going green: Who is investing in energy efficiency and why it matters. Available at: https://www.eib.org/attachments/efs/eibis_2019_report_on_energy_efficiency_investments_en.pdf

[48] See Paramonova, S., & Thollander, P. 2016. Energy-efficiency networks for SMEs: Learning from the Swedish experience. *Renewable and Sustainable Energy Reviews, 65,* 295-307. Available at: https://www.sciencedirect.com/science/article/pii/S1364032116303227

[49] See European Commission. 2014b. Obligation schemes and alternative measures. Available at: https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/obligation-schemes-and-alternative-measures_en#:~:text=Under%20the%20Energy%20Efficiency%20Directive,annual%20sales%20to%20final%20consumers.

Article, such as improving the quality and availability of energy audits to consumers such as SMEs, to help meet their obligations under Article 7 of the EED.[50] Therefore, the use of tools such as auditing programmes, which offer flexibility for meeting the requirements of the EED, can be beneficial for Member States who would otherwise struggle to meet their yearly savings targets in a cost-effective manner.[51]

Meanwhile, within energy efficiency networks, SMEs can receive support from an external network coordinator to determine their energy efficiency potential, monitor performance, and establish good energy management practices in order to reduce their energy costs.[52] This can potentially help companies establish an energy culture and prioritise energy efficiency measures. However, the success of such networks can often depend on the level of engagement of participants, group dynamics, and existence of a learning atmosphere. Considering the local context, successful examples include activities in Sweden, Switzerland, Germany and Denmark, however their replicability across the EU remains to be explored and may be linked to cultural values around addressing energy efficiency and energy targets.

For industries with limited resources available to implement energy efficiency measures, services such as energy performance contracting and third-party financing can resolve barriers such as other priorities and lack of time and/or funding.[53] Energy performance contracts (EPCs), for instance, allow SMEs to finance their investments through a private energy services company (ESCO) and pay through energy savings.[54] That being said, EPCs are said to be viable under specific conditions, in which contract payments are less than achieved energy savings, contract revenues are greater than costs incurred by the ESCO and total savings in production costs are greater than the total increase in transaction costs.[55]

The potential for improved energy efficiency exists not only in energy management practices but in implementation of technologies. In particular, digitalisation, as a key part of the EU's SME strategy, may spur an increase in process-knowledge and provide managers with more information and up-to-date data on energy performance.[56] Technologies such as smart meters, for example, allow for the collection of data on energy use and the conditions affecting it.[57] However, although digitalisation is generally consistently perceived as relevant for industry, there are still significant challenges in implementing digital services, due to the need for a holistic approach and overall change in business mindset in many cases.[58] EU policy therefore has a significant role to play in this area. Furthermore, digitalisation is likely to require learning and follow-up procedures that may take up considerable resources, such as through the reconfiguration of machines, and the training of the experts required.

In summary, energy efficiency in SMEs has a key role to play in the EU meeting its 2030 and 2050 climate objectives, and there remains significant opportunity to deliver improved energy efficiency performance across the breadth of EU SME operations. In comparison to larger organisations, SMEs tend to face significant barriers in terms of lack of resources, competing priorities, appreciation of the potential risks, and more. These barriers vary considerably according to the sector, activity, and energy culture, with institutional and organisational barriers sometimes being more prevalent than economic ones. Economic models, therefore, are not always adequate in explaining the uptake of cost-saving energy efficiency measures. Consequently, the role of policy interventions in addressing these barriers is not always clear.

---

[50] See Ricardo Energy & Environment. 2016. Study evaluating progress in the implementation of Article 7 of the Energy Efficiency Directive. *European Commission.* Available at: https://ec.europa.eu/energy/sites/ener/files/documents/final_report_evaluation_on_implementation_art._7_eed.pdf
[51] See EURELECTRIC. 2017. European Commission legislative proposal to amend the Energy Efficiency Directive. Available at: https://www.eurelectric.org/media/2433/eurelectric_positionpaper_eed_final-2017-030-0240-01-e.pdf
[52] See Paramonova, S., & Thollander, P. 2016. Energy-efficiency networks for SMEs: Learning from the Swedish experience. *Renewable and Sustainable Energy Reviews, 65,* 295-307. Available at: https://www.sciencedirect.com/science/article/pii/S1364032116303227
[53] See Andrei, M. & Thollander, P. 2019. Reducing the Energy Efficiency Gap by Means of Energy Management Practices. *ACEEE Summer Study on Energy Efficiency in Industry. Inspiring Action for a Sustainable Future.*
[54] See European Commission. 2018. New financing models for energy efficiency for SMEs. Available at: https://ec.europa.eu/easme/en/news/new-financing-models-energy-efficiency-smes
[55] See Sorrell, S. 2007. The economics of energy service contracts. *Energy Policy 35,* 507-521.
[56] See Andrei, M. & Thollander, P. 2019. Reducing the Energy Efficiency Gap by Means of Energy Management Practices. *ACEEE Summer Study on Energy Efficiency in Industry. Inspiring Action for a Sustainable Future.*
[57] See IEA. 2019. Energy efficiency and digitalisation. Available at: https://www.iea.org/articles/energy-efficiency-and-digitalisation
[58] See Andrei, M. & Thollander, P. 2019. Reducing the Energy Efficiency Gap by Means of Energy Management Practices. *ACEEE Summer Study on Energy Efficiency in Industry. Inspiring Action for a Sustainable Future.*

There is evidence that, in many cases, energy audit programmes and energy efficiency networks can be highly beneficial for SMEs in facilitating a learning process and cultivating an energy culture. Furthermore, energy services such as EPCs may address key barriers to energy efficiency implementation in SMEs under the right conditions, and support for digitalisation could help SMEs to overcome significant technological and informational barriers. That being said, the success of these services can be highly dependent on the level of ambition of an SME, the capability of the service providers involved, and the overall strategy of the business.

4 The selected IEE-II and H2020 Industry projects: an overview

Brief summaries of the projects selected for this study are given below. They are presented in date order with the earliest projects first.

CARE+ (2008-2010): The CARE+ project aimed to assess the energy needs of SMEs in the chemical industry to develop best practices and delivery mechanisms to address the large potential for energy efficiency savings in chemical industry SMEs. It carried out activities in Bulgaria, Italy, and Poland (https://cefic.org/careplus/, website no longer operational).

CHANGE (2008-2010): Chambers promoting intelligent energy for SMEs (CHANGE) aimed to help SMEs to optimise their energy use by developing a European network of intelligent energy (IE) advisors at Chambers of Commerce and Industry (CCI) across Europe, making them the “first port of call” for SMEs on matters related to IE (http://www.eurochambres.eu/change, website no longer operational).

SURFENERGY (2008-2011): The specific overall objective of the action was to strengthen competitiveness in the surface engineering and printed circuit board industries by achieving the wide introduction of energy efficiency measures. The aim was to overcome the non-technological barriers to the introduction of these measures through creation of a web-based tool and through an extensive dissemination programme (www.surfenergy.eu, website no longer operational).

EU Plast Voltage (2009-2011)**:** The objective of this project was to prepare a voluntary agreement for the European plastics converting industry. This action was intended to bring together experience and best practices at national and industry levels, with the aim of creating a long-term agreement at European level (http://www.euplastvoltage.eu, website no longer operational).

FOUNDRYBENCH (2009-2011): FOUNDRYBENCH aimed to foster energy efficiency and rational energy use in the metal casting sector. It aimed to do so through raising awareness, developing a best practice database for foundries and by developing a foundry-specific benchmarking tool (http://www.foundrybench.fi, website no longer operational).

RegCEP (2009-2011): RegCEP focused on the use of regional clusters for sustainable energy planning, providing a territorial instrument for the development of intelligent energy by enterprises. RegCEP aimed to help overcome barriers to the intelligent use of energy in SMEs by exploiting regional clusters as a tool for energy planning by industry. It thus promoted regional clusters as an instrument for integrating energy and regional policies (http://www.regcep.eu/, website no longer operational).

EINSTEIN-II (2010-2012): The EINSTEIN-II project aimed to contribute to a widespread implementation of integrated energy-efficient solutions for thermal energy supply in industrial companies for non-industrial users of similar demand profiles. The existing EINSTEIN thermal energy auditing tool kit was extended to new countries, the number of auditors was increased, and the methodology was extended to large non-industrial users (https://www.einstein-energy.net/).

ERASME (2012-2014): EneRgy Audits in SMEs (ERASME) aimed to demonstrate that a more effective solution is possible and practicable for energy audits in SMEs, providing a joint solution common to several SME associations, in several countries characterised by similar difficulties. The project had a Central Europe regional focus.

SESEC (2012-2014): SESEC aimed to help the European clothing industry tackle energy efficiency by developing tools, benchmarks and guidance to unlock energy savings potential. The project first focused on the four EU Member States with the largest clothing industry and then transferred the knowledge to every Member State (https://euratex.eu/content/sesec, website no longer operational).

CODE2 (2012-2015): The CODE2 project built on the lessons learned from the previous CODE project and stimulated cogeneration uptake in the EU by supporting Member States in developing their Cogeneration Roadmaps and by developing "how-to" guides on cogeneration legislation and business cases (http://www.code2-project.eu/).

COOLSAVE (2012-2015): The COOLSAVE project aimed to reduce industrial energy consumption in cooling installations by vapour-compression mechanical systems in the food and drink sector through the dissemination of cost effective energy efficiency strategies implementation (https://www.cool-save.eu/, website no longer operational).

ECOinFLOW (2012-2015): The Energy Control by Information Flow (ECOinFLOW) project aimed to address the barriers to energy savings in the European sawmilling industry by inducing knowledge transfer, promoting energy management systems (EnMS), disseminating best practices and developing an online benchmarking tool (http://ecoinflow.com/).

IND-ECO (2012-2015): The IND-ECO project aimed at achieving two main objectives: obtaining initial primary energy savings by its end and creating favourable conditions for more investments by 2020. It brought together a European umbrella association and national associations from the most relevant countries for leather and leather products, technical centres, engineering companies and manufacturers (http://www.ind-ecoefficiency.eu/).

PINE (2012-2015): PINE aimed to increase energy efficiency in industrial SMEs by means of auditing schemes and subsequent provision of professional technical advice for the implementation of customized measures, with the long-term goal of creating a self-sustaining model capable of expanding project-specific measures (http://www.pineaudit.eu/, website no longer operational).

EUREMPlus (2013-2015): EUREM is a standardized training of further education, that enhances the skills of technical experts in the field of energy efficiency improvement. The project EUREMPlus aimed at making this programme available to more companies, especially from the manufacturing industries sector, to enable them to increase energy efficiency and competitiveness (https://www.energymanager.eu/).

Go-Eco (2013-2015): The main target of Go-Eco was to apply a co-operative approach to reduce energy consumption and CO_2 emissions in existing business parks. This was to be achieved through the participative development and implementation of a strategy incorporating analyses of energy supply and demand structures of each business park, energy audits and feasibility studies (http://go-eco.info/, website no longer operational).

GREENFOODS (2013-2015): GREENFOODS aimed to lead the European Food and Beverage sector, specifically SMEs, to higher energy efficiency and reduction of carbon emissions to guarantee sustainable production in Europe. The project focused on six countries in Europe: Austria, France, Germany, Poland, Spain, and the UK (http://www.green-foods.eu/).

Night Hawks (2013-2015): The Night Hawks project aimed to identify and tackle energy leakages (or idle losses) in shopping centres, retail parks and shops outside of their opening hours. This initiative would yield immediate energy savings and introduce the participating organisations and their staff to the potential of energy efficiency (http://www.night-hawks.eu/, website no longer operational).

SPICE^3 (2013-2015): SPiCE^3 aimed at enabling energy efficiency improvements in the chemical sector by giving access to information and competences, particularly for SMEs where barriers for energy efficiency investments are higher. This project drew together partners that cover around 80% of the chemicals sector by energy use across the EU. Bringing together expertise in reaching out to SMEs and national knowledge, the consortium provided a platform that aimed to transform the chemical sector's supply chain (http://www.spice3.eu/, website no longer operational).

EE-MUSIC (2013-2016): EE-MUSIC tackled information barriers and increased capacities for energy management in the music event sector. The aim of the project was achieved by providing tailored training schemes for promoters of music events who were committed to implementing energy saving measures (http://www.ee-music.eu/, website no longer operational).

TESLA (2013-2016): The main objective of the project was to extend the best available practices for the evaluation of the energy situation and for the adoption of improving measures amongst the European SMEs in the agro-food sector. Within the agro-food sector, the TESLA project focused on the agro-industry cooperatives of wineries, olive oil mills, animal feed factories, and fruit and vegetable processing plants (http://www.teslaproject.org/, website no longer operational).

EECC (2014-2016): The aim of the EECC project was to increase energy efficiency in SMEs' offices by motivating changes in employee behaviour regarding energy consumption. From each of the 10 partner countries SMEs entered a 1.5-year long competition on energy savings in office buildings. Each participating company appointed one energy agent to enter energy consumption data and information on the building's energy standard and improvements into an energy management system (https://www.co2online.de/ueber-uns/kampagnen-projekte/).

SET (2014-2016): The SET project mainly aimed to design a new tool such that textile companies could self-assess their energy consumption, learn to collect data, benchmark, and receive recommendations for tailored best practices. The project therefore intended that companies achieve potential energy savings, becoming more energy and cost-effective (https://euratex.eu/set, website no longer operational).

EMSPI (2014-2017): EMSPI aimed to promote actions to increase energy efficiency in SMEs in the printing industry. The main objective was to reap the maximum energy savings by promoting the implementation of Energy Management Systems (EMS) based on the European standard EN 16001 and/or the global standard ISO 50001 (https://www.emspi.eu/).

SME EnergyCheckUp (2014-2017): The project targeted SMEs in a series of specific sectors, offering them a sector-specific benchmark in an easy-to-use tool, and informing them of the potential to save energy in their specific company, triggering real energy saving measures. The project built on an existing successful Dutch energy saving tool, developed by CCS for MKB Energiecentrum (http://energycheckup.eu/en/home/).

STEEEP (2014-2017): The aim of the STEEEP project was to involve and provide 630 SMEs across different sectors from 10 different countries with tailored training and guidance on effective energy management tools and practices targeted towards specific national or regional needs. This was to enable SMEs to measure and consequently control energy costs more efficiently and reduce their energy use by 10 to 15% (http://www.steeep.eu, website no longer operational).

ENERWATER (2015-2018): The main objective of ENERWATER was to develop, validate and disseminate an innovative standard methodology for continuously assessing, labelling and improving the overall energy performance of wastewater treatment plants (WWTPs). For that purpose a collaboration framework in the wastewater treatment sector was set up. This included research groups, SMEs, utilities, city councils, authorities and industry (http://www.enerwater.eu/).

STEAM-UP (2015-2018): STEam And Management Under Pressure (STEAM-UP) focused on energy savings from steam systems. It did so by defining the "state of the art" of industrial steam use and thereby developing an in-depth steam audit. The project included capacity building programmes for energy auditors, managers and training providers and an online energy management tool, with energy savings coming from the implemented measures of the energy audits that were carried out (https://www.steam-up.eu/).

EE-METAL (2016-2019): EE-METAL, implemented in Spain, Italy, France, and Poland, aimed to provide enterprises in the Metalworking and Metal Articles (MMA) industry with tools (benchmarking, audit methodology, best available techniques, guides) to identify and implement energy efficiency measures. Partners in each country included one technical expert and one MMA SME association/cluster (https://www.ee-metal.com/).

Energywater (2016-2019): Energywater aimed to improve energy efficiency in the EU manufacturing sector through benchmarking and benchlearning tools and best practices in industrial water processes, that would then increase the competitiveness of EU industry. The project also aimed to create an Energy

Angels network to train energy managers and auditors and sought to influence energy efficiency regulation, through the involvement of public authorities, by means of the removal of regulatory and non-regulatory barriers (http://www.energywater-project.eu/).

SCOoPE (2016-2019): The SCOoPE project worked directly with energy-intense agro-food industries to implement cross-cutting and collaborative energy management systems aimed to reduce their energy consumption without resulting in any decrease in the production capacity of the companies and maintaining correct socioeconomic and environmental conditions. SCOoPE further spread this knowledge within technicians, businesses managers, and energy and agro-food institutions (https://scoope.eu/).

WaterWatt (2016-2019): The project aimed to address the improvement of energy efficiency in industrial water circuits: auxiliary electric motor driven systems with high optimisation potential. At the time, there was neither a benchmark on the energy consumption in industrial water circuits, nor tools for its systematic reduction, nor awareness of the saving potential. The WaterWatt project aimed to remove market barriers for energy efficient solutions, in particular the lack of expertise and information on energy management and saving potential in industrial water circuits (http://www.waterwatt.eu/).

INDUCE (2018-2020): The objective of INDUCE was to develop an open access platform where training material, online lessons, guidelines and tools are available for companies aiming to increase their energy efficiency. In order to achieve this, the project tested and validated the INDUCE methodology and toolkit in 15 pilot companies from the food and beverage sector in four countries that represent over 45% of the EU companies in this sector: Spain, France, the Netherlands and Germany. (https://www.induce2020.eu).

EUREMnext (2018-2021): The overarching strategic objective of the EUREMnext project is to contribute to both environmental protection and competitiveness in businesses by increasing the quality of energy audits and thereby the rate of implementation of energy efficiency measures. This shall be achieved by providing training to increase the availability of qualified and accredited experts with a holistic view both of technical/engineering and of economic/financial aspects. Notably, the project aims at enriching the well-established EUREM training programme as well as making it available in six new countries: Albania, Bosnia and Herzegovina, Estonia, Latvia, Serbia and Turkey (www.eurem-next.eu).

IMPAWATT (2018-2021): The IMPAWATT project aims to create staff training and capacity building programmes to enhance corporate policy towards energy efficiency and towards energy culture and sustainable supply-chain initiatives, targeting all relevant actors. This programme was developed as an online toolbox with resources for capacity building and staff training (https://www.impawatt.com/).

M-BENEFITS (2018-2021): The project is aiming at including the Multiple Benefits of energy efficiency in investment decisions of companies and thereby substantially increasing the deployment of cost-effective energy saving measures. The consortium has developed a tool to analyse and to promote energy-saving measures to the participating SMEs while evaluating the operational and strategic impacts. The tool will allow energy managers and practitioners to improve the business case for energy efficiency measures as well as speeding up the implementation rate (https://www.mbenefits.eu/).

SPEEDIER (2019-2021): The project is aiming at fostering the actual implementation of energy efficiency measures among SMEs by outsourcing the role of energy manager to certified experts through a *one-stop-shop* solution. The service will be available via energy consultants, providing auditors along with experts and will facilitate the uptake of energy audits as well as the subsequent implementation of energy efficiency measures in SMEs. The mechanism for making this work in practice follows an Energy Performance Contract model where the consultant delivering the support retains a share of the savings as payment for the duration of the contract. (https://speedierproject.eu/).

E2DRIVER (2019-2022): The E2DRIVER project aims to 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 (https://e2driver.eu/)

ICCEE (2019-2022): The project aims to facilitate SMEs in the cold chains of the food and beverage sector to undertake energy efficiency measures (EEMs) after carrying out supply chain energy audits.

The implementation of the holistic approach, shifting from the single company perspective to the chain assessment, leads to increased opportunities for EEMs. The feasibility of EEMs is being evaluated by considering economic, environmental and social impacts encompassing their entire life cycle and the entire supply chain. Non-energy benefits and behavioural aspects are also being addressed and recommendations on financing schemes for SMEs will be assessed.(https://iccee.eu).

INNOVEAS (2019-2022) The project will build and deliver a capacity building programme that addresses the major non-technical barriers that hamper the adoption of the energy auditing practice, in particular where such audits are not required by law. The goal is to consolidate a structured, permanent and expandable offer to help develop continuous self sustainable services to raise awareness and build capacity in the field of energy auditing and related energy saving measures in SMEs (https://innoveas.eu/).

SMEmPower Efficiency (2019-2022): The project aims to train 720 European SMEs and encourage them undergo energy audits and implement standard and innovative energy saving measures using the variety of available financing tools and options. In-house short trainings for decision makers and operational staff of SMEs grouped according to their specificities will be delivered, during the practical action in pilots, by both partners – mainly universities – and trainees. (https://smempower.com).

5 The methodology overview in brief

The methodology used to evaluate the achievements of the 41 selected projects is briefly described below. The methodology builds on the approach used in an earlier study for EASME on bioenergy projects – see Figure 5-1 below.

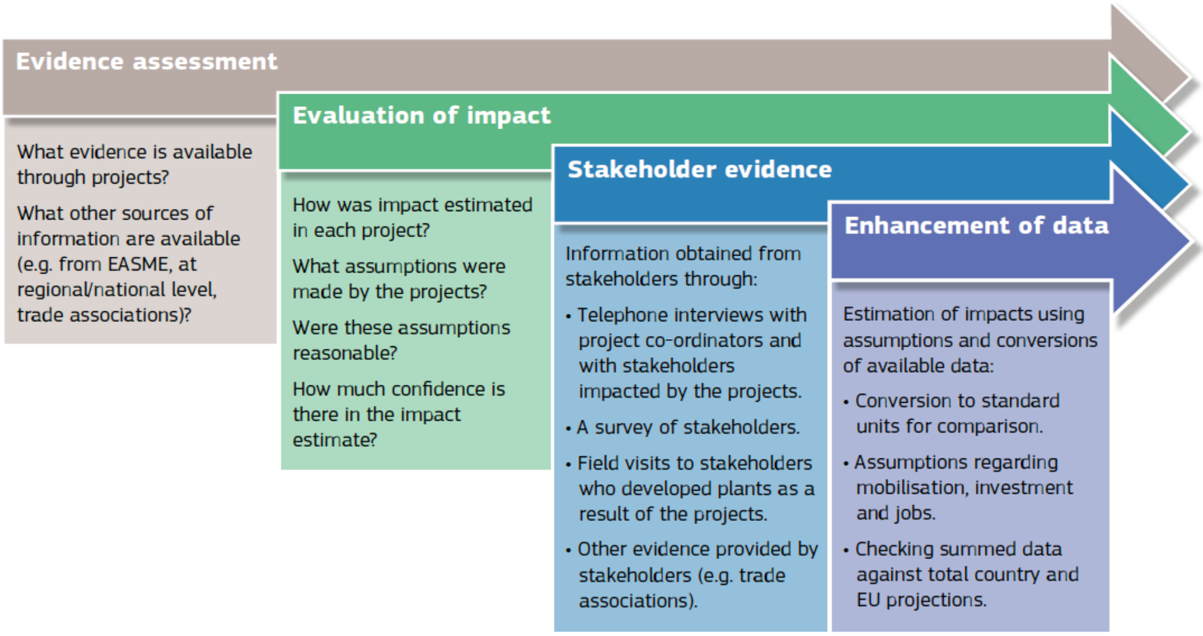


Figure 5-1: Proven methodology applied under the previous study Review of bioenergy projects implemented under IEE II, 2016, and the main approach for this work.[59]

For the current work, the methodology further developed the staged approach in Figure 5-1, and is outlined in Figure 5-2. There were a number of strands to weave together to achieve high-quality data and analysis outputs. These steps have by necessity overlapped and evolved. The methodology developed here represents this more detailed flow of activity, recognising the complexity that has been necessary to analyse impacts of the projects.

- The starting points were the data collection requirements of this study (orange boxes in Figure 5-2), and the tool for managing the data (the Data Collection Tool (DCT)). This phase was

[59] Please note that field visits to stakeholders were not possible due to COVID-19, and were instead replaced with structured interviews.

necessary to extract key information related to project activities, achievements and impacts from the project documentation. This enabled us to develop a deep understanding of the 41 projects

- The evidence assessment (grey boxes) describes the steps necessary to understand each project, understand the approaches taken through each project's intervention logic and then to understand potential gaps in the data and assumptions, both of which were to be addressed
- The evaluation of impacts (green boxes) focused particularly on the steps the projects took to assess their own impacts, and how common assumptions were considered across the portfolio and common factors were established that could be applied to standardise the approach
- The stakeholder evidence (blue boxes) details the three key activities that were used within this study to gather a wide range of inputs to validate data. This includes in particular the interviews that were used to confirm the accuracy of the Intervention Logic diagrams for each project, to improve understanding of impact calculations made by each project, and to fill gaps in the information available for assessing the impacts
- The data enhancement step (purple) is the point at which the outputs of all the previous steps came together, and a fully data-populated picture of the project was available to carry out a better estimate of its impacts across a number of categories. Once achieved for all projects, the portfolio level impacts were assessed.

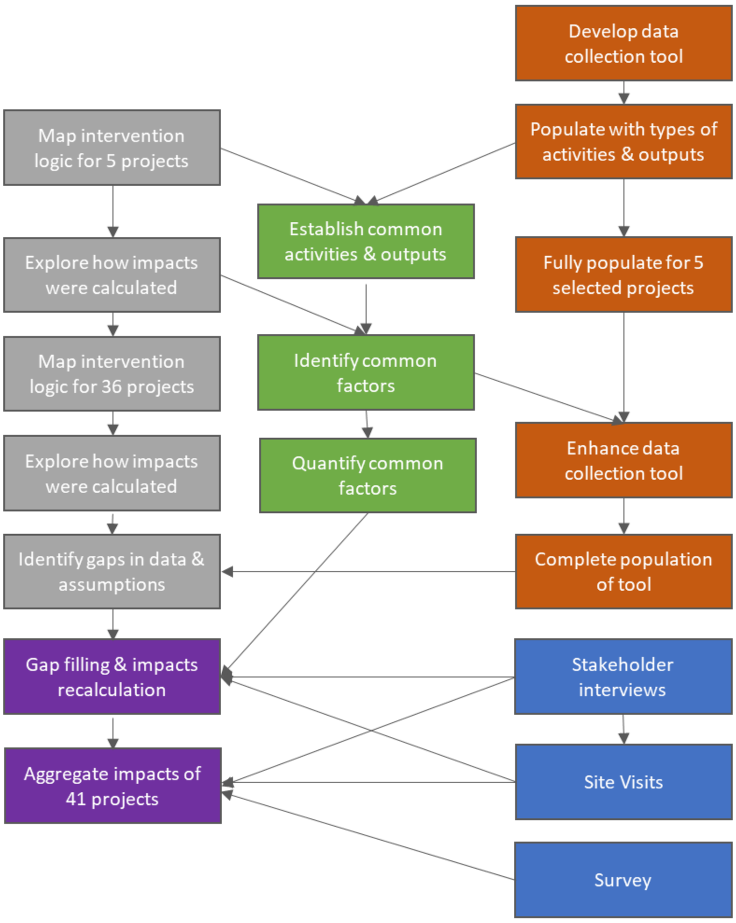


Figure 5-2: Outline of the methodology

For each of the 41 projects, whether fully complete or currently underway, an Intervention Logic diagram was produced. This outlined the main activities, outputs and impacts for the project (or anticipated impacts if the project is currently active). The Intervention Logic diagrams were discussed at interview and their accuracy improved, where possible, through seeking feedback.

A significant amount of material reported by the projects required review. This necessitated a rigorous approach to the data collection phase. The assessment of a project's impacts was only made possible by first gaining this deep understanding of the project's intervention logic, i.e. how the activities undertaken by the project led to the project outputs, which in turn led to the impacts seen within the project's lifetime and the longer term impacts after the project's lifetime.

Each IEE-II and H2020 project had its own intervention logic. Some involved similar activities and outputs and so common factors or assumptions were identified. These common factors were used to fill data gaps, re-assess project impacts and improve the reliability of short-term and long-term impact calculations. Information from the interviews contributed, sometimes very significantly, to gap filling and the re-assessment of project impacts.

The green and purple sections in Figure 5-2 involved the pulling together of common activities and results, and the recalculation of impacts across the portfolio of projects. In particular, the work involved reviewing each step of the project's impact calculations to determine their reliability based on the project's assumptions and methodology. This allowed identification of the overall reliability of each KPI, as well as of which step in the methodology could be improved. Finally, by addressing these issues and by filling any gaps with common factors, literature values or information from interviews, the KPIs were recalculated. See Section 5.2 for further description and detail.

5.1 Outline approach to the evaluation of impacts

The approach for the evaluation of impacts at project level was to define the key performance indicators (KPIs) that were valuable for EASME to explore within this study. These encompassed the required project performance indicators / common performance indicators (PPIs / CPIs, used for H2020 / IEE projects respectively) that projects were required to report against, as well as a host of other aspects. All of these were captured, where data was available, in two worksheets within the data collection tool (one for H2020 projects, one for IEE II projects). From this point forwards reference to KPIs encompasses the PPIs/CPIs that projects were asked to report against, for the respective programme.

For all projects, the study evaluated the reported KPIs for impacts resulting both from activities during the project lifetime (triggered up to the end of the project) and those from activities occurring after the project lifetime (up to 2020 for IEE-II projects or up to 5 years after project end for H2020 projects)[60]. A summary of the indicators is given below:

- Energy savings triggered by the project – during project lifetime and after project lifetime also considering annualised figures and lifetime of the identified measures
- Cumulative investments in sustainable energy – during project lifetime and after project lifetime, building renovations performed, associated costs saved
- GHG reductions – during project lifetime and after project lifetime (recognising this was not required for H2020 projects)
- Renewable energy production – during project lifetime and after project lifetime (recognising this was not required for H2020 projects)
- Capacity building activities
    - Training provided, number of events held, and number of people reached through these, number of long-lasting training schemes established (beyond the lifetime of the project)
    - Behaviour changed for individuals and organisations
- Tangible outputs – audits, tools, methodologies, prototypes, demonstrations, products, patents and publications delivered within the lifetime of the project

[60] The definitions of impacts counted as "during the project lifetime" and "after the project lifetime" are given in Section 5.3. There is also some discussion later in the current section.

- Policy making – number of new and modified policies, national and local level
- Other (e.g. European standards, roadmaps, networks, local energy communities, etc.).

Across all of this reported KPIs heterogeneous information, including units and terminology was presented in a standardised format. Where necessary, information was disaggregated to facilitate understanding.

To explore and understand the reported impacts from each project, the project calculations were first re-performed using project inputs and assumptions. This facilitated a quick check for simple errors and to confirm that all assumptions and factors that had been used by the project partners were captured and understood.

Though this approach, a catalogue was developed of common steps, methods and assumptions used. This allowed identification of common factors had been applied to the KPIs reported by the projects. The reliability was also assessed of each of the 41 projects' calculations and assumptions. In some cases, the calculation approach was considered in further detail to fully understand the steps taken.

It should be noted that impacts during the project lifetime have been interpreted here as impacts that can be directly traced back to activities during the project lifetime. For example, if training was provided and there was an associated energy audit undertaken during the project as part of the training process, the savings from that audit would be considered to be attributed to the lifetime of the project, even if the measures are installed later.

Impacts after the project lifetime are those that arise from activities that take place after the project has been completed. Therefore, savings arising from audits undertaken by an auditor after the project lifetime are considered as impacts "after the project lifetime" even if the auditor was trained as part of a project activity. Similarly, the savings resulting from audits by auditors trained after the project lifetime are counted as "after lifetime" impacts – even if the training material was originally developed as part of the project.

The reason for this distinction is that there was some disparity between projects in terms of how "within" and "after" impacts have been reported. In many cases, projects reported impacts arising from activities that had taken place within the duration of the project as those occurring after the project lifetime. For further details on the methodology, please see Section 5.3.

Several factors were considered in determining the impacts of different activities, which together amount to the total impacts reported by a project.

A very common activity carried out within most of the 41 projects was energy auditing. Such audits were carried out for a number of reasons within projects: as part of the methodology process, to assist with training, benchmarking, tool development, and identifying a range of energy savings measures and their costs. Such energy audits provided companies with specialist and relevant energy advice and hence had a high potential to deliver direct benefits to companies with respect to the KPI impacts projects were seeking.

Considerations in estimating the impacts of energy audits and identifying common factors that could be applied to energy audits include:

- What level of potential energy savings did the audit identify? This is a relatively easy and well recorded data set within projects, typically expressed as a percentage saving. To calculate the energy savings potential, the baseline energy use of the company or relevant process is also required.
- What level of the recommended measures did the company implement? This is a harder set of data to record, as companies may not communicate this back to auditors or projects, and potentially the implementation occurs sometime after the audit was conducted and projects are potentially completed and no longer available to gather this information.
    - The current study has identified that recording of this level of detail varies considerably. Quite a few projects did record large amounts of detail of measures implemented.

Sometimes this was not present in project reporting and was made available to this study through the interview process.

- Therefore, this level of detail is often missing, especially for projects conducted some time ago. A further issue is that within some projects company data was treated as confidential and not made available for reporting and sharing. Some early projects assumed, either explicitly or implicitly, that 100% of identified measures were implemented, while some more recent projects assumed the implementation of at least the no-cost and low-cost measures recommended in the audits.

- How long did each measure remain relevant, over how many years should the lifetime of the intervention be considered?
- Did the achieved annual savings continue year-on-year at the same level (persistence)?
- What fuels were displaced (electricity, gas, oil) by the energy efficiency measures installed, hence what were the primary energy and greenhouse gas (GHG) savings?
- Was the measure implemented solely due to the information contained within the audit provided, or might the company have installed the measure anyway in the near future (attribution and the free rider effect)? A paper 'How relevant are free-rider effects for target achievement?' by Fraunhofer ISI[61] suggests that the free rider effect is small for audit programmes, i.e. most energy efficiency audits would not happen in the absence of funding and coordination. This is even more likely to be the case for SMEs compared to larger companies with greater knowledge and resources.

Where a project involves training energy auditors, there are additional factors to consider:

- How many audits does an average trained auditor conduct in a year following on from their training?
- Is the above annual number consistent for the coming years or does the trained auditor stop auditing after a while?
- Has the project stimulated other similar auditor training programmes in neighbouring cities or countries?

Most projects assume that the energy experts/auditors would not have had any training if they had not been involved in the project and would therefore not have been qualified energy auditors, i.e. they attribute all the energy savings identified by the auditors to the project. That is not necessarily the case as the auditors may have already been trained and wanted some extra training, or they may have needed more training and support after the project. They may also have been likely to participate in training over the year in any case, and this was simply the training they took - they could have taken a different programme. Such a detailed analysis has not been undertaken for every output from every project but this approach has been followed to seek to identify common factors, i.e. factors that could be used as a default where a project has not determined its own information and/or provided the figures used in its estimations.

Where commonalities were identified, these were noted and our learning was applied across the re-estimation approach as a whole. Two examples are: the typical energy savings (%) identified by an audit; and the proportion of the identified savings that are taken up.

For one-off projects that address very specific areas and challenges, common factors are not relevant, and the reliability was reviewed of the estimates of impacts from the project coordinators.

[61] See paper by Barbara Breitschopf, Barbara Schlomann and Fabian Voswinkel at https://energy-evaluation.org/wp-content/uploads/2019/06/2018-breitschopf-paper-vienna.pdf presented at the 2018 International Energy Policy & Programme Evaluation Conference

5.2 Stakeholder evidence

Stakeholder information fed into this work through stakeholder interviews and 'site visits'. ('Site visits' were conducted remotely due to COVID-19 travel limitations across Europe during the time period this work was conducted – these have instead been conducted as multi-stage interviews). Interviews were sought for all projects with multiple stakeholders.

Table 5-1: Overview of interview programme.

Metric	Status
Contacts identified	218
Contacts contacted (of which were undelivered)	212 (32)
Interviews completed	63
Projects interviewed[62]	34

As shown in Table 5-1, a significant proportion of the project participants that were approached returned 'undelivered' emails, and many more were not responsive to emails or calls. Additional research was carried out to identify up-to-date contact details to reach project participants. To date, interviews have not been possible with 7 of the 41 projects, despite seeking to contact 31 partners across these projects. This includes 4 projects that ended over 8 years ago.

The interviews were used as the primary approach to gap filling, supplying data that was not available, or difficult to discern, from the project reports and dissemination activities that were available. Discussions with co-ordinators, key project participants, and sector associations, who had the breadth of overview, were crucial in some cases. These discussions aided understanding of the scale of the likely true impacts and provided additional project data that had been collected but not shared with EASME (such as tracking spreadsheets for implemented measures). Furthermore, the interviews were necessary to identify follow-up actions (or a lack thereof) intended to ensure the replication of impacts even after the end of projects. These actions were not included in any official project reports or publications. Reliability assessment and impact re-estimates

5.3 Reliability assessment and impact re-estimates

The impacts of the 41 projects were categorised based on an assessment of the reliability of their calculations. Assessment was made of the calculation methodology for the project's KPI estimates, the numerical data feeding into the calculations, any assumptions that were made and what evidence was provided. Each of these elements was assessed separately so that an estimate that was based on a sound methodology, but uncertain assumptions could be re-estimated within a targeted approach that addressed the underlying issues. Thus, a reliability rating was assigned for each element. This fed into an assessment of the overall reliability of the KPI. The reliability rating was developed with EASME during the previous project assessing bioenergy projects. The rating includes:

- **Reliable** = where there was fully documented/referenced evidence of data sources and assumptions as well as a sound methodology for the calculation of impacts.
- **Acceptable** = where there was a partial documentation/referenced evidence of data sources and assumptions as well as a largely sound methodology for the calculation of impacts. KPIs were also marked acceptable where the unreferenced evidence, assumptions or methodology were comparable to literature references or other projects.

[62] We were unable to reach CARE+, ECOINFLOW, EMSPI, EU Plast Voltage, FOUNDRYBENCH, IND-ECO, SURFENERGY. Note these figures do not include the development of 'success stories' (see Section 7), which involved further consultation with 16 of the 41 projects.

- **Uncertain** = where there was no documented/referenced evidence of data sources OR an incoherent methodology.

The classification of reliability was key for this study, as only project impacts that have been classified as reliable or acceptable are used in the final summary assessment. This classification therefore had to be consistent between projects.

Once confident that there was a full set of available data, and that the calculation approaches employed by the projects were understood, the projects' impacts were re-estimated based on the enhanced data, common factors, and using additional information provided through the interviews.

By analysing the projects' calculation approaches for different activities, a step-by-step methodology was developed that could act as a template for calculating project impacts. Using project data, interview data and common factors, the impacts were re-estimated for most projects. For projects that reported impacts, the reliability assessment discussed above was used to identify any calculation steps for which the underlying assumptions or methodology were deemed to be uncertain. These steps were then enhanced using common factors and other learnings from this study. This approach also allowed an estimation of impacts for projects that did not report any impacts, since the re-estimation methodology could be applied, alongside the project data and common factors or literature data to generate an estimate of project impacts.

The re-estimate calculations for each project were carried out in a spreadsheet that allowed comparison across all projects. Each project's re-estimate was presented in the spreadsheet as a step-by-step "calculations note" using the re-estimate methodology. Where project, interview, literature or common factor data were used, this was highlighted in a comment to explain where the data came from and to justify any assumptions made. The impacts were presented in terms of those attributable to the project activities (during project lifetime) and those attributable to the intervention being continued after the lifetime of the project (after project lifetime), and this development has been shared and discussed with EASME on an ongoing basis.

In terms of establishing whether impacts were classified as during project lifetime or after project lifetime, it became apparent that a consistent approach had not been used between projects. For illustrative purposes only, if a 3-year project undertakes 10 audits each year and each audit is associated with 1 GWh/yr of primary energy savings, the project could report anything from zero to 30GWh/yr of savings "during" the project lifetime depending on whether implementation is instant or takes over 3 years. Yet the partition between "during" and "after" is artificial as all the impacts have arisen from audits undertaken during the project lifetime.

The approach employed here, developed through the re-estimates process and understanding how each of the 41 projects had approached the questions, is as follows:

- "During" refers to impacts of activities carried out during the project lifetime. E.g. audits undertaken during the project lifetime (possibly as part of or following training); application by companies of a tool during the project lifetime.
- "After" relates to the sustainability of the project and refers to the impacts of activities carried out after the project lifetime but triggered by the project, e.g. audits triggered by the project but carried out after the project lifetime – this could be due to training developed by the project and given either during or after the project lifetime with the subsequent audits all being undertaken after the project itself has completed; application of a tool developed during the project, but applied by a company after the project lifetime.

The overall approach taken here was largely bottom-up and project-specific. The re-estimate methodology was developed so that it was flexible enough to fit most project's calculations and so that the re-estimate calculation methodology was comparable across projects. This approach was driven primarily by the wide variety of approaches taken by the projects in their calculations and also by the different types and amounts of information available on project impacts. Rather than applying common factors across all projects, these were generally restricted to projects where limited information was available, for example in relation to the degree to which energy audits were implemented. On one hand, this approach allowed retention intact of methodologies of projects that were deemed reasonable throughout our re-estimates. On the other hand, the re-estimate methodology used for projects with a lack of a coherent methodology was modelled after projects with sound approaches. This resulted in harmonisation of calculation methodologies and allowed better comparison across projects.

Since some re-estimate methodologies still relied on common factors or assumptions, there were some aspects of the re-estimates which could not be marked as reliable but only acceptable. A similar process was applied to re-estimates as to the reported project impacts. Therefore, the reliability of re-estimated impacts could be assessed and compared to the reliability of the project reported impacts.

In some cases, there was not enough data provided by the project and the gaps could not be filled by interviews so that no reliable or acceptable re-estimate could be made. This was often the case for a project's impacts after the project lifetime where project participant interviewees did not have enough information to justify the key assumptions that had been made in the impact calculations.

6 Impact of the selected IEE-II and H2020 Industry projects[63]

6.1 Characteristics of the 41 projects

Projects undertook a wide range of activities in seeking to achieve their final goals. Within this tranche of Market Uptake projects focussing on energy efficiency support, the activities carried out often shared similarities and were potentially targeted at similar sectors and similar actors, and so insights at the programme level can be gleaned. In this section we explore these programme level insights.

6.1.1 Project activities

Across the 41 projects, Figure 6-1 demonstrates the representation of different activity areas. The vast majority of projects carried out several activities.

The activity most commonly present across the 41 projects was the deployment of audits (29 of 41 projects). This was followed by capacity building activities (25 of 41 projects), tool development (24 of 41), benchmarking (20 of 41) and establishing best practice (18 of 41). Other methods employed by projects to achieve their aims include a focus specifically on energy managements systems, standards creation, establishing awards schemes, games, network creation, policy development and lastly voluntary agreement development.

The vast majority of projects carried out several activities within their methodological approach to achieve the project's aims.

[63] All results and observations are based on information received to 31st Dec 2020

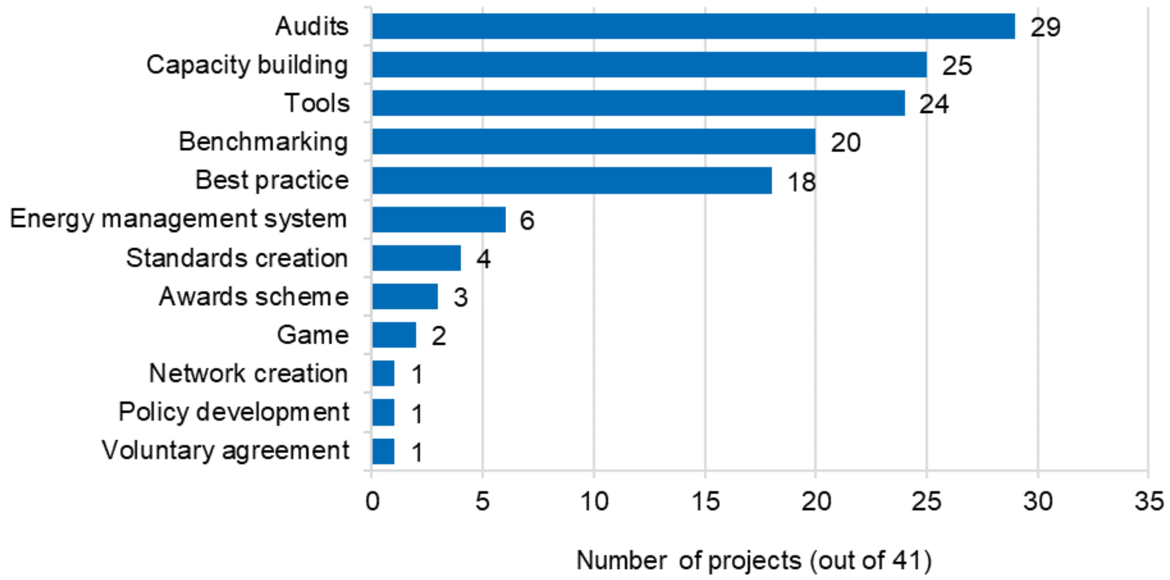


Figure 6-1: Type of CSA activity across the 41 projects

6.1.2 Targeted sectors

As illustrated in Figure 6-2, 15 of 41 projects considered took a cross-sectoral approach i.e. did not target a specific sector. Most other projects addressed a single sector, though one (INNOVEAS) addressed three specific sectors. Sectors addressed by more than one project were the food and beverage sector (7 projects), manufacturing (4 projects), the chemicals sector (3 projects) and textiles (2 projects). All other sectors covered were addressed by a single project.

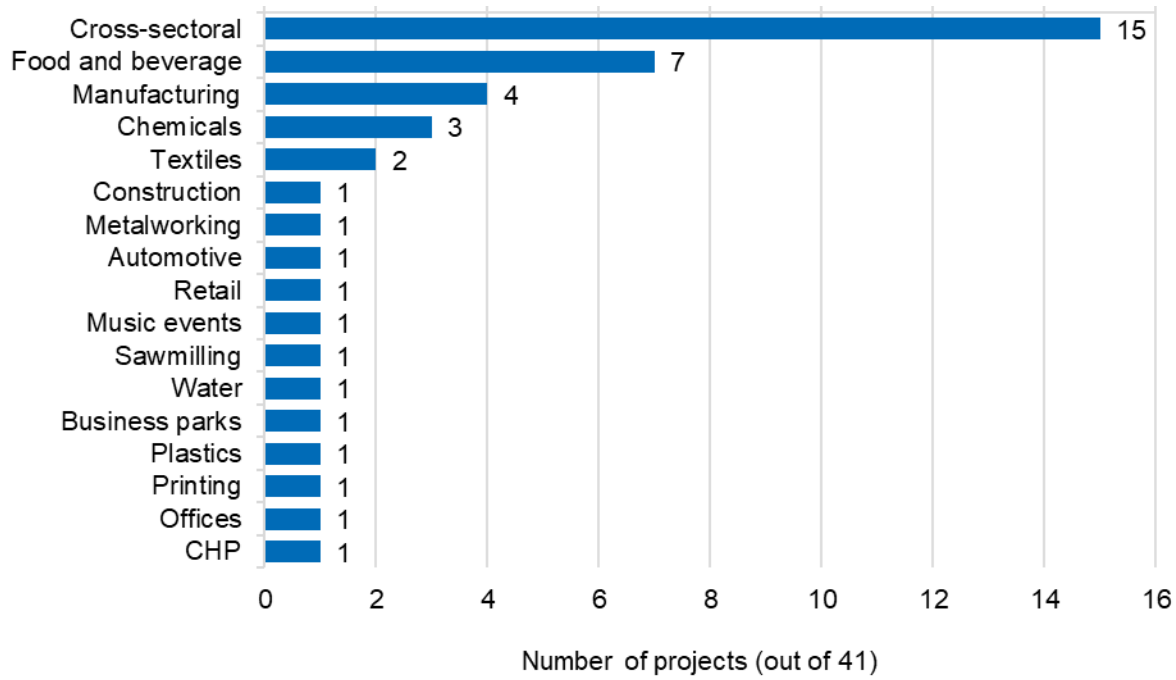


Figure 6-2: Sectors targeted across the 41 projects

6.1.3 Targeted market stakeholders

Figure 6-3, below, splits out the stated targeted market stakeholders of project outputs, i.e. the users of the project's outputs. All projects targeted SMEs. Industrial associations, public bodies, financial players, business and industry R&D and international organisations are each addressed by at least 10 of the projects. The majority of projects aimed to address more than a single category of market stakeholder.

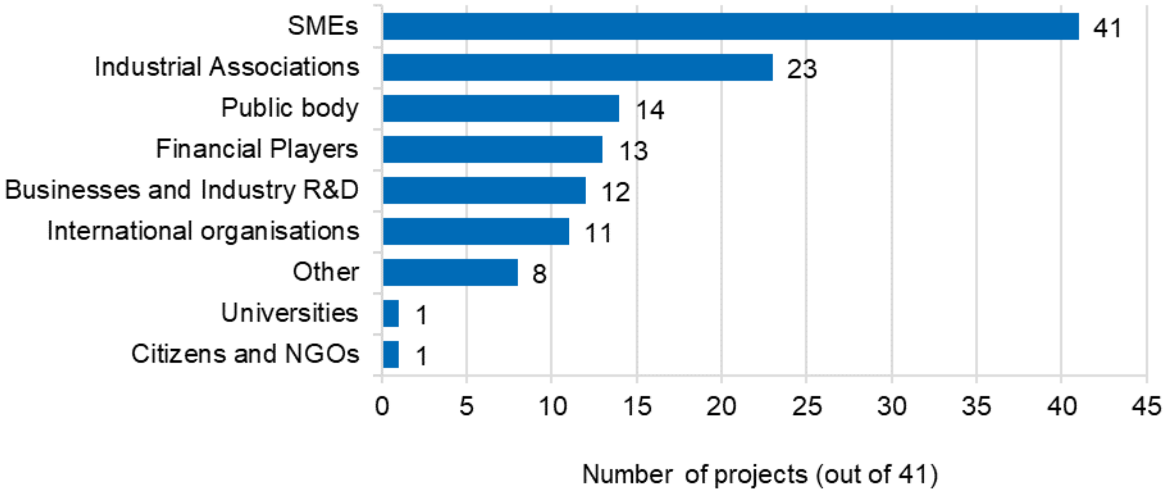


Figure 6-3: Targeted market stakeholders across the 41 projects

6.1.4 Project partners

As can be seen from Figure 3-4 the most common type of project partner in the projects considered is industrial associations, followed by SMEs[64], then businesses and industry R&D.

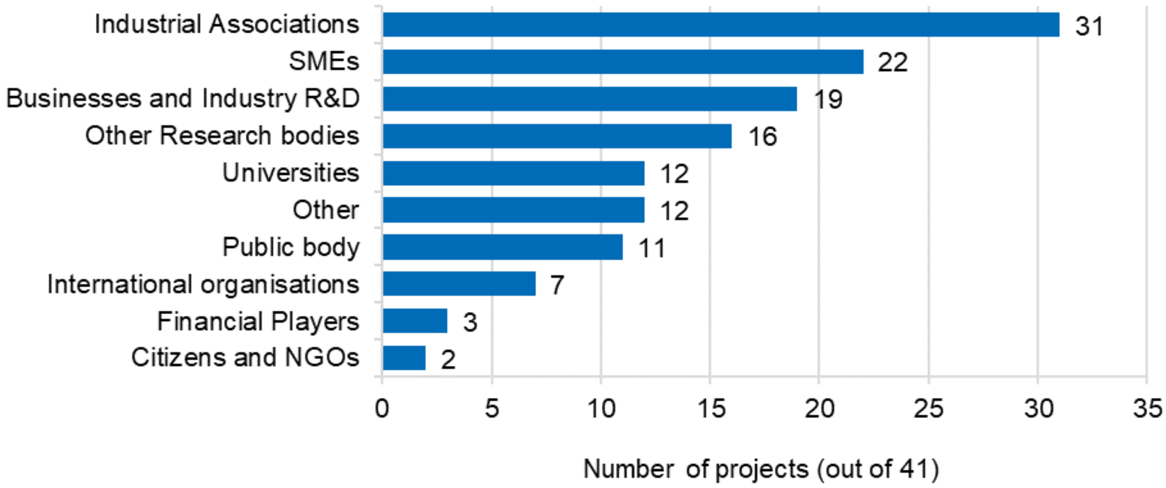


Figure 6-4: Organisational deliverers of project outputs

[64] In many cases, SMEs were involved in projects during their pilot phase to test the methodology, and not as direct beneficiaries.

6.1.5 Geographical spread

The geographical spread of the 41 projects is illustrated in the mapped diagram below, Figure 6-5. This is based on the stated countries of activity for each project. Eight projects considered their activities to be EU-wide in their application and these are not reflected in the figure below.

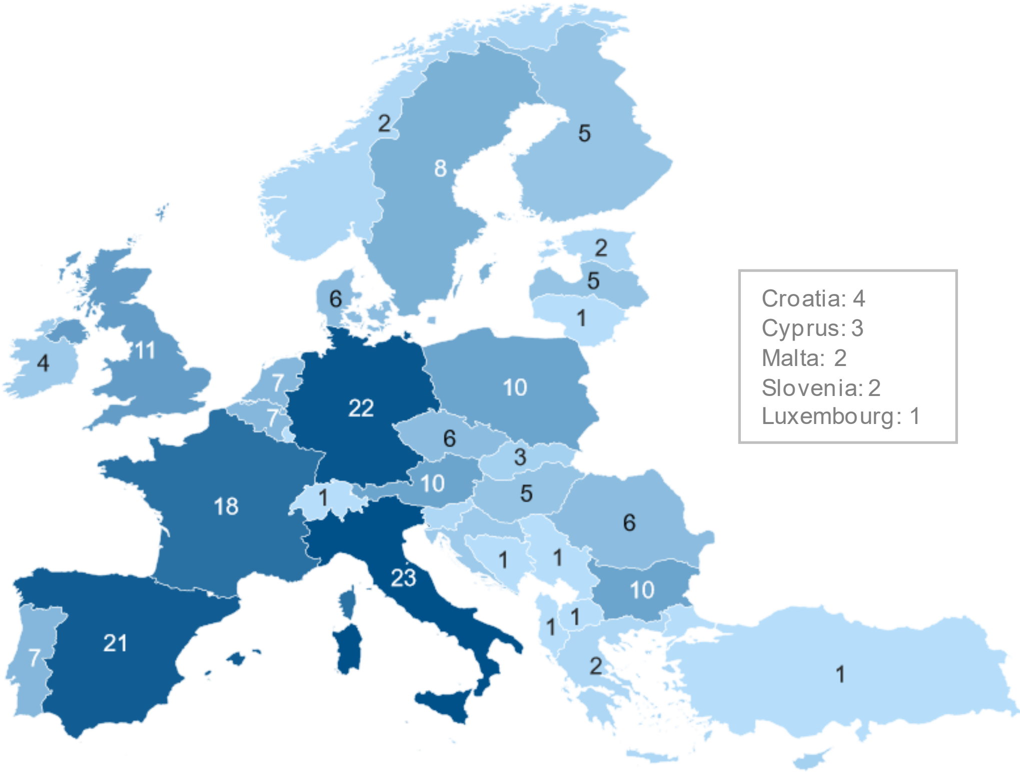


Figure 6-5: Geographical spread of project activity (number of projects active in each Member State and in neighbouring countries).

Regional and local aspects of project delivery are outlined in Box 6-1 below.

Box 6-1: Regional and local aspects of projects

It is highly likely that many of these projects have their impacts in a regional area within a country, rather than evenly distributed across a whole country, as the partners involved were often focused on regional areas, or had contacts and networks at the regional level and that will be where the majority of the benefit is delivered. Interviews supported this view, reflecting that partners involved with the work often had close ties with regional authorities, regional Chambers of Commerce etc.

That said, very few projects discussed regional aspects of their work in their project reporting or at interview. Nine projects have been noted for highlighting a regional aspect to their activities, but little specific detail was provided, and results are commonly presented at the national level.

IEE-II projects:

EE-Music: Noted that local experts and music scenes participated in each Member State, and that the PR strategy was focused on local and international aspects.

ERASME: Highlighted that it developed a Regional Advisory Committee (RAC).

Go-Eco: Highlighted that impacts had been experienced at the local levels - i.e. at business parks, and that the project had had a strong local focus. This project also noted that some partners had established partnerships with national and regional administrations to follow-up on Go-Eco.

RegCEP: Established regional "clusters" of companies as a framework for energy efficiency measures.

SPICE[3]: Workshops particularly highlighted local initiatives and funding schemes and country partners involved local or national authorities to engender higher acceptance amongst SMEs.

STEEEP: Established a network of regional and local Chambers of Commerce and Industry

TESLA: Regional Federations participated in the project with local SMEs brokerage events etc.

H2020 projects:

IMPAWATT: Noted that there were impacts at the local/regional level through the SMEs involved.

SCOoPE: Noted a local and regional focus, naturally an outcome of the cooperative basis.

6.2 Activities and Outputs of the 41 projects

This section provides a summary of the activities, outputs and KPIs - delivered within the project lifetime as well as after the project lifetime - for all 41 of the EASME IEE II and H2020 Energy Efficiency projects using the methodology outlined in Section 5. While Section 6.1 considered the stated 'how', 'who' and 'where' of project activities outlined in project reports, this section discusses the activities, outputs and KPIs of the 41 projects. As a first step total outputs across the 41 projects are presented (this section). These are then interrogated across different clusters of projects (Section 6.3). KPIs are then discussed for the project portfolio and for clusters of projects (Section 6.4).

This study of the performance of the 41 supported market uptake projects is based on analysis of available project documentation, supplemented by project interviews and data extrapolation where feasible. Where data extrapolation or estimation was required all estimates were developed using conservative data so as not to overestimate the impact.

The scope of the analysis was limited by:

- The published data availability. Although our research and identification of project-level data was far-reaching, some specific project data was not available to us. For instance, projects that finished more than 5 years ago usually do not maintain website domains, project deliverables and materials online while recently started projects have not yet triggered the expected impacts and so data is not yet available.

- Not all of the Project Coordinators and project participants engaged with this review process. This was perhaps due to the amount of time that has passed since the completion of the earliest projects. During the project, we were able to communicate with 34 out of the 41 projects. We have not received responses from seven projects, despite contacting 31 project participants across these projects. All seven of these projects are from the IEE programme.
- As indicated in the Methodology (Section 5) we made estimates for a proportion of the data where specific impacts were not calculated by the projects. All of our calculated estimates and conversions are regarded as "potential" impacts with regards to their reliability, as they are based on generic assumptions.

6.2.1 Project reach

Estimates for the reach of the 41 projects are presented in Table 6-1. These estimates are based on the project reporting and did not undergo re-estimation. When considering all the project activities and dissemination, the projects reached an audience of 4.5 million, although a large part of this reach was through media engagements and over 600,000 came from visits to project websites.

Table 6-1: Level of outreach across all 41 projects, within project lifetime.

Type of engagement	Reach
Number of people reached by projects (through all types of engagement)	4,525,386
Number of website visits	606,111
Number of workshops and events held (number of attendees)	1,129 (32,027)
Number of organisations with changed behaviour	6,257

The projects' more direct interactions through workshops and events attracted 32,027 attendees across 1,129 events and workshops. The average number of attendees per workshop or event was 28. This number was used to estimate the number of attendees for those workshops or events for which no attendee number was recorded.[65] An estimated 6,257 organisations changed their behaviour and improved their energy corporate culture as a result of project activities, leading to energy savings.

6.2.2 Project outputs – written outputs

The materials generated by projects and released for wider dissemination and knowledge sharing were compiled, as shown in Table 6-2. These estimates are based on project reporting and have not been re-estimated. These figures show the high level of outputs such as guides and articles, which contribute to awareness raising and knowledge sharing. In new hands, such material can seed ideas of potential improvements companies may not have been aware were implementable in their situation.

Table 6-2: Number of written outputs across all 41 projects, within project lifetime.

Type of output	Number
Good practice guides/case studies/fact sheets	368
Articles written and distributed e.g. for periodicals	598
Tools and platforms	51
Roadmaps and strategies	59

Several categories are merged together in the reported numbers because outputs described as case studies or factsheets were often used alongside each other. When reviewed, the types of material

[65] Information was available for 680 events, and the average was then used to calculate the attendees for the total 1,129 events

output were very similar, hence the categories were merged, as is the case with best practice guides/case studies/fact sheets.

For tools and platforms, the numbers are likely to have been higher than those reported above. Early projects developed single or several tools, while more recent projects tended to describe a single project platform that hosts a number of tools. Likewise, tools are typically designed as part of the implementation of a methodology but some projects did not highlight the tools developed, instead they just describing the methodology applied. Therefore, identifying all the tools developed, where they are not individually described, has been challenging and we sought to address this challenge by capturing tool(s) mentioned in written reports, methodology reports and calculations, or noted through our interview process.

Articles written may also be considerably higher than those reported above, particularly for peer reviewed publications, as those written after the end of a project will almost always not be captured by the final project reporting.

Furthermore, eight projects are still underway, with one in the process of closing, so the output numbers for activities such as articles, fact sheets and peer reviewed papers will likely increase further.

6.2.3 Project outputs – training and audits

Having discussed the reach and written outputs of the projects above, this section presents project activities and outputs that can be more directly linked through the results chain to impacts. The scale of these activities and outputs was reported more regularly by projects than the outputs discussed in the previous sections since they directly led to the estimates of the KPIs. The project activities and outputs presented in this section formed the basis of the impact recalculations since each output could be linked to a project-specific impact, as described in the methodology section. Therefore, these outputs were also analysed more carefully and discussed in interviews to improve on the reported figures. The numbers presented in this section are based on re-estimates from the current study.

The project outputs are presented in Table 6-3 and show the size of each output based on the reliable and acceptable re-estimates. From the recalculations, we can say that a total of 10,247 people were trained through a variety of courses developed by the projects. The recalculations we have conducted indicate that by their end, all projects will have (including the 8 on-going projects) carried out 3,553 audits as part of their activities.

Table 6-3: Number of people trained and audits undertaken, and number of projects contributing to the total reported.

Type of activity	Reach [Number of projects]
Number of people trained	10,247 [24]
Audits undertaken or expected	3,553 [27]

Interrogating the training by country and sector reveals the following (See Figure 6-6 and Figure 6-7Figure 6-7). The Member States with the highest number of project trainees are Italy, Spain, Poland, Germany, France and Poland, each with 600-1,000 people trained. The volume of training drops to 350-400 for Austria and Belgium, with all other Member States below this level.

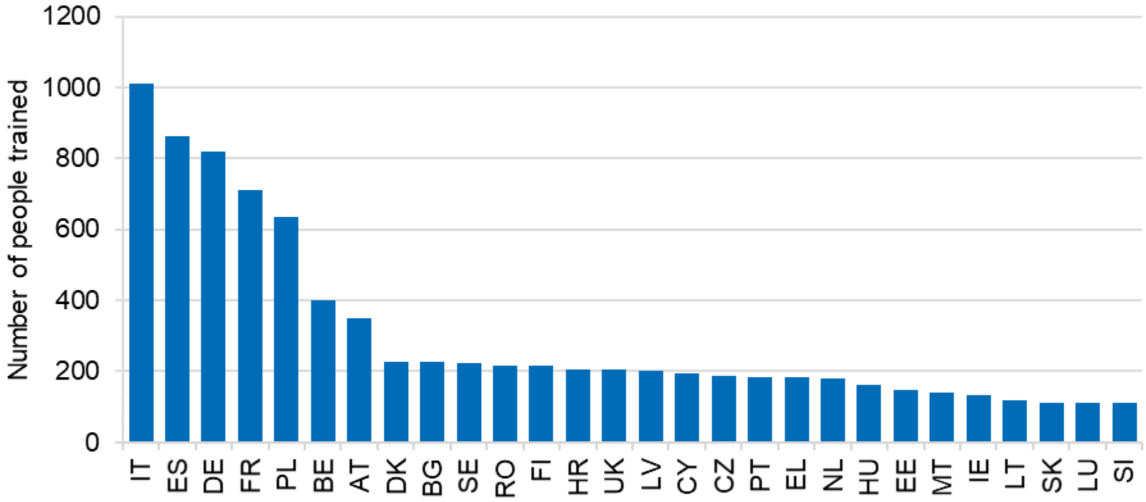


Figure 6-6: Distribution of people trained within the lifetime of the 41 projects, by Member State

In terms of which sector the trainings have taken place in, by far the largest number of individuals have been trained in cross-sectoral projects. Some 2,912 people were trained in the 15 cross-sectoral projects. The greatest numbers of people trained in projects focused on individual sectors are in the food and beverage, construction, metalworking and automotive sectors. This trend largely reflects the number of projects focused on these different sectors.

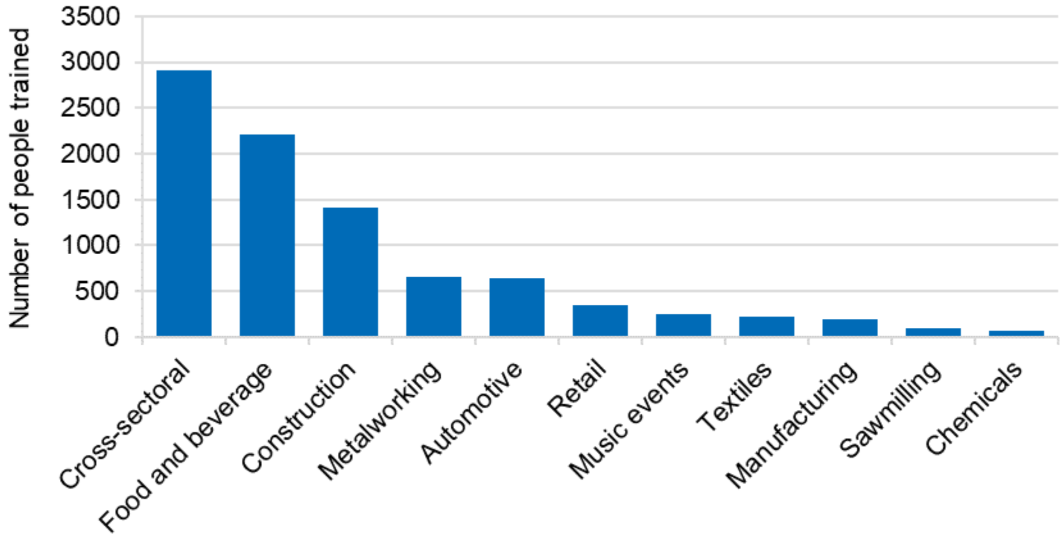


Figure 6-7: Distribution of people trained within the lifetime of the 41 projects, by sector

The description and approach to recording and reporting people trained shifted between IEE and H2020 programmes, with the earlier programme asking projects to identify people trained short term and long term. Within the H2020 requirements this had developed into three categories: market stakeholders (professionals) with increased skills; market stakeholders that participated in training; and market stakeholders with 3rd party qualifications (i.e. a qualification from a body not involved in the project). The results identified are split out between these categories and described later in this report (see Section 6.3).

The audits carried out during the lifetime of the projects are presented by country in Figure 6-8. Italy benefitted from the largest number of audits with 279, followed by Spain, Germany and France with 251, 219 and 198, respectively. Austria and Poland benefitted from about 150 audits with the remaining distribution gradually decreasing from 132 to 31 audits for the remaining Member States.

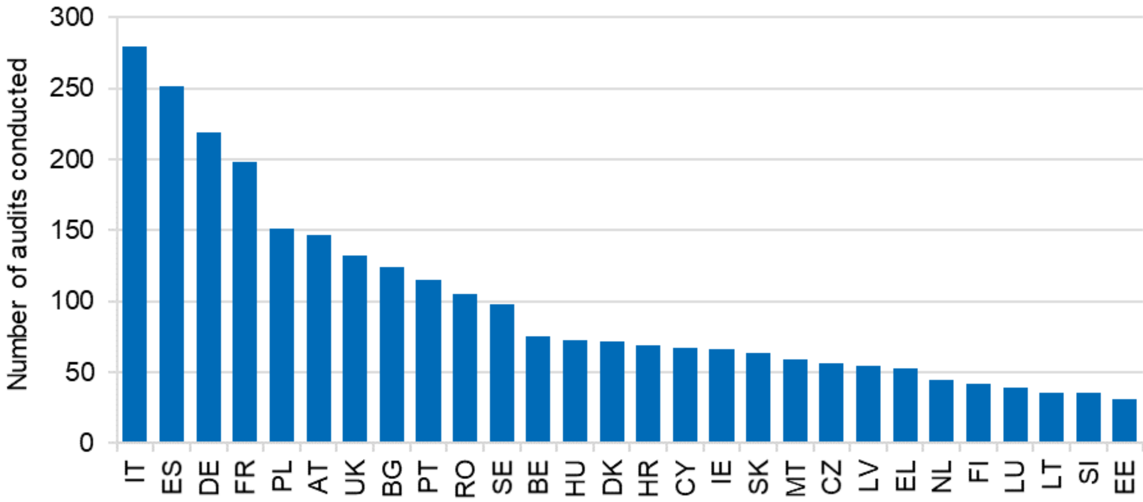


Figure 6-8: Distribution of audits conducted within the lifetime of the 41 projects, by Member State

Figure 6-9 shows the distribution of these audits across different sectors. As many as 1,755 audits were carried out by projects focusing across a non-specific, range of sectors. This is followed by the food and beverage sector benefitting from 420 audits. The remaining 579 audits were distributed across nine other sectors, with 123 being conducted in the retail sector.

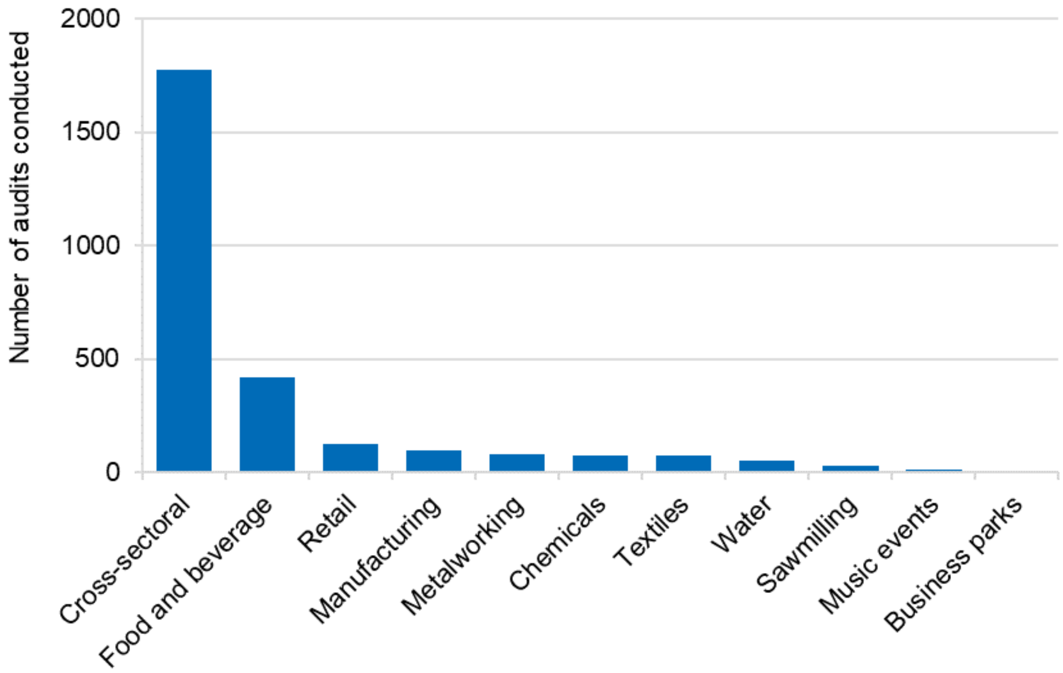


Figure 6-9: Distribution of audits carried out within the lifetime of the 41 projects, by sector

6.3 Impacts by completed and ongoing projects

There were often differences in approach and data reporting requirements between IEE and H2020 projects, which meant that direct comparison of some indicators has limited value. Furthermore, throughout this analysis it became apparent that there were some projects that did not sit easily within a "one size fits all" assessment, particularly the policy development focused projects.

In this section we cluster projects together where this best illustrates the learnings. Where of value we have presented separate totals for IEE and H2020 projects, as they represent two funding programmes, with slight differences in terms of their focus, requirements and EU funding rate.

Further interrogation of the project outputs considered in Sections 6.2.1 to 6.2.3 has been differentiated and described within the following clustering of projects to provide appropriate distinctions:

1. **Actual achievements from the fully completed projects targeting individual actions**, arising from the project lifetime as well as beyond the project lifetime.
2. **Actual achievements from the fully completed projects focused exclusively on policy development**, and projects with very significant policy development outputs. These have been clustered in a separate category, as while these projects very likely contributed to the transformation of their sector, their achievements and impacts may be realised long after the project lifetime and applying a numerical short-term approach provides little accuracy.
3. **Actual achievements for on-going projects**, where these have been demonstrated in already produced progress reports and deliverables,
4. **Planned achievements for on-going projects** where they are planned for future delivery. This includes any potential disruptions from the COVID-19 pandemic

6.3.1 Completed projects

The first cluster of projects considered is of the 33 projects that are complete. The timelines of when these projects were active is in Figure 6-10. Of these completed projects, 26 were funded through the IEE-II programme and 7 through the H2020 programme.

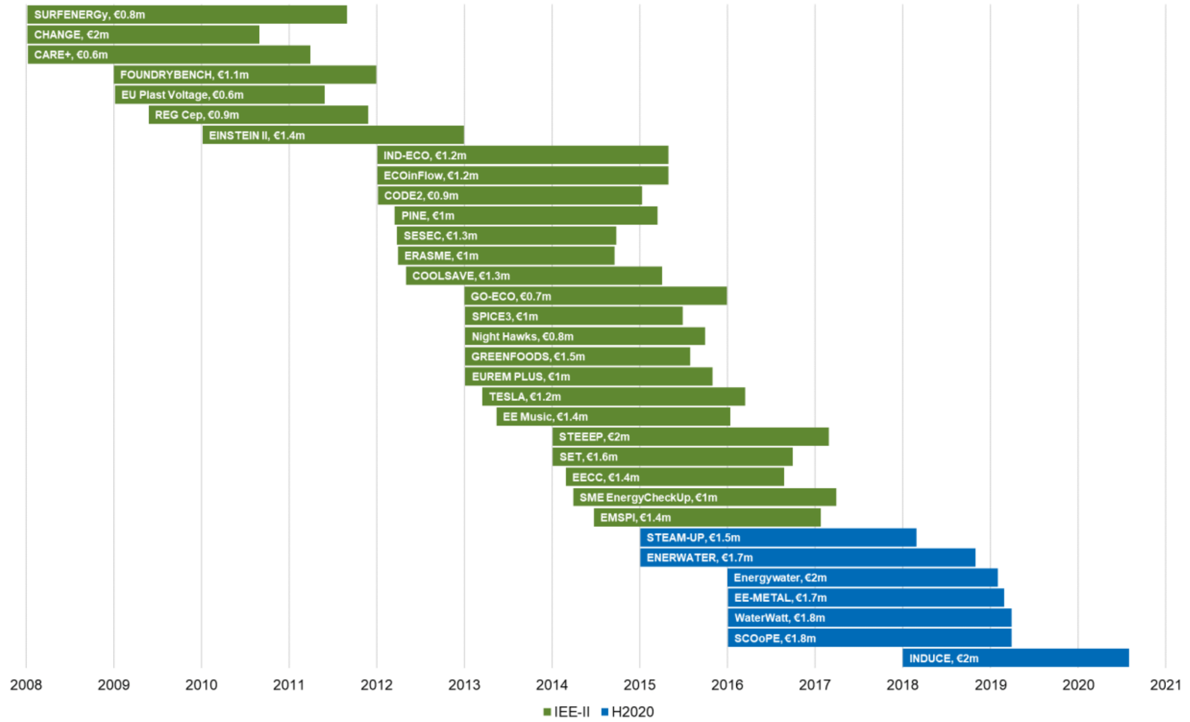


Figure 6-10: The completed IEE-II and H2020 projects

The estimates for the project reach of the 33 projects are presented in

Table 6-4: When considering all the project activities and dissemination, we found that the projects reached an estimated audience of around 4.5 million, although a large part of this reach was achieved through media engagements, and a further half a million came from visits to project websites. EE MUSIC accounted for a reach of 3,720,069 media impressions across the music industry and beyond. This was largely due to targeted media activities and is based on the estimation that the individuals reached were 1% of the 349,291,471 total media impressions made in 175 media publications.

Table 6-4: Project reach of the 33 completed projects and number of projects contributing to the total reported.

Type of engagement	IEE-II (26)	H2020 (7)
Project reach (through all types of engagement)	4,395,249	74,190
Number of website visits	550,321	5,790
Number of workshops and events held (number of attendees)	981 (27,829)	51 (1,447)
Behaviour changed (number of organisations)	3,178	2,238

The projects' more direct interactions through workshops and visits attracted around 29,275 attendees across 1,032 events and workshops. An estimated 5,416 organisations changed their behaviour as a result of project activities, leading to energy savings.

An overview of the written or developed outputs of the completed projects is presented in Table 6-5. Completed projects produced a total of 333 best practice guides, case studies and fact sheets. Furthermore, 514 articles were written by the projects to report of project findings and results. Finally, the projects developed a total of 34 platforms or tools.

Table 6-5: Written or developed outputs of the 33 completed projects and number of projects contributing to the total reported.

Type of output	IEE-II (26)	H2020 (7)
Best practice guides and case studies/fact sheets	268	65
Articles	422	92
Tools and platforms	24	10

As discussed in section 6.2.2, not all project achievements can be summarised in distinct categories as presented in the preceding tables. However, these various achievements are still notable and may result in significant impacts. A shortlist of these other achievements is presented here:

- Long lasting training schemes:
    - The EUREM training programme was first developed in 2005 and has since expanded to more countries and areas of expertise. The EUREMplus and EUREMnext projects focussed on introducing the EUREM programme to new countries and on developing new modules for the programme. Furthermore, other projects recognised the value of attaching their output to ongoing training programmes and made it a key component of their strategy to have impact beyond the project time. For example, the GREENFOODS and STEAM-UP projects developed training courses focussing on the food and beverage industry and the use of steam in industry, which were then integrated into the EUREM programme as additional modules.
    - EINSTEIN II noted that its training courses were delivered more widely than first anticipated in Europe, and also there was some delivery of these courses in African countries.
    - Within H2020 projects the effort to ensure the training programme material and learnings are captured and incorporated into long running and sustainable programmes

has assumed a higher significance. SMEmPower Efficiency has designed and received accreditation for its training course in 8 countries[66].

- Products and platforms launched on the market were reported by CARE+, CHANGE, COOLSAVE, Energywater, ENERWATER, FOUNDRYBENCH, GREENFOODS, IND-ECO, PINE, REG-Cep, SESEC, SET, SME EnergyCheckUp and STEAM-UP. Where detail was available, in all cases this was the release of the methodology/webtools.
- Benchmarks and standards were flagged by a number of projects, namely ECOinFlow, EE-MUSIC, EINSTEIN II, EMSPI, ENERWATER, EU Plast Voltage, EUREMplus, Go-Eco, IND_ECO, PINE, REG-Cep, SESEC, SET, SURFENERGy, and Energywater, usually through the development of benchmark approaches within the methodology developed within projects.

There were no prototypes developed or patents awarded captured from the reports from the 41 projects – since it is not part of market uptake activities but rather of research and innovation type of actions.

6.3.1.1 Projects targeting individual actions

The majority of projects have explored actions focusing on bottom up approaches of working with individual interested parties, be they people, companies or cooperatives. This is referred to as projects targeting individual actions and includes auditing and training activities. Top down actions such as policy development are discussed in the following section.

The majority of completed projects targeted individual actions, with audits and training being the two most common activities. The tables below show the number of audits and the number of people trained, as re-estimated in this study. These are presented by programme and by time (within or after the project lifetime). The total numbers given are only for those projects where the estimates of energy savings are rated as reliable or acceptable. The number of projects where re-estimates are considered reliable or acceptable is also given.

Audits were undertaken by 24 of the 33 completed projects during their lifetime and by 5 projects after their lifetime. The number of audits presented in Table 6-6 only count those audits from which reliable or acceptable impacts could be established. Across IEE-II (1,888) and H2020 (362) projects, a total of 2,250 audits were carried out during project time. After project time, IEE-II (560) and H2020 (408) projects carried out a further 968 audits. In total 3,218 audits have been carried out.

For IEE-II and H2020 projects, audits offered two main functions. Firstly, audits functioned as an approach for projects to gather data to inform methodology development, benchmarking, identifying best practices, and training people. Secondly, audits allow projects to make direct impacts on companies by identifying inefficiencies and potential savings. This represents 3,218 companies that received energy efficiency guidance and reports on their energy use and processes. Projects can thereby have a positive influence on companies by helping them understand their energy use and opportunities for potential changes, even if immediate action cannot always be guaranteed to take place.

Table 6-6: Audits conducted across the 33 completed projects and number of projects contributing to the total number reported.

Programme (No. of projects)	Timeline	Projects conducting audits (reliable + acceptable)	Number of audits
IEE-II (26)	During project lifetime	19 (17)	1,888
	After project lifetime	3 (2)	560
H2020 (7)	During project lifetime	5 (5)	362
	After project lifetime	2 (2)	408

[66] Confirmed through interview with the project coordinator.

Audits carried out by projects during the project time are straightforward to capture since the projects' activities are directly linked to the audits carried out. Some projects prepared and introduced provisions for further audits to be carried out after the project completed. However, this often happens in the form of people being trained and consequently carrying out audits. In these cases, the projects' activity was recorded as training and not as direct auditing. Therefore, the number of projects carrying out audits after the project time is small.

Training was provided by 16 of the 33 completed projects, where all projects providing training after the project lifetime also provided training during the project lifetime. In total 6,374 people were trained, of which 3,411 were trained during and 2,963 after the project lifetime. An overview of the training split across programme and time of activity is shown in Table 6-7. Only those trainings for which reliable or acceptable energy savings could be estimated are included in this table.

Table 6-7: People trained across the 33 completed projects and number of projects contributing to the total number reported.

Programme (No. of projects)	Timeline	Projects training people (reliable + acceptable)	Number of people trained
IEE-II (26)	During project lifetime	11 (11)	1,921
	After project lifetime	2 (2)	1,914
H2020 (6)	During project lifetime	5 (5)	1,490
	After project lifetime	2 (2)	1,049

One also has to consider that not all trainings resulted in the same level of capacity building. Some projects reported people were trained after participation in a one-day workshop while other projects only report those stakeholders that participated in longer courses as trained. For this reason, we also collected data on what projects reported in terms of the level of the stakeholder training. As discussed in Section 6.2.3, this data was only a reporting requirement for H2020 projects and is thus only presented for H2020 projects.

An overview of the findings is presented in Table 6-8. Note that the numbers presented below do not correspond with those in Table 6-7 because not all trainings were considered reliable or acceptable, or thorough enough to be associated with project impacts.

Table 6-8: Number of stakeholders trained, by level of training for the 7 completed H2020 projects

Programme	Level of capacity building (number of reporting projects)	Number
H2020 (7)	Market stakeholders (professionals) with increased skills (5)	2,739
	Market Stakeholders participated in training (4)	1,773
	Market stakeholders with 3rd party qualifications (1)	222

An overview of the findings is presented in Table 6-8. Note that the numbers presented below do not correspond with those in Table 6-7 because not all trainings were considered reliable or acceptable, or thorough enough to be associated with project impacts.

It should be noted that the most recently completed project, INDUCE, was impacted by the COVID-19 pandemic, Box 6-2 below highlights the impact of the pandemic on the INDUCE project.

Box 6-2: Impact of the COVID-19 pandemic on the INDUCE project.

In the case of the INDUCE project, they completed their activities in 2020 and have therefore been severely impacted by the global pandemic. This project developed a methodology for the design and implementation of capacity building programmes through a Human-Centred Design approach. The initial pilot stage of the project involved 15 companies, and the intention was to replicate these activities, with improvements, with 300 companies over Spring/Summer 2020. However, this could not take place. The planned workshops could not be held face to face due to the inability of companies to participate during the various lockdowns and economic turmoil of 2020, and there was insufficient time available to change to remote delivery.

Table 6-9: Originally anticipated activities of INDUCE project and 'actual' achievements

Type of engagement	Anticipated	Actual
Number of audits conducted (pilot phase)	15	15
Number of audits conducted (replication phase)	300	0
Number of workshops held	4	8 (some online)
Number of workshop attendees	Not stated	Not observed
Stakeholders reached (through all types of engagement)	100,000	8,000
Companies reached (through all types of engagement)	15,000	Not observed
Market stakeholders (professionals) with increased skills	60	63
Market Stakeholders participated in training	60	63
Market stakeholders with 3rd party qualifications	60	63
Companies implementing INDUCE methodology after project duration	40,000	305[1]

The actual achievements of the project, fall well below those originally anticipated in the Grant Agreement. However, assuming the replication phase could have been carried out with a level of implementation in line with the 'common factor' obtained from other projects, we were able to extrapolate what their likely results would have been.

In the Final Report, the consortium extrapolated the "potential" impact from 11 of the 15 pilot companies to the 315 companies originally targeted within the duration of the project. In our 're-estimate' of the INDUCE project KPIs (see Section 6.4) we have used the actual achieved impacts from the 11 companies. However, we have also noted the effect of the COVID-19 pandemic on the project and provided alternative 'potential' KPIs that could have been achieved if the pandemic had not affected the final stage of activities.

6.3.1.2 Projects targeting policy development

While the majority of projects studied here have taken a 'bottom-up' approach, by looking to build capacity or effect change in the behaviour of individuals and SMEs, some projects have specifically taken a 'top-down' approach by seeking to influence the development and implementation of policies and legislation at EU, national or local level. This discussion addresses the reported outputs for new/modified policies/strategies both at the national and local level.

One project, EU Plast Voltage, targeted policy development as its central aim, creating and implementing a Voluntary Agreement, addressing long-term energy efficiency targets for the European plastics-converting industry. The agreement saw companies in the industry set a target of improving energy efficiency by 20%, in line with the EU target on energy efficiency, and the agreement addressed 60% of the plastics converting capacity in Europe; some 945,000 employees. The completion point for the project was the establishment of this agreement. The project did not report any specific impacts. Our re-estimate of the impacts is zero for those during the project lifetime, but significant for the long-term impact of the policy. We were unable to verify the level of compliance with the agreement at interview as project partners could not be reached. We therefore included an additional factor besides the 20% energy savings figure, reflecting a likely level of compliance with the voluntary agreement. This was based on the implementation rate of a similar voluntary agreement found in literature, rather than assuming full compliance.[67] The impact of this agreement over the period 2011 to 2016 was estimated within this work as 180.3 GWh/y in terms of primary energy savings, € 28.7 million investments and 48,974 tCO_2e GHG emissions reductions.

The CODE2 project sought to stimulate cogeneration uptake in the EU by supporting Member States in developing roadmaps and providing guidance on cogeneration legislation and business cases. The project outputs were 27 MS roadmaps and an EU level roadmap for cogeneration, all of which are classed as policy development and support. The project also focused on generating 30 best practice case studies and reports to support the business case. However, the actual impact of the project's outputs and activities cannot be measured or calculated due to a lack of evidence. Furthermore, any cogeneration uptake is impossible to directly associate with CODE2 due to questions around attribution. Therefore, we have to take a top-down rather than bottom-up approach. We assumed a 1% increase in the uptake of CHP after the project lifetime due to the roadmaps developed and the policy discussion facilitated. Since CHP is around 20% more efficient at producing heat and power than conventional heat and power production, the increased CHP uptake is expected to save 20% of energy inputs for the same heat and power produced. Using these assumptions, we estimated around 862 GWh/year of energy savings.

Several other projects have had notable policy successes as part of the package of activities they have undertaken. Through an interview with the project coordinator, it was recently confirmed that the ENERWATER activities of establishing a baseline and an audit standard methodology for wastewater plants have yielded a confirmed European Standard through CEN[68]. It was originally anticipated within the project that recommendations for standards and legislation would be made, but not that this considerably further stage would be achieved. The standard development relied significantly on the further involvement of project partners in its development after the project lifetime. In our re-estimate of impacts after the project's duration, we have assumed that the new standard can achieve an average 1% improved efficiency across all European wastewater treatment plants. This approach is in line with the "Guidelines for the Calculation of Project Performance Indicators" published by EASME and was also used by ENERWATER in their Grant Agreement estimates for impacts beyond the project lifetime. We estimate the impact of this standards creation as 255.8 GWh/y primary energy savings, € 49.8 million of cumulative investment and 73,579 tCO_2e/y of GHG emissions reductions.

A further example of potential direct policy influence for after project lifetime impact of project activities is the NIGHTHAWKS project, which may have influenced the required design and settings on vending machines for overnight temperatures.

Energywater also reported the production of seven policies created for sustainable energy. ICCEE reported the production of two policymaker statements. EINSTEIN II noted there had been CEN/CENELEC collaboration during the project. Energywater and EMSPI both discuss Voluntary Agreements in their reporting. However, in these cases the links between activities and subsequent policies could not be corroborated or were deemed insufficient to warrant attribution to the impact of policies to project activities. Where the specific causal relationship is unclear, we have been conservative.

Table 6-10: Significant policy outputs from completed projects.

Project	Call	Activity
EU Plast Voltage	IEE-II	Voluntary Agreement (European Plastics Converting Industry Voluntary Long-Term Agreement on Energy Efficiency)
CODE2	IEE-II	27 roadmaps (National Cogeneration Roadmaps)

[67] https://piru.ac.uk/assets/files/RD%20SCOPING%20lit%20review%20(Bryden%20et%20al),%2011%20Apr%2012.pdf
[68] CEN/TR 17614 Standard method for assessing and improving the energy efficiency of wastewater

Project	Call	Activity
ENERWATER	H2020	Standard produced through CEN (CEN/TR 17614 Standard method for assessing and improving the energy efficiency of wastewater)

In the above three projects, both EU Plast Voltage and CODE2 conducted no training and no audits, as the focus was fully on policy development. For ENERWATER, the audits (50 within project lifetime) and market stakeholders with increased skills (143) activities have been counted within the Individual Actions section 6.3.1.1 above.

While many projects target policy development and seek to support discussions, knowledge sharing, education of decision makers, such progress is not possible to quantify, and so only policy activities that have a specific tangible output, that we were able to identify through project reporting or interview, have been included in the impact recalculations we have conducted.

The wider, common range of outputs (such as project reach, publications, events etc.) have been captured within the set of data for the portfolio of 41, and again in the set of data for the 33 completed projects.

6.3.2 Ongoing projects

As described in the introduction of section 6.3, the achievements (or potential achievements) of ongoing projects are considered separately in this section. The reasoning for this is that although some achievements have already been confirmed, the projects are yet to be completed and still have to present their final results and reporting. Therefore, the findings in this section are mostly based on interim reports and interviews, as well as some reference to grant agreements.

An overview of the ongoing projects is presented in Figure 6-11. The actual achievements of ongoing projects, as discussed in section 6.3.2.1 below, focus on project achievements for which enough evidence could be gathered through interim reports and interviews to confirm the achievements. Section 6.3.2.2 discusses the planned achievements of ongoing projects and includes achievements of ongoing projects that were not yet at a stage to confirm that the activities leading to impacts had been completed by the time of writing.

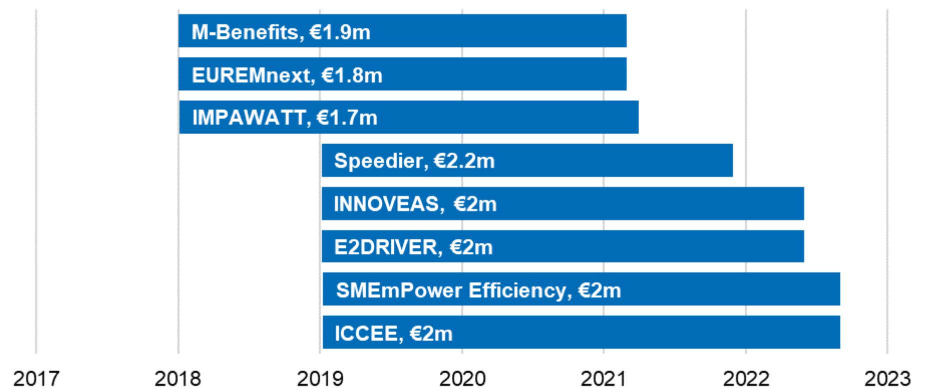


Figure 6-11: All currently ongoing projects (8)

6.3.2.1 Actual achievements

There are three ongoing projects that began at the start of 2018 and have reported achievements to date in their Interim Reports (M-BENEFITS, EUREMnext and IMPAWATT). These projects have been impacted by the COVID-19 pandemic and so care has been taken in determining what impacts have been achieved. This has involved analysis of interim reports and stakeholder interviews.[69]

[69] There was a particular challenge around projects that were currently live and near conclusion. EUREMnext and IMPAWATT provided enough evidence of actual achievements, while the remaining six ongoing projects were not at a stage yet to confirm the activities leading to impacts were completed. Therefore, the actual achievements only comprise achievements of the EUREMnext and IMPAWATT projects.

All three of the projects have addressed individual actions, with none anticipating outputs in terms of new/modified policies/strategies at a national or local level.[70] Hence all projects in this section are discussed in terms of individual actions.

The number of market stakeholders reached by the projects as reported in the interim reports and by project partners in the interviews is shown in Table 6-11. Out of the three projects, only IMPAWATT sought to carry out audits and confirmed through an interview that 47 had already been carried out[71] with a further 18 to be completed soon. Furthermore, the number of people benefitting from these projects' capacity building activities are split by level of capacity built by the projects.

Table 6-11: Type of engagement actions achieved to date in the ongoing projects.

Type of engagement	Planned numbers
Workshops held (attendees)	8 (170)
Audits conducted	65
Stakeholders reached (through all types of engagement)	995
Market stakeholders (professionals) with increased skills	1,156
Market stakeholders participated in training	1,156
Market stakeholders with 3rd party qualifications	306
Behaviour changed (individuals)	1,156
Behaviour changed (organisations)	551

The wider, common range of outputs (such as project reach, publications, events etc.) have been captured within the set of data for the portfolio of 41 projects to provide a programme level of project reach.

As mentioned previously, the COVID-19 pandemic has had an impact on the ability of some projects to carry out their activities as planned. The three projects had more time remaining in their timeline than INDUCE (see Section 6.3.1.1), and so had more chance to amend their plans. All three have requested and received extensions to give them more time to overcome obstacles encountered due to the pandemic and a better chance of achieving the impacts originally targeted in the Grant Agreement. It follows that our 're-estimates' of KPIs for these projects are generally similar to the KPIs originally targeted in their Grant Agreements, as project activities are not expected to have been dramatically affected.

For instance, M-BENEFITS is currently carrying out a pilot phase with 30 companies, whereas 50 were originally targeted. Although IMPAWATT as a project depends on capacity building and was therefore impacted by the COVID-19 outbreak, it has finalised its development of the IMPAWATT platform, the training platform and the webinars. The project has had 47 companies register with the platform, of the targeted 75 for the extensive IMPAWATT+ programme, and 81 companies register, of the targeted 95, on the regular IMPAWATT programme. Furthermore, the project has carried out capacity building for at least 600 people by the end of 2020, with the target being 850 by the end of the project.

Meanwhile, EUREMnext's impacts and KPIs are actually higher than originally targeted. This was due to the number of training participants exceeding the original targets that were used in the Grant Agreement estimates, which assumed 12 training participants in those countries that were new to the EUREM programme. The first of the new countries to start the EUREM training programme was Albania in October 2018 with 23 participants before Bosnia-Herzegovina, Estonia, Latvia and Serbia followed

[70] Note: M-Benefits aimed to produce policy recommendations as part of the project but neither project translates these into expected impacts
[71] As of December 2020

suit with a total of 80 participants. The course in Turkey began in December 2019. These impacts which have already been achieved have been included in the 'actual' achievements above (Table 4-12).

6.3.2.2 Planned achievements

This section presents the outputs and activities that ongoing projects have planned to achieve. The planned achievements discussed in this section focus on those that are rated as reliable or acceptable or mentioned during interviews. Figure 6-11, at the start of section 6.3.2, outlines the nine H2020 projects that are ongoing. Four of the projects are well on the way to completion (discussed in the previous section) with some of their outputs still to be achieved, while the five projects that have been awarded more recently are all starting to achieve their outputs. The interrogation of these projects is based for the earlier four on the outputs still anticipated to be achieved, and for the more recent five fully on their anticipated outputs as stated in the Grant Agreement project description as well as updates and insights gained through interview and discussion.

Planned project achievements are recorded in Table 6-12. Out of the nine ongoing projects, SMEmPower Efficiency (160) and Speedier (110) are planning further audits, on top of those already carried out to date. The numbers given here will bring the projects up to the totals originally stated in the grant agreements.

Table 6-12: Type of engagement actions expected from the 9 live projects

Type of engagement anticipated to take place	Planned numbers
Workshops still to be held (attendees)	89 (1,802)
Audits still to be conducted	270
Stakeholders still to be reached (through all types of engagement)	54,952
Market stakeholders (professionals) with increased skills	5,055
Market Stakeholders participated in training	1,795
Market stakeholders with 3rd party qualifications	450
Behaviour to be changed (individuals)	4,050
Behaviour to be changed (organisations)	290

Through interviews with project coordinators and partners for SPEEDIER, INNOVEAS, E2DRIVER, SMEmPower Efficiency, and ICCEE it has been identified that the main activities for these projects are still under development or have begun only recently. SPEEDIER, for instance, is currently developing the project tool, which has been presented to the core group. The INNOVEAS project meanwhile has just delivered its preparatory studies and analyses and is about to complete its first tools for its Capacity Building Programme. Within the E2DRIVER project, the platform to implement the online part of the project learning is currently under finalisation and will be launched in the coming months. Moreover, the SMEmPower Efficiency project has developed its training material and platform and will implement the training process starting from January 2021. Lastly, the ICCEE project is currently in the process of validating its toolkit and running national workshops in partner countries.

For ongoing projects there are, and continue to be, disruptions from the COVID-19 outbreak. A workshop can, with enough time available, be changed from face to face to online delivery, and this even offers an opportunity to involve a greater number of participants. However, the level of engagement by participants and the knowledge they will gain cannot be known.

Interviewees from INNOVEAS and SMEmPower Efficiency have stated that their projects have adapted well or with ease to the COVID-19 outbreak to date, with a successful shift from physical to virtual modalities. SMEmPower Efficiency, in particular, will be focussing on capturing relevant elements of new EU policies and directives, including the EU Green Deal, in its training material. Meanwhile, interviewees from the E2DRIVER project highlighted that although they had been successful in recruiting 12 pilot companies, finding 28 other replication companies in the later stages of the project may be more difficult due to the effects of the pandemic. Nevertheless, they appear confident to meet their targets at this stage.

Within the SPEEDIER project it was noted by partners that fostering an improved energy efficiency culture would be difficult even without COVID-19 complications. The SPEEDIER team aims to encourage participating SMEs to undergo energy audits for the purpose of supporting economic recovery by improving profit and loss accounts, as well as providing a range of benefits, rather than just delivering energy savings. Finally, an interviewee from the SMEmPower Efficiency has stated that although the earlier stages of the project were not significantly impacted by the pandemic, the effect of COVID-19 on engagement and willingness of SMEs to participate has become more evident now that the partners have begun to reach out to SMEs.

The ongoing H2020 projects are still in the process of developing or implementing their stakeholder-based activities. These will have therefore more time and resources available to adapt to the unfolding COVID-19 situation, while some of the recently completed H2020 projects were more severely impacted due to their lack of budget and time to adapt.

The wider, common range of outputs (such as project reach, publications, events etc) have been captured for the portfolio of 41 projects to provide a programme level of project reach.

Box 6-3 below highlights the interactions that recent projects have been benefitting from knowledge sharing and supporting each other's dissemination activities.

Box 6-3: Recent projects benefitting from knowledge sharing

The five ongoing projects awarded in the same round, SPEEDIER, E2DRIVER, ICCEE, SMEmPower Efficiency and INNOVEAS, periodically come together to share their status with each other, to mutually support their dissemination activities (such as sharing survey links through each other's newsletters), to support each other in identifying the most appropriate SMEs for their activities, and to develop synergies in their project work. The projects have also organised joint workshops, joint publications and have presented their findings together at the Sustainable Places 2020 conference.

They recognise that between all their European based partners, they have connections to a large number of SMEs from a wide range of sectors. By working together, they can enhance the impact of their messages, share learnings, encourage each other, and potentially help the SMEs benefit from the most appropriate project. This may yield increased impacts, but we have not been able to quantify this.

This approach may offer further benefits as the projects continue to navigate the changing economic landscape of COVID-19 impacting Europe, altering their project approaches to deliver online training rather than face to face, to deliver remote data gathering and energy advice. The projects are able to share approaches that work, and those that are less successful. These steps have helped them continue to make progress with the project programmes, in spite of the challenging times being faced by European SMEs.

6.4 Project key performance indicator (KPIs)

A significant focus for analysis throughout our study were the project impacts in the form of the common performance indicators (CPIs, IEE programme KPIs) or project performance indicators (PPIs, H2020 programme KPIs), which all projects were required to report. Together these two sets of indicators are referred to as KPIs within this report. This allowed us to carry out a more thorough investigation of trends compared to the project performance indicators, which were very project specific and sometimes lacked clarity.

In this section we have assessed the total impacts of the 36 projects that have been classified into the highest categories of reliability: reliable and acceptable. The majority of impacts are achieved impacts, but in some cases enough evidence was available to also mark anticipated impacts as acceptable or reliable. Projects that were classified as uncertain have not been used within the assessment. Through the re-estimate methodology, we enhanced the reliability of the impacts achieved by the projects.

Figure 6-12 illustrates the reliability rating assigned to the reported KPIs **during** the project lifetime in the grant agreement, final reporting and re-estimate.

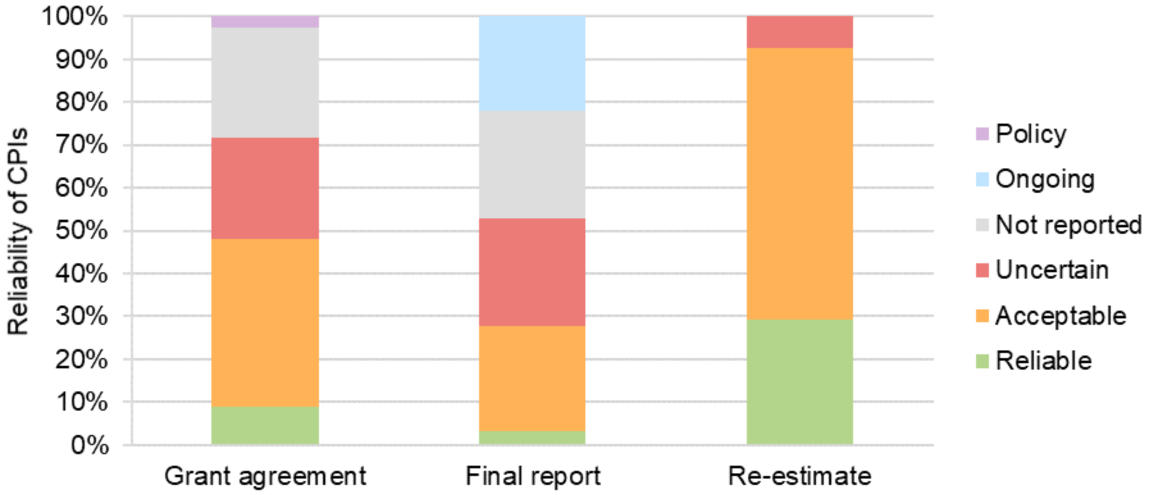


Figure 6-12: Reliability rating shares of the KPIs reported for impact during project duration (excluding the renewable energy KPI due to its low frequency of reporting).

As indicated in the figure above, the research and calculations done throughout the study has contributed to increasing the reliability rating of the impacts (as reflected in the re-estimate) so that reliable and acceptable impacts were estimated for 93% of KPIs. The process for performing the re-estimate was outlined in section 5.3.

The reduced levels of reliability recorded for the final report KPIs compared to the grant agreement can be assigned to two main reasons. The first reason is that the KPIs of more recent projects, which generally were more reliable (as discussed in 6.5.3), were not yet reported at the time of writing this report, therefore reducing the share of reliable and acceptable KPIs. The second reason is that final report KPIs were generally expected to be more detailed and based on project-specific evidence, while the grant agreement KPIs could be based on references and on top-down estimates. Therefore, a lack of evidence for the reported KPIs had a more significant impact on the assessment of the reliability of the final report KPIs.

The impacts **after** the project lifetime were difficult to estimate in many instances since there was a lack of data and clarity about how the outputs were used as well as whether and how activities were continued. Therefore, the actual achieved impacts after the project are likely higher than estimated in the following sections, but could not be quantified. The lack of acceptable or reliable estimates for the project impacts after the project time is especially noticeable for H2020 projects, since the earliest H2020 projects only ended in the last two years and the achieved impacts up to five years after the project end could not fully be captured. Figure 6-13 illustrates the reliability rating assigned to the reported KPIs after the project lifetime in the grant agreement, final reporting and re-estimates.

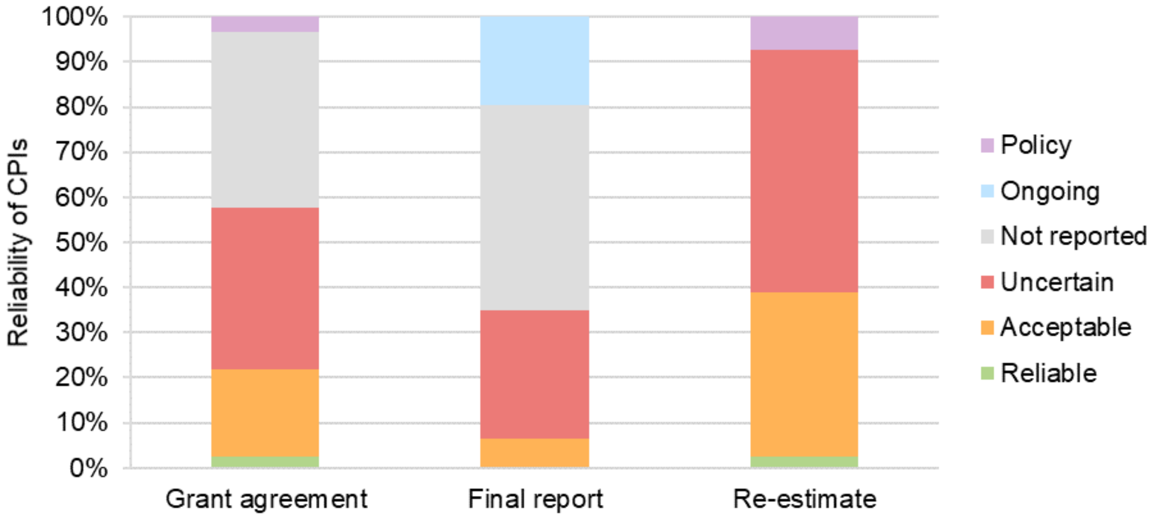


Figure 6-13: Reliability rating shares of the KPIs reported for impact after project duration (excluding the renewable energy KPI, due to its low frequency of reporting).

As indicated in the figure above, the research and calculations carried out throughout the study have contributed to an increase in the reliability rating of the impacts so that reliable and acceptable impacts were estimated for about 39% of KPIs. This includes a few cases where evidence was found through interviews that it is unlikely that any follow-on activities would have led to further impacts. In these cases, an impact of zero was estimated and rated as acceptable or reliable.

A significant share (54%) of KPI re-estimates were marked as uncertain. However, these fell into two categories. On one hand, there were impacts that we could quantify based on some evidence, but these were not deemed reliable enough to include in the final analysis. On the other hand, there were projects for which no impacts after the project lifetime could be estimated due to limited or complete lack of evidence. In some of these cases, some evidence of continued activity could be identified, however the actual impact could not be quantified.

6.4.1 Energy savings

After assessing the energy saving activities and outputs of 41 projects, we estimated the total primary energy saved by completed projects or ongoing projects with reliable or acceptable estimates. In total, 1,754 GWh/year energy savings were estimated to be triggered by activities carried out within the project lifetime and 1,737 GWh/year by sustained actions continuing after the project ended. An overview of the total energy savings by programme during and after project lifetimes is shown in Table 6-13.

Table 6-13: Estimated primary energy savings reached during and after the project lifetimes in GWh/year and number of projects contributing to the estimates, with number in brackets indicating number of projects with reliable or acceptable energy savings and excluding number of projects with uncertain or no savings.

Primary energy savings (GWh/year)	IEE-II	H2020 (completed)	H2020 (ongoing, based on estimations)	Total
During project lifetime (36)	1,090	471	194	1,754
During project lifetime (average)	50	67	28	49
After project lifetime (12)	1,485	252	0	1,737
Total	**2,574**	**723**	**194**	**3,491**

The total primary energy savings achieved by IEE-II projects were 2,574 GWh/year compared to H2020's projected 916 GWh/year. The average primary energy savings achieved during the project lifetime was 50 GWh/year for IEE-II projects, 67 GWh/year for completed H2020 projects and 28 GWh/year for ongoing H2020 projects. The lower average for ongoing H2020 projects is due to the fact that these projects have not yet finalised their activities and the impacts are therefore difficult to quantify to a reliable or acceptable rating.

The number of projects offer a relatively small sample size to make definitive statements about why there may have been an increase in energy savings per project from the completed IEE-II to H2020 projects. It is possible, however, that the adoption of the EED in 2012, particularly Art. 8, may have had a role in pushing SMEs involved in H2020 projects implemented from 2014 to 2020 to be more willing to invest in energy efficiency measures compared to those SMEs that were involved in the IEE-II programme. Another possibility is that some IEE projects lacked evidence to make a comprehensive re-estimate of the project's energy savings. This resulted in a more conservative estimate for these projects and will have decreased the average found for IEE-II projects.

The primary energy savings achieved after the project lifetimes amounted to 1,485 GWh/year for IEE-II projects, 252 GWh/year for H2020 projects. The comparatively low energy savings by H2020 projects after the project lifetime is due to these projects having been completed recently. Any activities carried out after the project lifetime will either be ongoing or yet to commence, so that the achieved energy savings are limited and the anticipated energy savings lack evidence.

While carrying out the re-estimates for how much energy was saved by each project, the re-estimates also captured the type of energy that was saved. The accuracy of this was very dependent on the accuracy of the savings data provided by the projects. Where projects showed detailed audit data, we could sometimes identify what types of energy were saved. Where projects only reported energy savings, we had to make assumptions of what energy was saved based on industry, years active, Member States and primary energy factors. The estimated primary energy shares saved due to the projects within their lifetime by type of energy is illustrated in Figure 6-14.

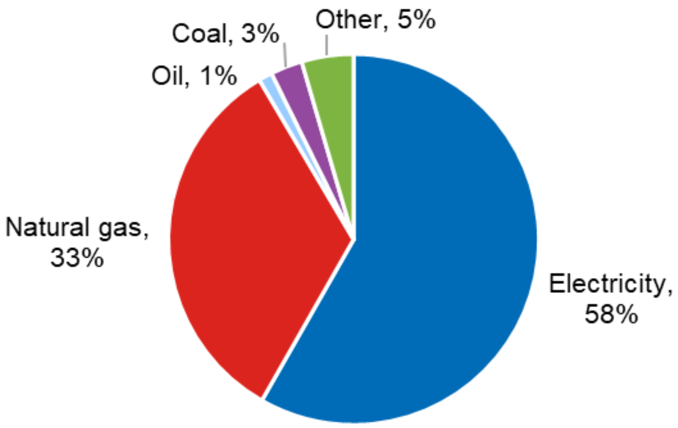


Figure 6-14: Shares of primary energy saved during project lifetimes type of energy

The main driver for investment decisions is the associated payback time of the investment. In the case of investment in energy efficiency measures, the payback time is dependent on the cost savings or increased revenue as a result of the measure. When only considering the energy savings resulting from the energy efficiency measure, one can identify the associated cost savings by multiplying the energy savings by the energy costs.

Using the final energy savings estimated for the projects, split by energy type, we can use Eurostat industrial energy prices for each energy type to estimate the cost savings triggered by the measures implemented as a result of the projects. The calculation shows that an estimated total of €89 million per year was saved by measures resulting from activities carried out during projects, and a further €94 million per year by measures resulting from activities carried out after projects.

6.4.2 GHG reduction

The GHG reduction resulting from the project outputs and activities was estimated from the energy savings using relevant emission factors. An overview of the GHG reduction by programme during and after project lifetimes is shown in Table 6-14. The GHG reduction achieved by IEE-II projects within the project time was 416 ktCO_2/year compared to H2020 projects' 170 ktCO_2/year. The average GHG savings achieved during the project lifetime was 19 ktCO_2/year for IEE-II projects, 17 ktCO_2/year for completed H2020 projects and 8 ktCO_2/year for ongoing H2020 projects. The lower average for ongoing H2020 projects is due to the fact that these projects have not yet finalised their activities and the impacts are therefore difficult to quantify to a reliable or acceptable rating.

On comparison of the average primary energy savings and the average GHG reduction of completed IEE-II and H2020 project, one finds that although H2020 projects saved more energy, they led to less GHG reduction. This is due to an electricity system with decreasing GHG intensity during the period when H2020 projects were active compared to the period when IEE-II project were active. Therefore, the higher primary energy savings of H2020 projects resulted in less GHG reduction per unit of energy (or more specifically electricity) saved.

Table 6-14: Estimated GHG reduction reached during and after the project lifetimes in ktCO_2/year and number of projects contributing to the estimates.

GHG reduction (ktCO_2/year)	IEE-II	H2020 (completed)	H2020 (ongoing)	Total
During project lifetime (36)	416	116	54	586
During project lifetime (average)	19	17	8	16
After project lifetime (12)	463	48	0	511
Total	**879**	**163**	**54**	**1,097**

The GHG reduction achieved after the project lifetimes amounted to 463 ktCO_2/year for IEE-II projects, 48 ktCO_2/year for completed H2020 projects and 0 ktCO_2/year for ongoing H2020 projects. The comparatively low GHG savings by H2020 projects after the project lifetime is due to these projects having been completed recently. Any activities carried out after the project lifetime will either be ongoing or yet to commence, so that the achieved GHG reduction is limited and the anticipated GHG reduction lacks evidence.

6.4.3 Investment triggered

An overview of the investments in energy efficiency triggered by the programme during and after project lifetimes is shown in Table 6-15. The investment triggered within the project lifetime by IEE-II projects was 325 million Euros compared to H2020's 132 million Euros. The average investment triggered during the project lifetime was 6 million Euros for IEE-II projects, 10 million Euros for completed H2020 projects and 4 million Euros for ongoing H2020 projects. The lower average for ongoing H2020 projects is due to the fact that these projects have not yet finalised their activities and the impacts are therefore difficult to quantify to a reliable or acceptable rating.

Table 6-15: Estimated investment triggered during and after the project lifetimes in EUR million.

Investment triggered (€m)	IEE-II	H2020 (completed)	H2020 (ongoing)	Total
During project lifetime (36)	131	72	30	232
During project lifetime (average)	6	10	4	6
After project lifetime (12)	194	31	0	225
Total	**325**	**102**	**30**	**457**

The investment triggered during the project lifetimes amounted to 131 million Euros for IEE-II projects, 72 million Euros for completed H2020 projects and 30 million Euros for ongoing H2020 projects. The comparatively low energy savings by H2020 projects after the project lifetime is due to these projects having been completed recently. Any activities carried out after the project lifetime will either be ongoing or yet to commence, so that the investment triggered is limited and the anticipated investments in energy savings measures lack evidence.

The type of measures that companies invested in as a result of the projects were only sparsely reported. In most cases projects simply reported the type of measures, while some projects also reported the share of each type of measure in the total investments.

Some examples of low-cost investments listed were insulation, energy management/monitoring and general behaviour change. Other measures include replacing lighting, motors, pumps and fans, heating/cooling systems, heat recovery, compressed air, renewable energy and other measures. A large share of investments was also made in process optimisations, which can come in many different forms and is industry dependent. An example of the share of measures is listed in Table 6-16, based on reports by three projects.

Table 6-16: Examples of measures and payback times based on reports by three projects.[72]

Measures	Share of investment (%)	Average payback time
Lighting	5.3%	3.2
Compressed air	8.5%	1.7
Motors, pumps and fans	1.9%	5.7
Cooling systems	5.7%	12.5
Heating systems	9.7%	4.1
Heat recovery	29.2%	3.8
Process	20.8%	5.4
Renewable energy	2.5%	10.4
Other	16.4%	3.5

6.4.4 Renewable Energy Triggered

The renewable energy production triggered as a result of the project outputs and activities was estimated for the few projects that reported this KPI. An overview of the renewable energy triggered by the programme during and after project lifetimes is shown in Table 6-17. The renewable energy triggered within the project lifetime by IEE-II projects was 183 GWh/year compared to H2020's 42 GWh/year. The average investment triggered during the project lifetime was 37 GWh/year for IEE-II projects, 26 GWh/year for completed H2020 projects and 8 GWh/year for ongoing H2020 projects.

Table 6-17: Estimated renewable energy production triggered during and after the project lifetimes in GWh/year.

Renewable energy triggered (GWh/year)	IEE-II	H2020 (completed)	H2020 (ongoing)	Total
During project lifetime (8)	183	26	16	225
During project lifetime (average)	37	26	8	28
After project lifetime (1)	2	0	0	2

[72] Shares of investments and the average payback time were averaged across the three projects for the different measures.

Renewable energy triggered (GWh/year)	IEE-II	H2020 (completed)	H2020 (ongoing)	Total
Total	**186**	**26**	**16**	**227**

6.5 Analysis

Having presented the 41 projects' characteristics and achievements in the previous five sections, we now turn to analysing these in more detail. Learnings from this analysis feeds into the subsequent sections in which we highlight general observations and conclusions. By simultaneously exploring the characteristics and achievements of projects we can identify noteworthy trends or common factors.

6.5.1 Common factors

As outlined in Section 5, common factors were identified throughout the assessment and re-estimate processes and were continually refined. Often literature values were the starting point to gauge if a project's assumptions were acceptable. As the study continued, the common factors were refined using project assumptions and data.

For some potential common factors there was insufficient data available from literature or from projects to produce a reliable value. Furthermore, assessment of the projects revealed that there is significant variance between the factors used and applied by each project. For example, some projects focussed their activities on the implementation of measures. For such projects, a higher implementation rate of identified energy saving measures was found compared to projects where the focus was on training of energy auditors. The figures developed in this study are from a range of project types and sectors. The identified common factors are considered to give values that can be used to re-estimate impacts where these factors are missing or uncertain.

6.5.1.1 Energy use

The starting point for the calculations in the re-estimate methodology was the energy use per company. Although most projects presented some assumptions, estimates or data, there were instances where the presented figures were uncertain or where no estimates were reported at all. In these instances, we used the average final energy use found by the PINE project, which audited 280 SMEs across 8 Member States and a variety of industrial sectors, such as metal processing, wood processing, food processing, packaging, plastic processing and construction (Fresner, Morea, Krenn, Aranda Uson, & Tomasi, 2016). The project reported an average energy use for a company of 5.6 GWh/year.

As a comparison, the average energy use of companies involved in the projects assessed was calculated based on the reported energy use and the number of participating companies. The average was 3.7 GWh/year. There is a significant variation across the 41 projects, with some projects targeting larger companies using an average of 90 GWh/year, and other projects focussing on smaller SMEs using as little as 0.1 GWh/year.

The energy mix used by companies was reflected in our re-calculations, whenever projects recorded and reported it. Where this was not reported, the energy mix of the projects' targeted sector in the Member States during the project time was used, as reported by the ODYSSEE[73] database.

An overview of the factors found for energy use is presented in Table 6-18.

Table 6-18: Energy use common factors and averages for SMEs[74]

Factor	Value	Source	Comment
Average energy use per	5.6	Literature value, PINE project (IEE II, 2011)	Used where projects did not report average energy use per company and there is no

[73] https://odyssee.enerdata.net/database/
[74] Some of the projects in the current study included companies that are not SMEs. The project outputs were relevant to SMEs and the factors derived are considered to be applicable to SMEs.

Factor	Value	Source	Comment
company, GWh/year			relevant industry specific data. Note, where this is reported, the value varies widely.
Average energy use per company, GWh/year	3.7	33 projects in the current study	Based on the energy use of 10,204 companies involved in 33 of the projects in the current study.
Energy mix	Energy mix of the targeted sector in the relevant Member States and over the relevant time period from ODYSSEE database		Where projects record and report the relevant energy mix, the project value is used.

6.5.1.2 Energy savings rate

When determining the energy savings that are achieved by project activities (e.g. audits), one has to consider two elements. The first element is the potential energy savings that could be achieved (e.g. the potential energy savings an audit identifies). The potential energy savings can be identified by multiplying a company's energy use by the potential savings rate. Since not all identified energy saving measures are implemented, the potential savings rate does not represent the final savings rate. Therefore, the second element is the implementation of those identified savings, and can be referred to as the implementation rate. The product of these two elements, the potential savings rate and the implementation rate, result in the final savings rate. The final savings rate multiplied by the energy use of a company results in the final energy savings an audit will trigger.

$$Final\ savings\ rate = Potential\ savings\ rate * Implementation\ rate$$

Audits

Using the re-estimate methodology, we attempted to extract average final energy savings as a result of auditing within the project time for each project. The level of detail provided by projects varied, so that some projects reported potential savings rate and implementation rate for both electricity and heat use, while other projects did not report anything. An overview of the factors found for energy savings per audits is in Table 6-19. The table shows what literature values were found for the potential savings, implementation rate and final savings for electricity and for heat and fuel. Further, the table also shows the rates found based on the data provided by projects, indicating a potential savings rate of 18%, an implementation rate of 25% and a final savings rate of 4.5%.

The average final savings rate was calculated by weighting the rates found for each project using the number of companies audited by each project. This results in the average rates found across all companies involved in the projects. The following formula shows the calculation, where the products of the final savings rates and number of companies audited for each project were summed up and divided by the sum of the number of companies audited. The same approach was taken for determining the average potential savings rate and the average implementation rate.

$$Average\ final\ savings\ rate = \frac{\sum(Final\ savings\ rate * Number\ of\ companies\ audited)}{\sum Number\ of\ companies\ audited}$$

An alternative way to calculate the final savings rate would be to divide the total final energy savings due to audits by the total final energy use of companies audited (this would result in 2.9%), however this would put more weight on projects that audited larger companies. A further method to calculate the final savings rate would be to take the average of the average savings rate found by each project (this would result in 6.9%), however this would put more weight on projects that carried out a small number of audits but had high savings rates.

Table 6-19: Factors and averages for energy savings due to audits

Factor	Value, source	Comment
Electricity, literature values		
Average potential savings identified per audit, % of total used	5 %, inferred	Used where projects did not report their own figures, or only some of these figures
Average implementation rate, % of potential savings	20 %, EMEEES project[75]	
Average final savings per audit, % of total used	1 %, EMEEES project	
Heat and fuels, literature values		
Average potential savings identified per audit, % of total used	13.3 %, inferred	Used where projects did not report their own figures, or only some of these figures
Average implementation rate, % potential savings	15 %, EMEEES project	
Average final savings per audit, % of total used	2 %, EMEEES project	
Energy savings, this study		
Average potential savings identified per audit, % of total used	18 %	Average for 819 companies audited across 11 projects (8 IEE-II and 3 H2020)
Average implementation rate, % of potential savings	25 %	Average for 774 companies audited across 11 projects (8 IEE-II and 3 H2020)
Average final savings per audit, % of total used	4.5 %	Average for 2,585 companies audited within project time of 25 projects (17 IEE and 8 H2020)[76]

Similar to the process for deriving factors for energy use described in section 6.5.1.1, we first identified literature values that could serve as a starting point. Data from the EMEEES project was used as this was a reference quoted by a number of projects (EMEEES, 2009). The EMEEES project proposed that in cases for which no energy savings rates were reported, an average 1% final savings could be used for electricity and 2% final savings for heat and fuels. Furthermore, the project reported that default values for the implementation rate should be 20% for electricity and 15% for heat and fuels. This implies that for an average audit, 5% potential electricity savings are identified, and 13.3% potential savings are identified for heat and fuels.

How these common factors were applied depended on which factors were already reported by the projects. In some cases, the project only reported the potential savings. In this case, the common factors for the implementation rate were used to identify the final savings rate. When possible, and not reported by the project itself, the re-estimate methodology made use of the identified energy mix, potential savings rate and implementation rate to produce a value for final energy savings.

Not many projects explicitly reported the final savings rate per audit, as most only reported one component, e.g. potential savings. A detailed analysis of project results based on data from literature,

[75] http://www.evaluate-energy-savings.eu/emeees/downloads/EMEEES_WP42_Method_18_Energy_Audits_Revised_draft_080530.pdf
[76] Includes all values whether assessed as reliable, acceptable or uncertain. Only considers audits carried out within project time.

interviews and the implementation rate common factor gives an average final savings rate of 4.5% per audit, as described above. A total of 2,585 companies audited during the project lifetime of 25 projects (17 IEE-II and 8 H2020 projects) were considered in this calculation. Less companies explicitly reported the potential savings rate or the implementation rate. These were determined on the data found for 11 projects in both cases.

An overview of the distribution of the average overall savings rates and the number of companies audits is shown in Figure 6-15. This illustrates why the weighted savings rate is lower than the average of the projects' average savings rate, since projects that audits more companies tended to have lower savings rates.

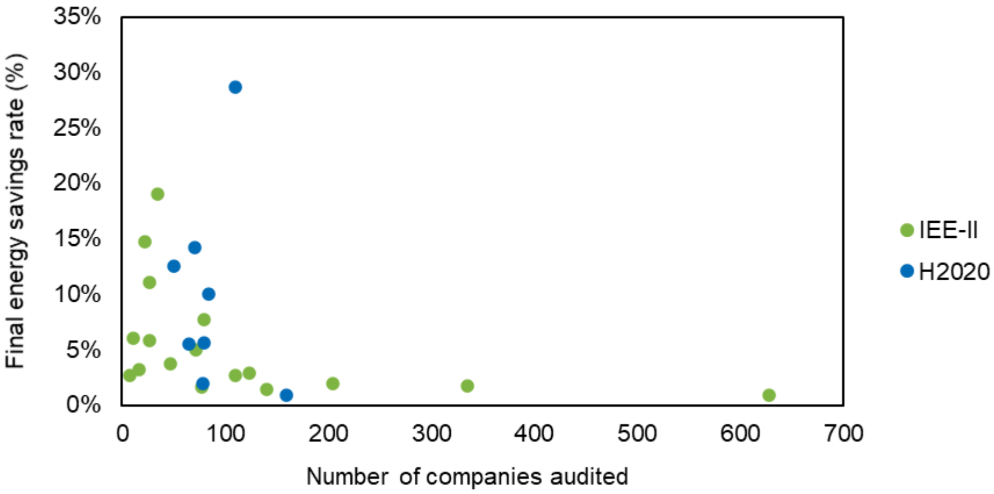


Figure 6-15: Distribution of the final savings rate for audits across 25 projects.

The figure shown above shows that the average final savings rate achieved through audits varied from project to project. When viewing the above figure and comparing it to the average final savings rate of 4.5% across 2,585 audits, one has to consider that projects carrying out more detailed audits alongside implementation support will likely have higher overall savings rates but will audit less companies. Conversely, a project that carries out audits on a larger scale will likely not be able to support the companies with the actual implementation of the recommended measures and might not go into further detail. This skews the average savings rate lower.

As indicated in Figure 6-15, the distribution of audit savings rate against number of SMEs or companies audited is slightly different for IEE-II projects and H2020 projects. The projects that worked with a high number of SMEs and companies were mostly IEE-II projects. Furthermore, the average audit savings rate of IEE-II projects is lower both average across projects (5.4% for IEE-II and 9.9% for H2020) and averaged across companies (2.7% for IEE-II and 9.6% for H2020).

The outlier with the highest final savings rate (28.7%) was a project that targeted very small SMEs with an energy use of around 0.1 GWh/year. As opposed to larger companies, SMEs of this size will have had less capacity to consider energy efficiency in their business. Therefore, there may be more 'low hanging fruit' in terms of saving energy in these companies, resulting in a higher savings rate. However, since these SMEs use small amounts of energy, they do not result in substantial energy savings in absolute terms.

Considering the other projects that resulted in high savings rates, we found that a few of the projects focussed on a specific sector or segment that did not previously benefit from much detailed analysis of energy efficiency in the sector. In combination with new benchmarks, best practices or tools, project could increase the effectiveness of the audits carried out in the sector by providing companies more context or understanding of energy efficiency in their sectors.

Capacity building

Next to the savings rate associated with audits, a similar analysis can be undertaken for the savings rate and number of projects involved in trainings. The average final energy savings rate resulting from capacity building is 4.1%, as discussed in more detail in section 6.6.1.2.

Figure 6-16 illustrates the distribution of the savings rates against the number of people trained. A clear trend is less apparent in this chart. Nonetheless, the three highest savings rates are associated with projects that trained the least amount of people, which is in line with the trend observed for audits.

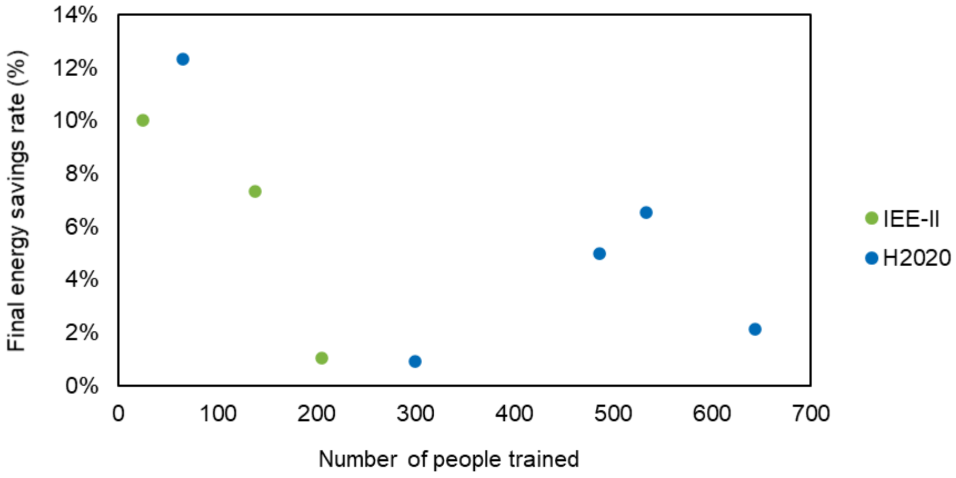


Figure 6-16: Distribution of the final savings rate for trainings across 8 projects.

Tools and benchmarks

Analysing the final energy savings related to activities involving tools and benchmarks one finds an average final savings rate of 3.2%.

Figure 6-17 shows the distribution of the savings rate against the number of companies implementing the tools or benchmark. The chart illustrates the same trend, indicating a decreasing savings rate with an increasing number of companies involved.

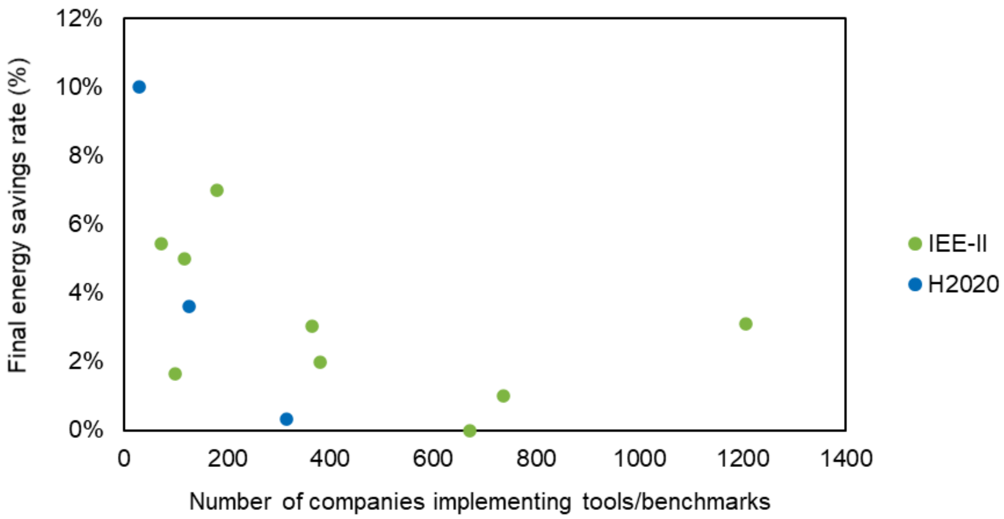


Figure 6-17: Distribution of the final savings rate for tool or benchmark implementations across 12 projects.

6.5.1.3 Primary energy savings

Most projects operated in final energy savings and then converted these to primary energy savings, hence our re-estimate methodology followed the same steps. To convert final energy to primary energy, so-called primary energy factors (PEFs) had to be applied for each energy/fuel type. This was done using values obtained from literature.

For most heat and fuel sources PEFs between 1.0 and 1.1 were used, since the fuel is used directly. However, for electricity, there are some losses by the time the electricity is used as final energy. Therefore, a higher PEF must be used. This PEF depends on the conversion efficiency of the different electricity generating technologies or fuel used to power the electricity grid. The grid composition varies by Member State, but a figure of 2.5 was most typically used within the projects' original calculations.

However, the PEF for electricity typically decreases as a country's mix of electricity generation technologies decarbonises since there is less heat loss due to combustion of fossil fuels. It is now generally accepted that the PEF for electricity has reduced across Europe in recent years.[77] For our re-estimates, we therefore used different PEFs depending on when the projects were carried out. In order to do this, we used values calculated in a study conducted for the European Commission in 2016 in advance of revision of the EED.[78] The electricity PEF values we used from this study were calculated by applying Eurostat conventions and represent an estimate for the EU-28. The values decrease over time, as expected. For instance, a PEF of 2.35 was used for re-estimating the impacts of project activities in 2006 compared to 1.91 in 2019. An average of PEFs was taken across the years for which impacts were being calculated, and subsequently used to convert final energy savings into primary energy savings achieved by the projects.

The use of year specific PEFs for electricity rather than 2.5, which was used by many previous projects and studies, affects the estimates for energy savings. If a PEF of 2.5 were to be used for electricity in all cases, the estimated total primary energy savings of 3,491 GWh/year would increase to 3,922 GWh/year. Similarly, the total GHG reduction would increase from 1,097 ktCO_2/year to 1,257 ktCO_2/year and the investment triggered from €457 million to €459 million.

6.5.1.4 Investment

Having analysed the project reporting, we found that the most reliable way to estimate the investments triggered due to implemented measures was the yearly cost savings and the average payback time. The yearly cost savings were estimated by using the energy saved and respective industrial energy prices from Eurostat for the respective time periods and Member States.

A factor commonly used for the average payback time of measures was around 2.5 years. This is in line with values quoted in literature, such as 1.5 years for electricity saving measures (IEEP, 2013) or 1-5 years for energy efficiency measures (BEIS, 2020). The payback period also varies substantially with the type of measures, so that behaviour change has very short payback periods but measures related to ventilation or insulation can average payback periods of up to 10 years (AEA, 2012).

Most projects reported little or no detail on measures implemented. Some information was obtained through interview. For instance, one project found that the measures implemented tended to be those that required a low investment. Those that required a significant investment were only considered if the SME was already planning to replace equipment. The average of the project reported payback times for measures implemented due to the projects was around 2.7 years. However, the average also includes behaviour change measures which had very short payback periods and more substantial investments that may have payback periods of 10 years.

6.5.2 Cross-sectional analysis

Having analysed the 41 projects' characteristics, outputs and impacts in the previous sections, we now turn to a cross-sectional analysis (vertical analysis). By simultaneously exploring the characteristics and

[77] https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive_en
[78] https://ec.europa.eu/energy/sites/ener/files/documents/final_report_pef_eed.pdf

achievements, we can identify if there are any specific characteristics that may have led to increased impacts. Only re-estimates rated as reliable or acceptable were considered.

6.5.2.1 Project activities

We assessed how the final energy savings from our re-estimates were split across different project activities, as shown in Figure 6-18. Across both the IEE-II and H2020 programmes, the project impacts were split across audits (these figures also include where the impact was through implementation of an energy management system), capacity building, events and dissemination, and tools and benchmarking developments.

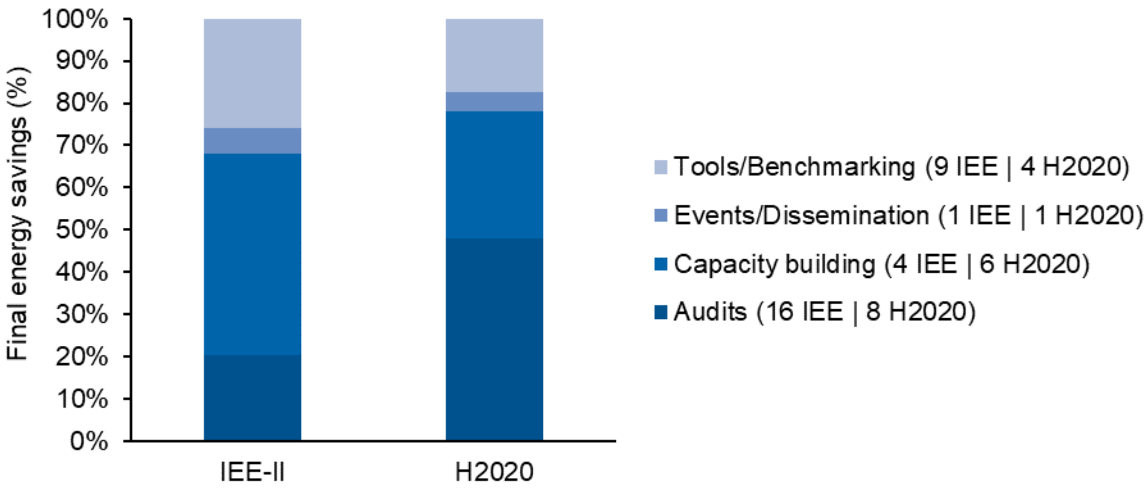


Figure 6-18: Final energy savings shares split across project activity for both IEE-II and H2020 projects. Number of projects from (IEE-II | H2020) programmes indicated in brackets

Across all projects (including current projects), 29% of final energy savings were estimated to come from audits, 42% from capacity building, 6% from dissemination, 23% from tools and benchmarking, and 27% from policy making activities. When comparing the programmes, the IEE-II projects delivered a larger share of energy savings through capacity building (48%) compared to H2020 projects (30%). On the other hand, the H2020 projects unlocked a larger share of savings through audits (48%) compared to IEE-II projects, which saved 20% through audits. The savings triggered through dissemination along with through tools and benchmarking were similar for both programmes.

Furthermore, we analysed how impacts triggered during and after the project were spread across different activities. The split is shown in Figure 6-19 and unsurprisingly shows a dependence on different activities during and after the project lifetime to generate energy savings. Audits dominate the energy savings resulting from activities carried out during the project lifetime with a share of 48% of all final energy savings, followed by capacity building (27%), events and dissemination (11%), and tools and benchmarking (13%). Of the energy savings triggered by activities after the project time, the majority (57%) originate from capacity building, followed by tools and benchmarking (34%), and then audits (9%).

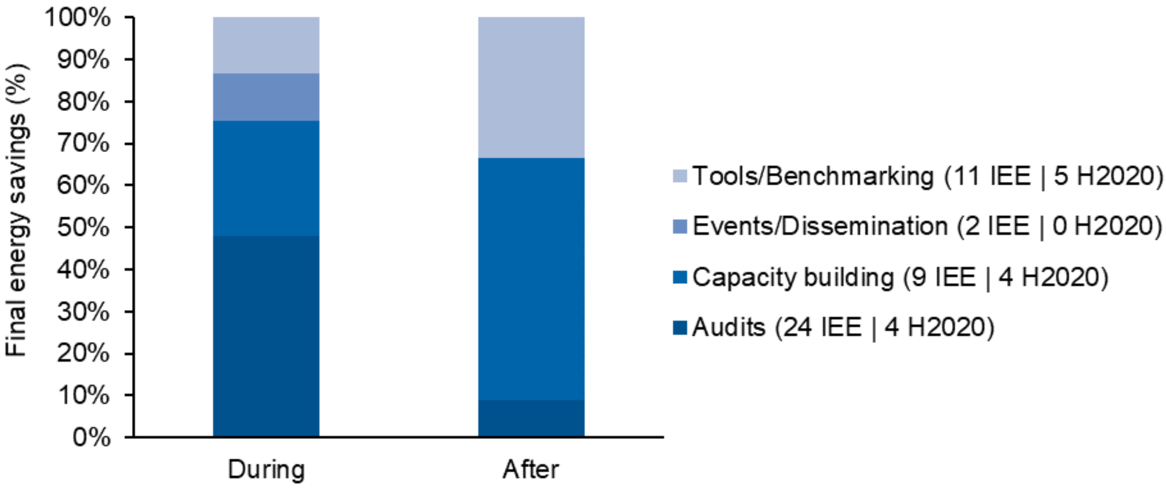


Figure 6-19: Final energy savings split across project activity for actions carried during and after the project lifetime. Number of projects carrying out these activities (during | after) project lifetime indicated in brackets

The distribution of activities during and after the project lifetime reflects how some activities, such as audits, are mostly direct actions carried out by projects during their lifetime, often supporting methodology development or benchmarking work, while other activities can be set up to have ongoing effects beyond a project's lifetime such as policy developments and ongoing impacts from capacity building.

Capacity building activities have to be developed during the project lifetime and can only then be used to train people and companies. When the capacity building activity is set up in a way that it continues to train people (e.g. from long-lasting training schemes), the materials developed during the project can be used to generate a new set of people trained after the project end. Similarly, energy savings as a result of policy making are unlikely to be achieved during a project but will more likely have long-term impact. Projects can initiate policy or standards development through activities during the project, but it typically takes a few years until such a policy or standard is adopted and achieves real impacts.

Conversely, audits as a direct impact of projects after the project lifetime are less likely as they have to be carried out by someone. Audits may be carried out by people trained, but this would then be counted as a result of a training activity rather than an auditing activity. No savings were identified for events and dissemination activities after the project lifetime. In reality it is likely that there would have been savings due to these activities, but these are not quantifiable in a reliable way.

A further cross-sectional analysis was made on the final energy savings achieved by projects that focussed on a single sector (26) against those that took a cross-sectoral approach (15). Figure 6-20 shows that projects with a cross-sectoral approach mostly relied on capacity building and auditing activities, while the sector-focussed projects also carried out tool development, benchmarking and policy making. This may be due to the greater ability and deeper sectoral knowledge required to carry out policy making, benchmarking and tool development activities.

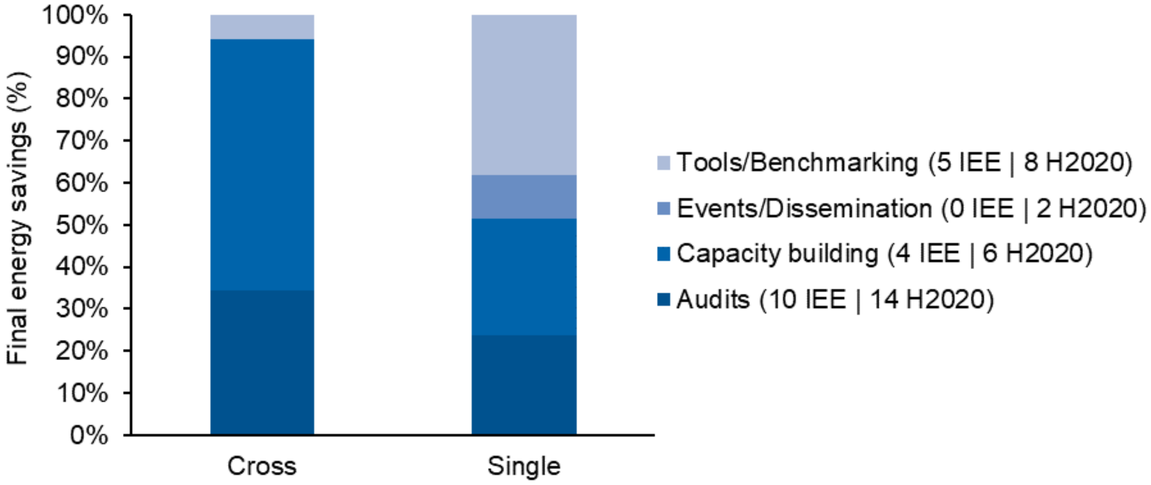


Figure 6-20: Final energy savings split across project activity for projects taking cross-sectoral approaches and those focussing on single sectors. Number of projects carrying out activities for (multiple | single) sectors indicated in brackets

The split between cross-sector project approaches and single sector project approaches differed slightly between IEE-II and H2020 projects. IEE-II projects predominantly took a single sector (18) rather than a cross-sectoral approach (8). For H2020 projects, the split was more even with 7 taking a cross-sectoral approach and 8 a single sector approach.

6.5.2.2 Geographic distribution

As described in Section 6.1.4, the projects carried out their activities across different Member States. Achieved primary energy savings during and after the project time by country is shown in Figure 6-21. This is based on dividing the primary energy savings per project acoss the countries in which the project was active. The energy savings achieved by EU-wide projects were split across all Member States.

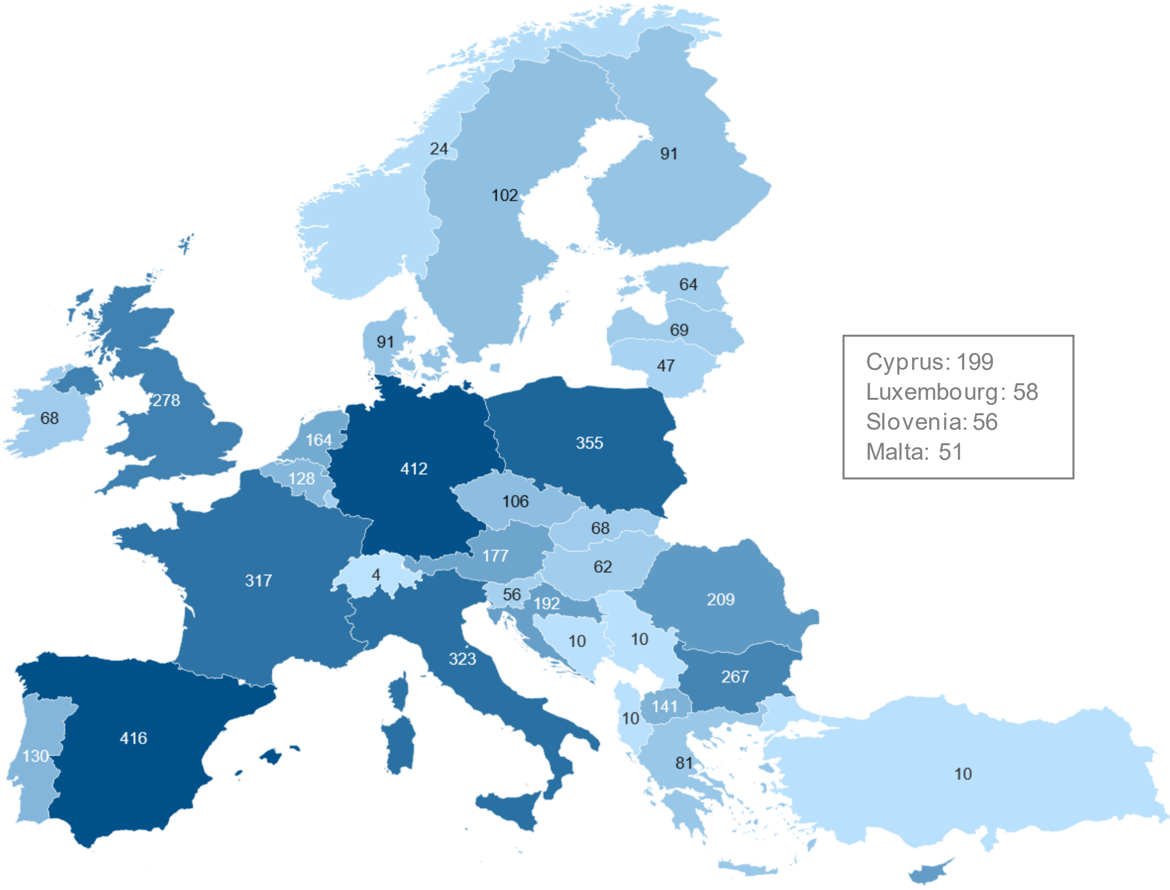


Figure 6-21: Primary energy savings (GWh/year) achieved in different Member States and neighbouring countries due to project activities.

6.5.3 Reliability

As explained in section 5.2, we assessed the reliability of the projects' estimates for the achieved KPIs. The reliability of projects' impact calculations depended on that of the availability of project-specific data, both from the outset in the Grant Agreement, and in interim or final reports.

A summary of the assessment is shown in Figure 6-22, which illustrates the share of reported KPIs that were rated with the different levels of reliability, excluding the KPIs for renewable energy triggered, due to the low incidence with which it was reported (as it was required only for early IEE projects). The reliability of the KPI re-estimates performed here, enhanced by literature research, common factors and interviews, is higher than that for the KPIs reported by projects in the Grant Agreements[79] and Final reports. For IEE-II and H2020 projects, 92% and 93% of the re-estimated KPIs were rated reliable or

[79] The KPIs reported in the Grant Agreement of the project are extracted from the proposal documents submitted in response to a given topic call.

acceptable, respectively. In comparison, the same figures were 42% for IEE-II and 44% for H2020 for the Grant Agreement and 29% for IEE-II and 67% for H2020 for the final reporting.

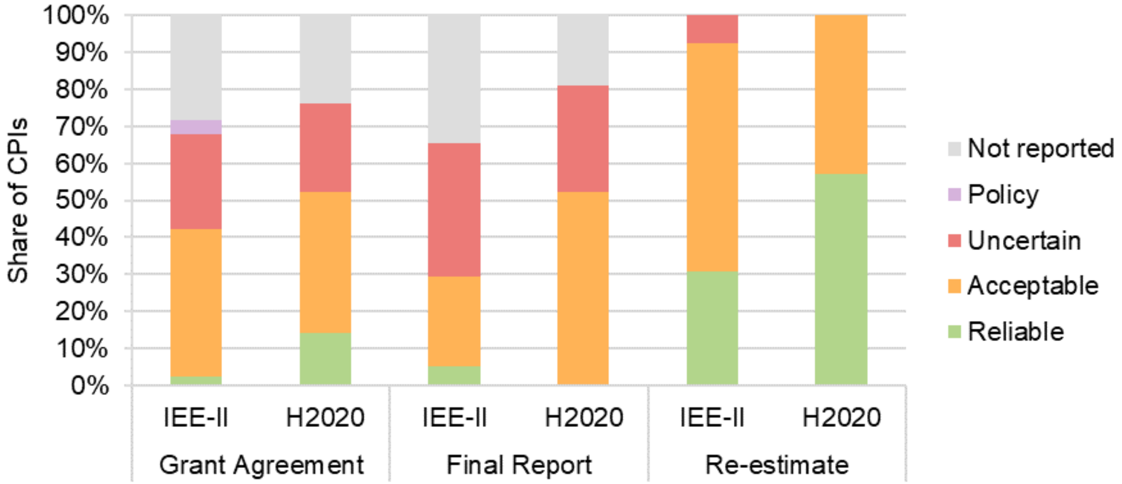


Figure 6-22: Reliability of KPIs by programme and reporting phase, excluding renewable energy (26 completed IEE projects and 7 completed H2020 projects).

The increase in the reliability of final reporting from the completed IEE-II projects to H2020 projects can be attributed to both a lack of reporting in early IEE-II projects and more reporting consistency across H2020 projects. Most early IEE-II projects did not report specific CPIs in their Grant Agreements so that only one of the seven IEE-II projects within the 2007-09 call was noted to have acceptable impact estimates in its Grant Agreement. Similarly, only one of these seven projects were noted to have reported a reliable or acceptable CPI in its final reporting.

For the 2011-13 calls of IEE-II projects, lack of reporting was no longer the issue as only one of the 19 projects in these calls failed to report CPIs in their Grant Agreement. Nonetheless, 35% of the CPIs reported by these projects in their Grant Agreement were found to be uncertain. The final reporting shows a similar trend, however, there is an increase in the 2011-2013 projects not reporting CPIs, from 7% CPIs not reported in the Grant Agreement to 18% not reported in the final reporting. Furthermore, the share of uncertain CPIs also increases from 35% to 44%. Both these increases may be related to projects setting out reasonable estimates in their Grant Agreement but then not reporting evidence based data and/or not using coherent data to justify the updated estimates in the final reporting, which may be due to inconsistent data collection during the project.

Considering the reliability of PPIs reported by H2020 projects, we find that the projects mostly provided reliable or acceptable PPIs for energy saved in the Grant Agreement (83%) and final reporting (83%). In comparison, only two projects made reliable or acceptable estimates for GHG reduction. The largest increase in reliability came from the estimates for investment triggered which increased from 17% to 83% reliable or acceptable. Just 11% of PPIs from final reports of H2020 projects were marked as uncertain, compared to 44% of the CPIs in the 2011-13 calls for IEE-II projects. One reason for this is that in a lot of cases H2020 projects were clearer in how they calculated their PPIs compared to the CPIs reported in the IEE-II projects, as they provided detailed data and reasoning.

One challenge found was that some projects applied a top-down method to estimate the potential impacts of their activities and projects. This resulted in very large numbers, which made the comparison across projects challenging. These estimates could not be marked reliable and acceptable because there was a lack of data supporting the overall assumption of impact.

The three figures below show the scale of this challenge. The graphs show the primary energy savings during the project lifetime only, for all completed projects, including all assessments of reliability (reliable, acceptable and uncertain).

The first, Figure 6-23 shows the energy savings estimated in the Grant Agreement, the Final Report and then our re-estimations. As can be seen the Grant Agreement values from within the IEE-II programme dominate and are not borne out by the impacts reported in the Final Report. The two following figures illustrate that this is mainly due to some projects that aimed at policy impacts, which were quantified using a top-down methodology. These impacts are unlikely to manifest themselves within the project times, yet the CPIs calculated by the projects did include at least some of the impacts within the project lifetime.

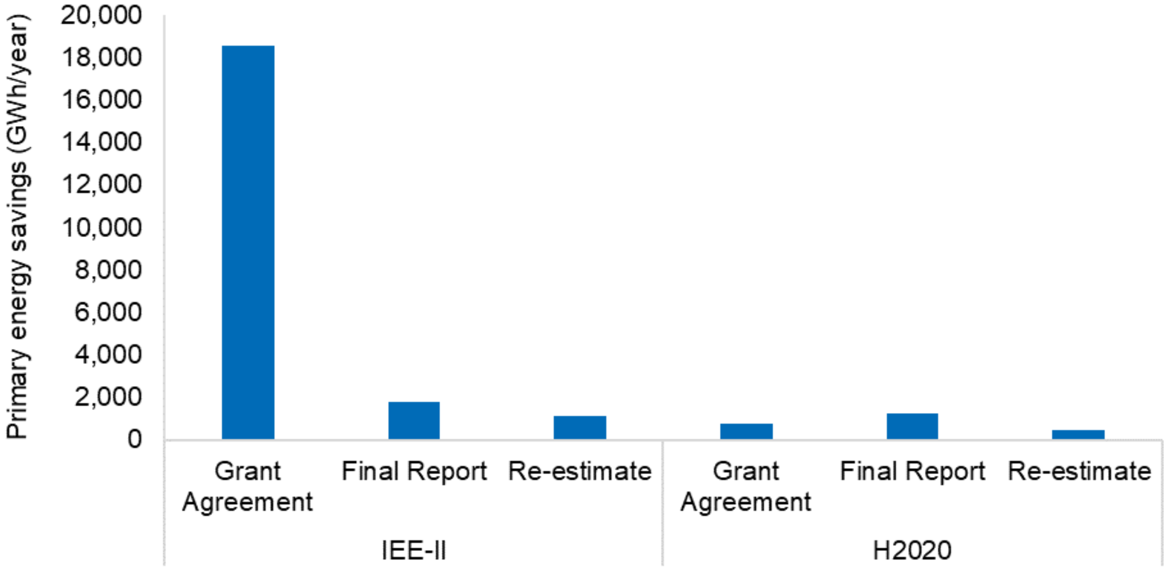


Figure 6-23 Primary energy savings, during project lifetime (26 completed IEE projects and 7 completed H2020 projects).

The second graph, Figure 6-24 repeats this data set but with an IEE-II project removed, as it is the only significant policy impact featuring in the results (other significant policy based impacts are recorded for after the project duration impacts, and so not being described here). The scale of the projected energy savings in the Grant Agreement falls, but it still dominates.

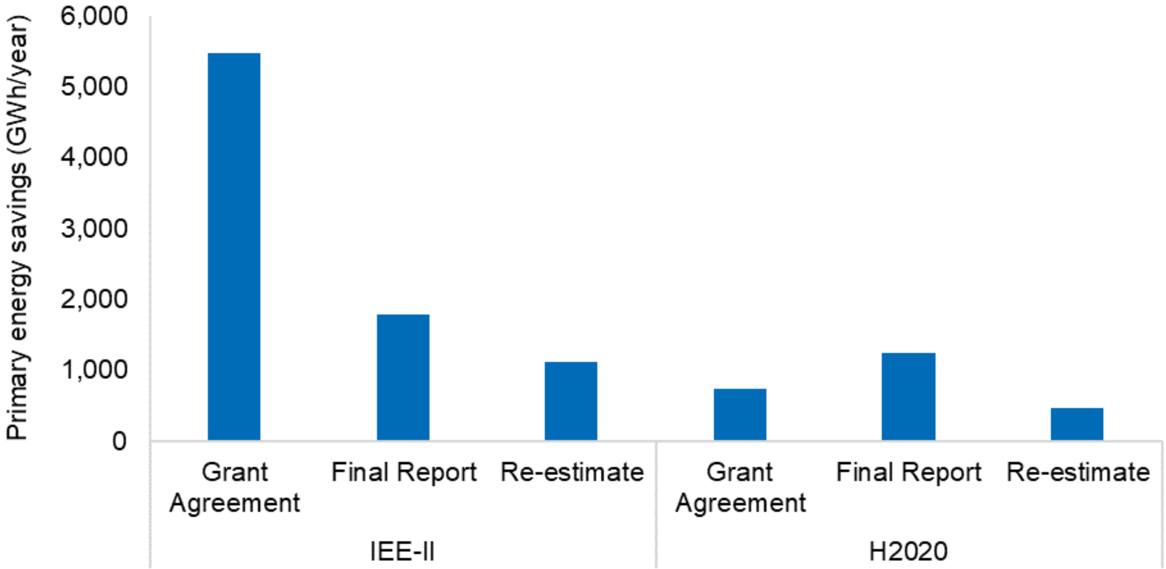


Figure 6-24: Primary energy savings, during project lifetime, excluding policy projects (25 completed IEE projects and 7 completed H2020 projects).

It is in the third graph, Figure 6-25, with the further removal of two IEE-II outlier projects, and the removal of the very early IEE-II projects that the scale of reported impacts begins to come into alignment.

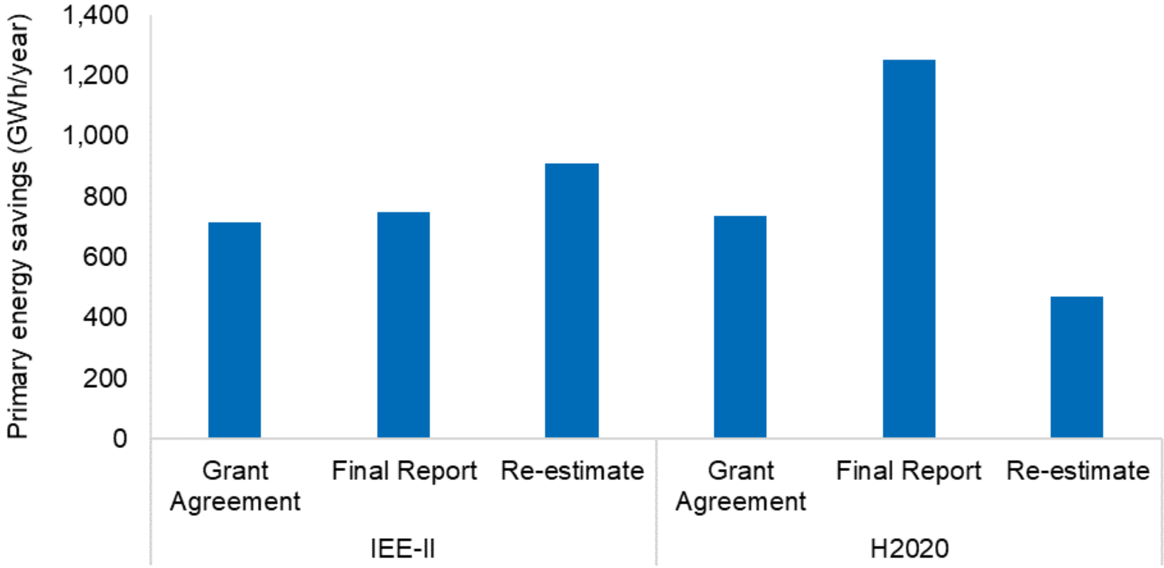


Figure 6-25: Primary energy savings, during project lifetime, excluding policy projects, very early IEE projects and two further outlier IEE projects (23 completed IEE projects and 7 completed H2020 projects).

Figure 6-25 above shows the summed totals of the remaining reported values. At this point it must be borne in mind that the re-estimates from this work for IEE-II are higher than either the Grant Agreement Value or the Final report due to early IEE-II projects not reporting impact figures at all in some cases, so the total number of projects included in the re-estimate amount is higher.

Hence, there are particular outlier IEE-II projects that distort the overall picture. Interrogation of this point, through the reliability assessments reveals significant further improvements in the data quality between the IEE-II and H2020 programmes. The proportion of reliable and acceptable estimates within the H2020 projects both at Grant Agreement and Final Report is significantly higher than the equivalent estimations within the IEE-II funded projects.

The point here is to reflect on the impact that improved guidance, and a heightened focus within EASME on the issue, has had in achieve higher quality data outputs. The focus on the impacts stated as to be achieved in the project application flows through to the end of the project. At this point projects are held to account to some degree by comparing their initial estimates of impacts with their final estimates based on project data. Further improvement is always possible, and should be sought, but this analysis illustrates that significant improvements have already been made and good progress is currently underway.

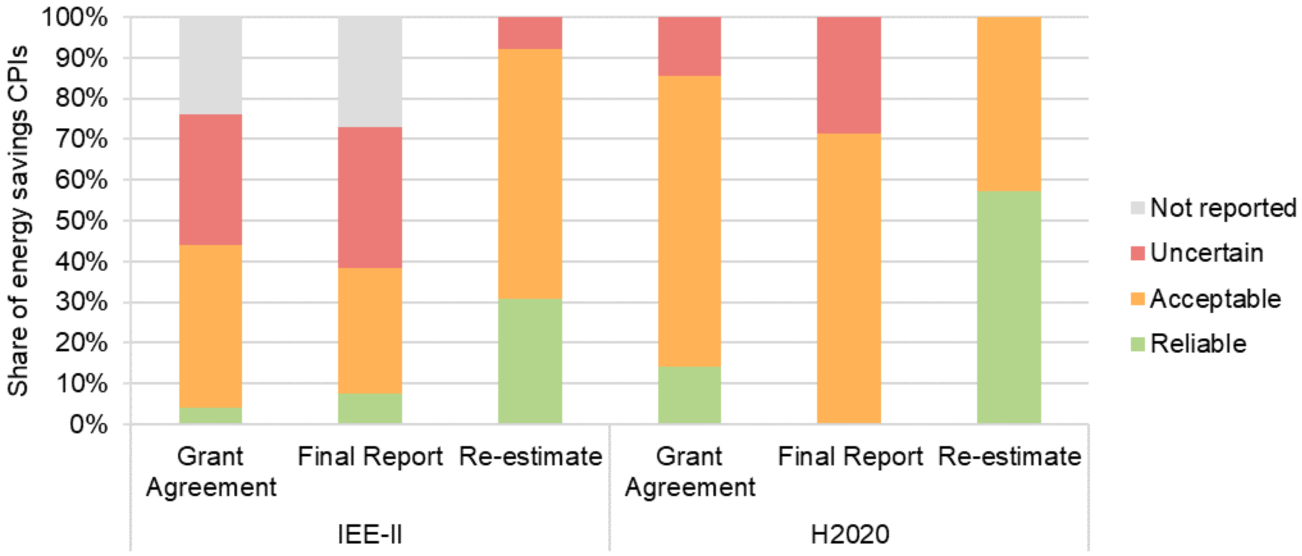


Figure 6-26: The reliability assessment applied to all completed projects, for the predicted energy savings within the project lifetime.

The discussion in this section has so far considered the differences in the reliability between the programmes and between the stages of reporting. A further aspect to consider is how much of the re-estimated impacts for during and after the project lifetime are classified as reliable, acceptable or uncertain. Figure 6-27 illustrates that the impacts estimated for ongoing projects, as well as the impacts estimated for after project lifetimes were not as reliable as those estimated for impacts within the project lifetime of completed projects. This can be linked to the level of evidence that is available in each of these cases.

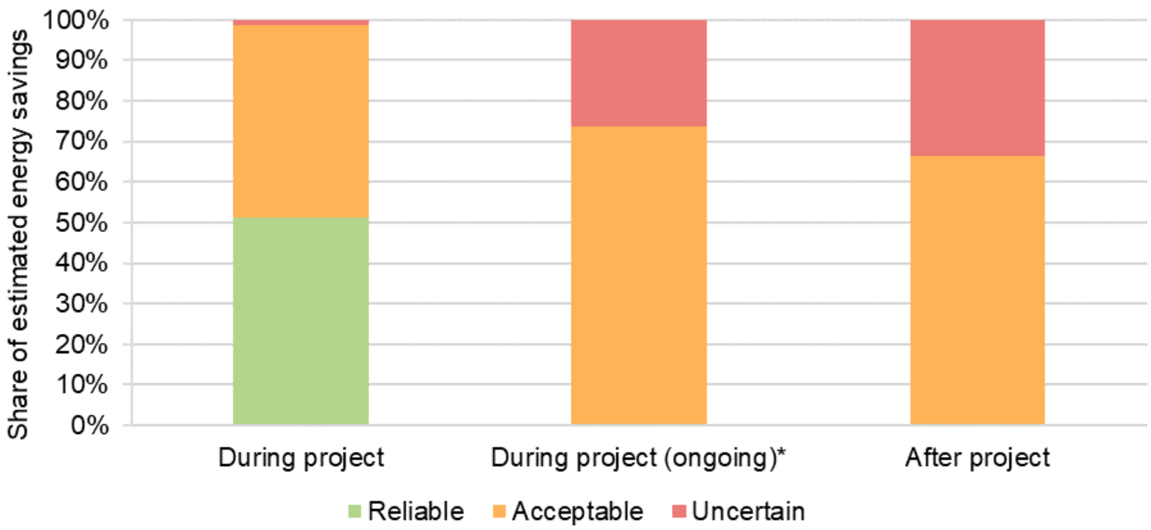


Figure 6-27: Reliability of the re-estimated energy savings during and after the project lifetime (excluding policy projects)

Figure 6-27 indicates the share of estimated impacts. The 'uncertain' shares represent impacts that could be estimated but were not deemed reliable enough to feed into the analysis. When assessing the reliability of impacts in the different periods based on share of KPIs (number of uncertain KPIs), rather than share of energy savings (uncertain estimated GWh/y savings over total GWh/y savings), one would find a larger share of uncertain KPIs than presented in the figure above since there were a considerable number of projects for which no impact could be estimated. Their impact was therefore marked as zero and 'uncertain'. These would therefore not feed into the figure above.

6.6 Assessment of Benefits

6.6.1 Cost Benefit Analysis

The Cost Benefit Analysis (CBA) was carried out on the project level to identify the scale of the project impacts with regards to funding awarded. With the re-assessment of impacts carried out, we were able to establish the energy savings delivered (estimated) and hence were able to generate the energy saving per Euro of EU funding and per Euro invested[80] by the project beneficiaries. Only impacts rated reliable or acceptable were considered in this analysis. Multiple benefits are discussed qualitatively and quantitatively in the following section 6.6.2.

Figure 6-28 provides an overview of the elements included in the cost benefit analysis. Note that the use of the word “funding” will refer to the EU contribution earmarked by the European Commission through its Executive Agencies into projects. In the case of IEE-II projects, this only covers the 75% of the overall budget that were contributed by the EU[81]. The word “investment” will refer to the investments made by SMEs or companies involved in IEE-II and H2020 projects. The cost benefit analysis carried out in section 6.6.1.1 and 6.6.1.2 compares the benefit in the form of the KPIs to the cost in the form of the EU funding or investment in the projects. In section 6.6.1.3 the cost benefit analysis considers the energy savings achieved by SMEs and companies involved in projects as the benefit and the investments made by these SMEs and companies as the costs.

Figure 6-28: Overview showing the main elements of the cost benefit analysis

6.6.1.1 Cost-benefit based on KPIs

As a starting point, we considered the KPIs with respect to EU funding in our cost-benefit analysis to identify if there are any general trends. Table 6-20 shows the cost-benefit metrics for primary energy saved, investment triggered and GHG reduction against project funding for projects that were completed and were found to have reliable or acceptable estimates for the indicators.

Beyond the three main KPIs that projects are required to report on, we also considered the annual cost savings associated with the energy savings achieved by the projects. Cost savings were calculated based on the product of industrial energy prices and the energy savings achieved by the projects. For example, where one project resulted in 1 GWh/year in electricity savings, and the average electricity price in the years and countries in which the project was active was €0.1/kWh, the associated cost savings would be €100,000 per year.

Table 6-20: Cost-benefit metrics based on KPIs for projects with reliable/acceptable re-estimates during project lifetime and the number of completed projects.

Indicator	All projects (29)	IEE-II (22)	H2020 (7)
Energy saved / funding (GWh/year per €m)	39.2	39.9	37.6
Annual cost savings / funding (€m/year per €m)	1.9	2.1	1.5
Investment triggered / funding (€m per €m)	5.1	4.8	5.7
GHG reduced / funding (ktCO_2e per €m)	11.0	15.2	9.2

Across all projects, the average annual primary energy saved per Euro of funding was 39.2 GWh/y/€m. This was determined by dividing the total annual primary energy savings of all projects by the total of

[80] Please refer to Section 6.4.3 on investments.
[81] H2020 projects were 100% funded by EU contributions.

funding received by all projects. This metric varied substantially between projects when assessing the energy saved with respect to the funding received. The metric for IEE-II was found to be 39.9 GWh/y/€m, while the average for H2020 was 37.6 GWh/y/€m.

The difference compared to the KPIs presented in section 6.4.1 can partly be explained by how the funding for IEE-II projects was used in this calculation. IEE-II projects were co-funded and received 75% of their funding from the European Commission. Since only the funding by the European Commission is considered, the funding used for the cost-benefit analysis is only 75% of the funding received, averaging €1.1m per IEE-II projects. Conversely, the H2020 projects were fully funded by the European Commission. If the full 100% of funding were considered for the IEE-II projects, then the cost-benefit would be found to be 29.9 GWh/y/€m. Furthermore, even when considering the full funding amount received by IEE-II projects (1.5 €m), it is still smaller than the amount received by H2020 projects (1.9 €m), on average, which explains the difference in the cost-benefit analysis KPIs.

An analysis of the cost-benefit with regards to the sectorial approach of the projects showed that projects taking a cross-sectoral approach achieved slightly more savings per Euro of funding, with 33.0 GWh/year per €m, compared to projects taking a single sector approach, with 28.0 GWh/year per €m.

We found that across all projects the funding achieved €1.9 in annual cost savings for SMEs involved in the projects for every Euro of funding. One Euro of funding generated €2.1 in annual cost savings across IEE-II projects and €1.5 across H2020 projects. However, if the full amount of funding were considered, the annual cost savings for IEE-II per Euro funded would be €1.5, aligned with the indicator for H2020 projects. However, these values do not include further cost savings triggered through activities after the project lifetimes, which indicated similar levels of annual cost savings. Considering these would therefore double the long-term cost savings achieved per Euro of funding. Furthermore, the cost savings considered are only those associated with implemented energy saving measures. When considering behavioural changes induced by interactions with companies, one can expect further savings in the long term.

With respect to investments triggered through the projects, the average was 5.1 Euro invested per Euro of funding. Again, the average across IEE-II projects was lower (4.8 €/€) than for H2020 projects (5.7 €/€).

The average annual GHG reduction per million Euros of funding was 11.0 ktCO_2e. For IEE-II projects this average was 15.2 ktCO_2e/€m and for H2020 projects 9.2 ktCO_2e/€m. The relationship of the GHG reduction per unit of funding for IEE-II and H2020 showed slightly more discrepancy than the metrics energy savings and investments. This can partly be explained by the higher average emission intensity of the saved energy in the IEE-II programme (292 tCO_2/GWh) compared to the H2020 programme (270 tCO_2/GWh), reflecting the decreasing emission intensity of the EU.

6.6.1.2 Cost-benefit based on activities

An analysis of the energy savings leveraged on an activity level during project time shows that projects' capacity building related activities leveraged an average 39.2 GWh/year in final energy savings. In comparison, tool, benchmark and best practice development activities averaged 15.6 GWh/year in final energy savings. Projects' audit activities resulted in an average 25.6 GWh/year final energy savings. An overview of the average final energy savings achieved per project activity is shown in Table 6-21. The table also shows the average final energy savings as a percentage of total energy use.

Table 6-21: Average energy savings by project activity during project time and number of projects included in the analysis.

Activity	Average final energy savings (GWh/year)	Average final energy savings (%)
Audits (24)	25.6	4.5%
Capacity building (9)	39.2	4.1%
Tools/benchmarks (11)	15.6	3.2%

The larger average final energy savings of capacity building activities can be attributed to the fact that only significant training activities could be quantified because projects collected useful data around training impacts when training activities played a key role in delivering impacts. Furthermore, capacity building programmes may have provided useful information on the financial aspects of energy savings measures, facilitating investments. On the other hand, audits were easier to quantify, even when only a few were carried out since there were enough common factors to fill the gaps.

As shown in Table 6-21, the final savings rate is higher for audits (4.5%) than for capacity building activities (4.1%). However, projects' capacity building activities tended to involve a larger number of companies (average of 300) compared to audit activities (average of 107). Therefore, the projects' average savings achieved through the capacity buildings activities was higher (39.2 GWh/year) than for audit activities (25.6 GWh/year). A further reason is that some of the training-focussed projects with the highest final energy savings did not report a savings rate.

A cost-benefit analysis at the activity level is not possible because the data on funding could not be disaggregated by activity level. However, a cost-benefit analysis could be done for certain groups of projects based on the activities they carried out. Therefore, projects that carried out audits, capacity building and/or one of tool, benchmark or best practice development were grouped and analysed as presented in section 6.6.1.1. This means that projects that carried out multiple activities, the energy savings of all their activities are considered. For example, a project (and all of its associated energy savings) that carried out both audits and capacity building will feature both in the audit group and the capacity building group.

For projects with reliable or acceptable audit impacts (24) the average energy saving per Euro of funding was found to be 31.9 GWh/y/€m. The projects that included capacity building activity impacts (9) averaged a rate of 61.2 GWh/y€m. This may suggest projects primarily focused on capacity building have a wider reach and greater impact beyond the direct project participants, but the sample size was too small to be definitive. Considering projects that had impacts based on developed tools, benchmarks or best practices (11), we found an average of 18.6 GWh/y/€m. Table 6-22 shows the average primary energy savings achieved during project time by the projects, as well as the cost-benefit for projects that carried out these activities.

Table 6-22: Cost benefit analysis of projects that carried out different activities during project time. Number of projects that carried out the activity indicated in brackets.

Projects	Average primary energy savings (GWh/year)	Primary energy savings / funding (GWh/year per €m)
Projects that carried out audits (24)	45.1	31.9
Projects that carried out capacity building (9)	94.0	61.2
Projects that developed tools/benchmarks (11)	27.5	18.6

The same analysis was not carried out for activities after the project lifetime since there was a lack of reliable and acceptable estimates to make an assessment. However, as shown Figure 6-19, capacity building, tools and benchmarking activities have greater impacts beyond the project than audits. This can be attributed to the longer-term nature of ongoing training courses, compared to the one-time impact of audits.

6.6.1.3 Cost-benefit of implemented measures

Another point of interest with regards to cost benefit is the amount of energy that is saved for every Euro spent by the companies involved in the projects. In other words, the energy saved per Euro of investment triggered. Across all projects, average savings were 9.2 kWh/year per Euro of investment, as shown in Table 6-23. The average for IEE-II projects was 10.0 kWh/y/€, while companies involved in H2020 projects achieved 7.9 kWh/year energy savings per Euro of investments. This may reflect H2020 projects targeting energy efficiency measures in an economy that is more energy efficient than it was during the IEE-II projects. This sentiment was echoed in some project reporting, which highlighted that the so-called 'low-hanging fruit' of energy efficiency would have already been implemented by companies.

Table 6-23: Cost-benefit of company investments during project lifetime

	All projects	IEE-II	H2020
Primary energy savings / investment (kWh/year per €)	9.2	10.0	7.9

As noted above, the cost-benefit presented here only considers the benefit resulting from implemented energy saving measures. Further benefits may come in the form of multiple benefits (as discussed in section 6.6.2) or behaviour changes that will trigger further long-term energy benefits that could not be quantified.

6.6.1.4 Contribution to 2030 and 2050 EU climate and energy targets

As according to the Literature Review for this study, the EU has a target to improve overall energy efficiency by at least 32.5% between 2021 and 2030[82]. Member States have submitted 10-year National Energy and Climate Plans (NECPs) and the Commission has estimated that the cumulative impact of these NECPs will deliver net energy efficiency savings of 29.4%-29.7%[83]. This falls short of the 32.5% target and so the Commission intends to help close this gap through various upcoming initiatives and revisions of existing legislation.

In terms of GHG emissions, the EU also aims to increase emissions reductions to at least 55% by 2030 against 1990 levels, with each sector expected to contribute to this target. Although the EU has no specific target for industry, which is mostly included within the EU ETS reduction target of 43% by 2030[84], the sector is expected to reduce its emissions by as much as 95% by 2050. As part of the EU's industrial strategy, adopted in March 2020, the EU will prioritise decarbonisation of energy-intensive industries such as steel and cement.[85] However, analysis by the International Energy Agency (IEA) shows that 59% of total energy savings could be achieved in less energy-intensive industrial sectors, indicating that a focus on SMEs is critical.[86]

The impact assessment published in September 2020 and accompanying the EU Communication "*Stepping up Europe's 2030 climate ambition - Investing in a climate-neutral future for the benefit of our people*"[87] presents various PRIMES modelling scenarios for 2030 and 2050. This shows that the combination of energy and climate policies deliver in 2030 around 10.6% energy savings in industry in the baseline scenario compared to 2015. This is increased to 14.7% to 16.8% energy savings in industry by 2030 in the mitigation scenarios. The impact assessment notes that much of the savings in the industrial sector will likely be achieved by energy intensive companies, and there are greater improvements needed from less energy intensive organisations such as SMEs in meeting the overall 32.5% energy efficiency target.

As stated in the Literature Review, further energy efficiency improvements will be required in the period 2030-2050 to meet the EU's ambition to make the EU climate-neutral by 2050, in line with the Paris Agreement. The PRIMES modelling for the impact assessment suggests there will be significant fuel switching in industry in the period 2030-2050, with associated energy savings. The baseline final energy use for 2050 is about 10 Mtoe (4%) lower than the baseline for 2030 (of about 250 Mtoe) despite growth in the economy, with a further 21-23 Mtoe (8%-9%) energy demand reduction compared to the 2050 baseline (of about 240 Mtoe) in the mitigation scenarios.

Table 6-21 shows the average final energy savings from IEE and H2020 projects from market up-take type activities including audits, capacity building and tools. These savings are not additive because the activities may be identifying the same energy efficiency measures. For example, opportunities to save

[82] From https://ec.europa.eu/clima/policies/strategies/2030_en
[83] See Communication COM/2020/564 available from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0564&from=EN
[84] The European Commission is preparing a revision of the EU ETS which will bring the target in line with the new target for 55% reductions by 2030
[85] See https://ec.europa.eu/commission/presscorner/detail/en/fs_19_6724
[86] See https://webstore.iea.org/download/direct/3010
[87] Impact assessment available from https://ec.europa.eu/transparency/regdoc/rep/10102/2020/EN/SWD-2020-176-F1-EN-MAIN-PART-2.PDF

energy by replacing inefficient lighting could be identified through an audit or the use of a benchmarking tool.

If we assume an average saving of 4.5% from these projects, as our results above suggest, and that a similar proportional impact could be achieved across the EU industry sector, that would suggest 4.5% savings across EU industry, equivalent to almost one-third of the total 2030 reduction target of about 15% in the New Industrial Strategy. This is likely to be an overestimate of the potential savings since larger companies are already required to conduct energy efficiency audits under Article 8 of the Energy Efficiency Directive.

In view of these considerations, significant efforts will still be required to achieve the above potential savings and enable the industry and service sectors to meet the EU 2030 and 2050 climate targets. As part of this study, we have collected market stakeholders' perspectives on the challenges and opportunities faced by these sectors, as well as content gaps to be addressed in the Clean Energy Transition sub-programme of LIFE (2021-2027), analysed separately in Section 8.

6.6.2 Multiple Benefits

6.6.2.1 Qualitative assessment of multiple benefits

As well as the direct benefits, achievements and impacts described and explored in Section 6 up to now, there are often a range of other non-energy benefits created within companies achieved through pursuing energy efficiency. These can arise through activities including (as will be highlighted in the Section 7.2) awareness-raising, testing and demonstration, implementation of action plans, support for governance, capacity building, engaging stakeholders, definition of strategies, replication, the incorporation of green targets into company policy, and the establishment of best practice.

Several of the projects currently underway reflect the value that can be generated through recognising the multiple benefits, most notably the M-BENEFITS project that is addressing exactly this aspect, but also SPEEDIER where partners reported that they are keen to understand the barriers facing SMEs and to identify how addressing aspects such as energy efficiency can feed into addressing a wide range of barriers, not just the obvious cost saving aspect. To date our research has identified several completed projects that did touch on this aspect, as well as several of those currently underway. It is interesting to note that all are H2020 projects.

STEAM-UP considered Non-Energy Benefits (NEBs), which the project described as side effects that can have significant value and could even exceed the value of the saved energy. Some examples noted were reduction of waste, maintenance costs and production downtime, as well as improved indoor climate, safety and product quality were achieved. STEAM-UP questioned why there were still so many potential savings reported as having low payback periods and outlined how highlighting the NEBs rather than just energy efficiency may help managers get on board with implementing measures. A survey conducted by the project indicated that 85% of companies consider NEBs in their investment decision. The project went on to develop an NEB web tool[88] that can guide energy consultants in how to quantify the value of NEBs. The project estimated that accounting for NEBs should reduce the payback time of measures by an average 0.5 years. The tool allows the user to specify the measures they are considering down to the industry, investment size and technology type, as well as specifying which NEBs to consider. The tool then illustrates the average payback time of such a measure with and without considering the NEBs. The tool also reflects negative side effects such as unplanned downtime as a result of implementing and NEB.

WaterWatt carried out a work-package focusing on human and organisational challenges and how these considerations can shape efforts to improve energy efficiency. The work-package findings helped the project partners understand the way firms and sectors organise and operate with regard to energy efficiency. According to the final report, this directly informed the project outputs with a view to maximising energy savings, decreasing vulnerability to energy price fluctuations and reducing CO_2 emissions. Although multiple benefits were clearly considered, it is not made explicit how findings from this work-package directly influenced project outputs.

[88] http://neb.uk.teknologisk.dk/statistik.aspx

The SPEEDIER project, which aims to deliver a self-financing outsourced energy management service, seeks to understand the broader barriers faced by SMEs, focusing on but not limited to the subject of energy efficiency. By offering an outsourced service, the project seeks to streamline the decision-making process in SMEs and remove barriers such as lack of capital and access to finance, maximising benefits such as financial savings, employee health and productivity, and staff engagement and awareness.

Interviews with partners from the INNOVEAS project highlighted the reputational benefits that can be accrued by companies which adopt an energy culture. Therefore, projects targeting behavioural factors rather than economic incentives in SMEs, particularly those in the H2020 wave of projects (such as ICCEE and SMEmPower Efficiency), may lead to further benefits associated with sustainable branding and other reputational aspects. Furthermore, these companies which adopt voluntary protocols and/or management systems, if sufficiently large, may pressure others in their supply chain to do the same.

Furthermore, the ICCEE project is seeking to develop a set of tools, including a “non-energy benefit (NEB) tool” which demonstrates how embracing energy efficiency improvements will deliver other co-benefits, such as enhanced competitiveness, decreased maintenance costs, better working environment, and improved environmental performance. A survey and series of direct interviews was conducted at the outset of the project to understand the relevance and role of NEBs within food supply chains and to explore how NEBs could be linked to energy efficiency measures. The project thus seeks to develop a detailed strategy, focussing on behavioural aspects, for the consideration of NEBs in company decision-making processes.

The M-BENEFITS project is ongoing, with the results of the pilot phase of the project currently being finalised across 30 companies. The focus of the work is very much on increasing understanding of the multiple benefits that will be delivered inside a company that makes an energy efficiency investment more impactful. One company involved in the pilot phase has been Nestlé. Through participation in the project, the department in charge of administrative buildings for Switzerland—'Swiss Workplace Solutions'—has been made aware of the additional benefits associated with energy efficiency improvements. A retrospective analysis was initially performed on the multiple benefits associated with refurbishment of a part of the HQ buildings (including the façade, technical distribution and lighting). Having seen the value of the approach, the company are currently using the M-BENEFITS methodology in two strategic projects.

During our interview with a project partner from the M-BENEFITS project, high level provisional findings from the pilot phase were shared. The consortium has found that when the multiple benefits of energy saving measures are considered, this can often divide by two (and sometimes by three) the payback times associated with energy efficiency measures for companies. Although this has yet to be confirmed or tested on a larger scale, it is an interesting outcome that could be used to inform future funding programmes and project level activities.

The ENERWATER developed a standard methodology for assessing and improving the energy efficiency of wastewater treatment plants (WWTPs). There were no previous methodologies that encompassed the specificities of energy efficiency for WWTPs. One important topic is the substantial use of chemicals to treat wastewater. One non-energy benefit of ENERWATER’s efforts was that WWTPs became much more aware of their chemical consumption. Furthermore, the production of the chemicals is associated with a substantial amount of emissions, which present a further benefit which is not accounted for in terms of energy savings.

6.6.2.2 Quantitative assessment of multiple benefits

As discussed in section 6.6.2.1 above, considering multiple benefits or NEBs can have a considerable impact on investment decisions. If the NEBs were to be assigned a value or a benefit, then this could have an impact on potential payback times and thereby if an investment is profitable enough. In this section we identify how the consideration of NEBs would impact the cost-benefit of the projects considered in this report.

A 2016 study on NEBs interviewed Swedish industrial firms and found that the most named reason for not investing in energy efficiency is the suboptimal payback time (Nehler & Rasmussen, 2016). The cost savings associated with NEBs may often outweigh the energy cost savings and could therefore have a significant impact on the payback time. The Swedish study found that although there was widespread awareness for the NEBs of energy efficiency investments, they are rarely included in investment calculations. The main reason for this was that there was a lack of knowledge about how to quantify and monetise NEBs.

The study suggests that on a company level NEBs should be calculated by reviewing each type of benefit and assigning an indicator that can be linked back to a monetary value. For example, reduction in emissions as a result of investments in energy efficiency may reduce the need for replacing filters or reduce the price of emission allowances. Reduced noise could reduce the price of silencers or noise enclosures. Improved safety will result in less sick leave and reduced rehabilitation costs. These indicators have a direct link to the profitability of an investment and should therefore be considered in investment decisions.

Evidently, some types of NEBs are more quantifiable than others. There may be some indirect NEBs, such as improved logistics and public image, that are more challenging to quantify. NEBs such as increased productivity is easier to quantify. Table 6-24 below illustrates how some NEBs are more quantifiable than others and how some NEBs may be evident in the short-term while other NEBs are more likely to manifest themselves over time.

Table 6-24: Overview of the quantifiability of different short term and long term non-energy benefits.

Quantifiability	Short term	Long term
High	Increased productivity and production, reduced cost of disruptions, reduced need for cooling, reduced material costs, reduced hazardous waste	Reduced waste, reduced maintenance costs, extended life of equipment
Medium	Improved product quality, reduced scrap, reduced noise, reduced emissions	Reduced labour costs, use of waste heat/fuel/gas, improved worker morale, safety, work environment, improved temperature control, improved air quality, improved lighting
Low	Improved logistics	Improved public image, health, reduced currency risk

Source: Adapted from Nehler & Rasmussen (Nehler & Rasmussen, 2016).

The projects reviewed in this study interacted with a wide range of companies and SMEs involved in different industries and implementing different energy savings measures. Therefore, no company level analysis of NEBs is possible. However, two estimates were presented for the quantification of NEBs above; one indicating the payback time could be reduced by an average of 0.5 years (STEAM-UP) and one indicating the payback time could be divided by 2 or 3 (M-BENEFITS). The study referenced above also mentions that the NEBs could have the same or a higher value as the energy benefits, which implies the payback time could be halved.

Based on these estimates, we have compared how different indicators perform when NEBs are considered compared to when they are not considered. One example will assume that NEBs reduce PBT by 0.5 years, while the other example will assume that NEBs can halve the payback time of implemented measures.

Table 6-25 shows how the total annual costs saved due to measures implemented as a result of the 41 projects would increase if NEBs were considered. The calculation shows that an additional 20.6 to 88.7 million € is likely saved per year, when considering NEBs. This increases the cost-benefit from 1.9 to between 2.4 and 3.9 of Euro saved for each Euro of funding.

Table 6-25: Potential increases in annual cost savings of the 41 projects when considering NEBs.

NEB consideration	Average payback time (years)	Total annual cost savings (€m)	Annual cost savings / funding (€m/€m)
No NEB consideration	2.7	89.4	1.9
NEBs reduce payback time by 0.5 years on average	2.2	110.0	2.4
NEBs halve payback time	1.3	178.8	3.9

6.6.3 Other benefits

Further to the multiple benefits delivered within companies and described in Section 6.6.2, there are a wider set of benefits created by projects. Such wider benefits include awareness raising in a wider context of the whole market place and policy making landscape (rather than in the specific company environment), spurring policy and/or legislative change, mainstreaming of green objectives/targets into national and EU policies and funds, and the establishment of best practice within a sector and industry.

Wider benefits could include results and developments that occur after the lifetime of the project such as partners being able to take their knowledge into the new projects and new collaborations which would otherwise not have happened. They could also refer to project results cascading into further projects outside the core funding streams such as development funds or municipally funded projects which potentially do not have the capacity to fund the methodology development aspects, but do exist close to the target audience and can implement the outputs. Capturing such benefits is challenging within the timeline of these projects, and very little detail of such developments is present in project reporting. We continue to explore this topic through the interview process and further follow up.

6.6.3.1 Partnerships and collaboration

A clear wider benefit is the collaboration and partnership formation as a result of different project partners and stakeholders working together. The value of these connections is not quantifiable, but several projects have highlighted good working relationships generating further partnerships, coordinated activities and future projects. The exchange of expertise and ideas across sectors and Member States can generate significant value and enable successes beyond the project lifetime.

Partners from the SESEC project highlighted that the long-term relationships created within the consortium hold significant value as they can lead to further projects and activities. Especially when considering that industries transform over extended periods, rather than just within one project's lifetime the importance of this wider benefit must be highlighted.

SET project partners are now collaborating on a follow-up activity in which they are setting up a tool to collect data from companies in the European textile industry, in order to enhance data collection, transparency, and communication between industry and the government. This will improve the specifications and definition on data representation to integrate the data collected from companies.

The SPICE[3] project enabled a project partner—a leading European business association—to establish good long-lasting partnerships with national federations in newer Member States including Bulgaria, Hungary and Poland. These national associations had worked with the company before but were perceived as being less interested in cooperation before this project attracted them and encouraged them to become more active members of the cross-European network.

The training method used in EUREMplus was also considered to result in strong partnerships, in particular new collaborations between companies and energy specialists. Each new EUREM provider carefully selected a team of external trainers to work with to implement the EUREM course.

6.6.3.2 Knowledge creation

Another benefit that projects achieved was the creation of knowledge that allowed a wider audience to engage in energy efficiency. In this section we discuss cases where projects conducted research and formulated this knowledge rather than only engaging in awareness raising. Some projects targeted specific sectors or market segments that lacked a detailed understanding of what energy efficiency meant in the context of that sector.

CODE2 has already been mentioned in section 4.4.1.2, with the discussion of CODE2's development of 27 roadmaps for cogeneration. The basis for the roadmaps was a comprehensive study by the CODE2 project on the potential of cogeneration. The project identified that there wasn't much information about CHP at the time but knew that it would play a part in policy development on the basis of the Energy Efficiency Directive (EED). To develop the understanding of CHP in the context of the EED, CODE2 articulated and quantified the benefits of CHP and a Member State level. A project partner highlighted:

> *"CODE2's analysis attracted attention from the sector and from analysts. It was also commented on by a DG Energy official as the most useful study on CHP so far seen."*

The achievement of the ENERWATER project was already discussed in section 4.4.1.2, where we highlighted the standard developed by the consortium following the project. The basis for this standard was the learnings from the project in which the project participants, including partners from academia, studied the current energy status of wastewater treatment plants (WWTPs) and developed an overview of best practices, best available technologies and benchmarks. This fed into an energy assessment and classification methodology for WWTP energy performance. The driver behind this work was that the classic definition of energy efficiency was difficult to apply to WWTPs. Through collaboration with WWTPs, academia, standardisation bodies and SMEs, the consortium was able to create the knowledge required to develop a standard applicable across Europe and was adopted as a European standard.

The SESEC project also marked a starting point for the clothing industry to recognise how energy efficiency can be estimated and addressed. The project undertook a detailed benchmarking exercise of the industry to identify best practices and to estimate what the benchmarks for the CO_2 emissions associated with a specific item of clothing should equate to. Thomas Fischer from the German Institute for Textile and Fibre Research (DITF) highlighted in an interview:

> *"The tool in the SESEC project marked a starting point for recognising estimates for the CO_2 equivalents of one item of clothing, for example the CO_2 equivalent of one t-shirt"*

6.6.3.3 Awareness raising

Awareness raising is one of the key ways for projects to maximise their impacts, however this is usually difficult to quantify. Beyond just dissemination of project results, many projects aimed to reach as many companies as possible to highlight the benefits of energy efficiency, as well as the methods and tools that companies can use to improve their energy efficiency. A further approach is to introduce companies to networks and raise awareness for available support schemes and regulations. Some examples are noted below.

The CHANGE project's trainings for chambers of commerce and industry (CCI) staff on matters of energy efficiency allowed these CCIs to take on a role of first point of contact for SMEs interested in knowing more about the topics. Due to the trainings provided by CHANGE, the CCIs were able to recommend suitable energy efficiency-related activities, national or regional support possibilities and relevant regulations. In most Member States the CCIs took on this knowledge facilitator role, while some CCIs went on to provide detailed technical advice and organised events on energy efficiency. The impact of this wider benefit is very difficult to quantify, which is why it did not feed into the re-estimated impacts. A project partner noted:

> *"CHANGE was the starting point for a lot of chambers' role as a facilitator of knowledge on energy efficiency and relevant resources."*

The EE-METAL project identified a lack of involvement of ESCOs with metal industry SMEs. This seemed to be both due to a lack of awareness on the side of the SMEs and a risk averseness of ESCOs, which preferred to work with larger companies. Through audits and developing a catalogue of best available techniques EE-METAL aimed to highlight the potential of energy savings to SMEs, as well as removing some risk for ESCOs by cataloguing the potential investments and cost savings associated with energy efficiency in metal industry SMEs. Support from ESCOs can significantly improve the rate of implementation of energy saving measures by SMEs.

The EE MUSIC project is a particularly good example of a project raising awareness of energy efficiency in an industry that often overlooks these considerations. High profile activities included an audit of the Eurovision Song Contest in 2015, as well as a presence at numerous other events in the music industry. Furthermore, the project led to partnerships that have led to new projects and initiatives after the project finished. For instance, two EE Music ambassadors came together to start ZAP concepts, a leading European consultancy helping venues with energy management. One of the partners involved in EE MUSIC has also helped develop the Vision 2025 pledge, encouraging festivals to cut their emissions, which has now been taken up by a number of festivals. These activities will have undoubtedly raised the profile of energy efficiency considerations within the music events industry.

6.6.3.4 Continued use of outputs

Several projects have tried to commercialise outputs, which is a core element of these projects' strategy to continue having an impact beyond the project lifetime. Outputs that do not offer a basis of commercialisation may stop being used or developed by industry after the project lifetime because there is no benefit for projects to continue with their deployment. When opportunities arise to commercialise outputs, project partners have an interest in continuing the output distribution and development.

A prime example is the EUREM training programme, which was already discussed in previous sections. The training was commercialised by earlier projects, but projects assessed in this study, EUREMPLUS and EUREMnext further developed the programme. EUREM offers participants the prospect of yearly cost savings averaging €30,000 as a result of implementations following the training programme. In comparison, the programme fee is €250. Therefore, the EUREM programme creates value for the industry by building capacity that leads to energy savings, while also generating revenue for the training providers to continue offering the programme.

A further example of output development includes efforts to commercialise the energy savings tool developed by EINSTEIN II. Both a free and commercial version of the tool were made available to companies for use after the end of the project.

Although not a commercial offering, the SME Energy CheckUp project, which developed an energy savings tool, enabled the development of follow-on projects such as BEST Energy CheckUp (funded by Climate-KIC), as well as other smaller projects some funded at the municipality level, with the tool being further developed and updated in the context of business parks. This work is ongoing still.

6.6.3.5 Other wider impacts

At interview, an INDUCE project partner suggested that job creation may have taken place as a result of the project. Some of the companies involved in the project didn't have specific staff managing energy measures and environmental processes impacts. Instead, production managers or quality managers would typically assume the role of energy efficiency control. In Spain, it was suggested that around 60% of the companies involved in the project added 'Energy Manager' roles during the project, although project activities are still being finalised, so this has yet to be confirmed.

Meanwhile, the REG-Cep project also was one of, if not the first, of its kind in integrating energy planning into regional planning. The project sought to implement and launch regional-based clusters, with the development of a toolkit uniquely positioned to integrating the strategies of regional authorities with the energy needs of SMEs. Therefore, this project helped to set up the initial framework needed to take on regional solutions based on shared facilities and common ownership.

7 Success stories

Within this project a number of success stories have been generated that take the activities of the projects and highlight the impact on specific companies that were participants in the IEE II or H2020 EASME supported projects. The majority of these illustrate specific projects and company participants who were able to take the learnings from their project participation and apply them to achieve change with their company energy culture and ultimately the levels of energy efficiency.

It has been repeatedly highlighted through the discussions held within this work that such successful stories are felt to be hugely important to engage with potential project participants and illustrate the sorts of energy efficiency changes that can be made, both in terms of equipment installed, and in terms of energy culture within organisations.

Several other success stories have been developed to highlight how benchmarking and standards work can lead to significant progress and how projects are supporting each other through their work programmes and now through the shifts needed due to the COVID-19 pandemic.

It is anticipated these success stories will provide examples of companies embracing energy culture changes as intended by the projects and will help to inspire other companies to do the same.

It must be flagged that this has been an unexpectedly challenging aspect of our work. It has become apparent that key participants from older projects have moved on, companies who were involved have moved on, records and memories have faded. For a number of companies involved in more recent projects they reported a reluctance to be involved due to data privacy issues surrounding sharing their energy data and activities. We have also been conducting this activity over the time period of the COVID-19 pandemic, when very likely SMEs in particular have significant day to day concerns.

We are very grateful to the companies featured in these success stories for so generously giving us their time Project coordinators and many partners of current and recently completed projects have been very helpful and generous with their time.

7.1 Summary of Success Stories

Success story	Description
EUREM and the global training programme	The successful EUREM training programme was initiated in 1999 and has been expanded both in content and in geographic scope through subsequent projects.
STEEEP and Air Liquide Hospital Care	The STEEEP project trained companies such as Air Liquide Hospital Care to adopt behavioural and operational changes. Measures adopted by the company included automation of lighting, upgrading equipment, and implementation of monthly awareness raising actions and training, resulting in about 16% energy savings by the end of the project in 2016.
EECC and Uponor	Uponor Latvia Ltd. participated in the EECC project and adopted various energy savings measures including the installation of new equipment and switching to more energy efficient devices. Through this project, Uponor successfully changed employee habits regarding the use of lighting, resulting in around 30% of electricity savings.
INDUCE and Carinsa	The INDUCE H2020 project worked with Grupo Carinsa to reduce their energy consumption and change the culture surrounding energy efficiency in the company
ENERWATER and CEN certification	The ENERWATER project methodology was approved as a European Standard that will guide how wastewater treatment plants assess and improve their energy efficiency.

Success story	Description
STEAM-UP and Fahnen-Gärtner	The STEAM-UP project helped Fahnen-Gärtner reduce their energy consumption by 1 GWh/year through an audit and support to install an EMS, a new steam boiler, an exhaust gas heat exchanger and a PV system to cover 20% of the company's electricity consumption.
EUREMnext and the Olympic sports centre in Riga	The head of technical operations of the sports centre participated in the 9-month EUREM training programme introduced to Latvia by the EUREMnext project. The EUREM training unlocked significant energy savings for the company and allowed the participant to grow in his role as the company's energy manager.
M-BENEFITS and Nestle	Nestlé's Swiss Workplace Solutions department have adapted their activities following participation in the H2020 project M-BENEFITS. Having seen the value of the approach and the additional benefits associated with energy efficiency improvements, the company are currently using this method on two strategic projects.
COOLSAVE and Nueva Pescanova's BAJAMR7 factory	The IEE project COOL-SAVE worked with the Nueva Pescanova group to reduce the energy consumption of their factory by 835 GWh/a
Overcoming challenges associated with the COVID-19 pandemic	Five ongoing Horizon 2020-funded projects, SPEEDIER, E2DRIVER, ICCEE, SMEmPower Efficiency and INNOVEAS, were already collaborating in order to support each other's activities before the pandemic. This collaborative approach has helped them overcome challenges posed by the pandemic.
EE MUSIC and the Eurovision Song Contest 2015	A special energy audit was provided by experts from the EE MUSIC consortium for the 60th edition of the Eurovision Song Contest that took place in Vienna in 2015.
TESLA and the Santa Maria La Palma winery	Audits and support during the IEE project TESLA helped the Santa Maria La Palma winery reduce their energy consumption by 2.93 GWh/a and encouraged them to invest almost € 2 million in energy efficiency measures
GREENFOODS and continued impact after project conclusion	GREENFOODS' project plan set out a strategy for how its outputs will continue to have an impact after the project ends. One big part of this was integrating outputs into existing formats: GREENFOODS training integrated into the EUREM training programme and the GREENFODS research integrated into an energy efficiency database.
IMPAWATT and the importance of the sustainable value chain	IMPAWATT highlighted the importance of life-cycle considerations when considering sustainability. The project developed four online courses for businesses to develop their understanding of life-cycle assessments and sustainable value chains.
SCOoPE and the Agriambiente Mugello cooperative	During the SCOoPE project, the cooperative was audited by technicians. Following the audit, the cooperative installed a number of technical solutions aimed at improving energy efficiency.
WaterWatt and Deutsche Edelstahlwerke	The WaterWatt H2020 project helped Deutsche Edelstahlwerke reduce their energy consumption through optimisation of their water cooling pipelines.

8 Results of the survey with EU Industry stakeholders

The aim of this survey was to identify particular market priorities and content gaps to accelerate the energy transition of the industry and service sectors, with a particular focus on SMEs, in order to determine priority areas in the forthcoming LIFE programme (2021-2027). Notably, the participating stakeholders were asked to share their views on the relevance of past and ongoing actions supported through IEE II and H2020 as well as to identify priorities for the industry and service sectors to achieve the low energy transition needed.

During the next programming period, the LIFE programme will include a sub-programme for the clean energy transition, aiming at fostering the market uptake of energy efficiency and renewable energy measures. The general objectives of the new LIFE programme have been provisionally agreed, and the task is now to draw up the first Multiannual Work Programme covering the period 2021-2024. The results from this survey will feed into the preparation of the priorities and actions to be addressed in the Work Programme.

The consultation focused on gathering feedback from stakeholders on the following issues:

- Relevance of past and existing topics for the future challenges in energy efficiency
- Key future challenges and opportunities where the LIFE Programme has the greatest potential to make a difference in energy efficiency and renewable energy and
- Prioritisation of measures to include in LIFE and the ways in which these solutions can be operationalised.

899 beneficiaries were invited to complete the survey, which was open between 5th June and 4th September. A total of 185 respondents completed the survey sufficiently for their responses to be included in this analysis, with 148 of those having fully completed the survey.

The following sections present the key findings of the survey and share reflections and recommendations of respondents. The results of the survey on existing topics are summarised in Section 8.1. Given the aim of the survey to support the design of the next programming period of LIFE, the outcomes regarding future challenges and opportunities are presented in greater detail in Section 8.2. The prioritisation of measures is then presented in Section 8.3. These result sections are followed by the Survey Conclusions in Section 8.4.

8.1 Responses on existing topics

Figure 8-1 below shows a summary of the responses for each of the current energy efficiency topics. As is clearly seen all are ranked as still having ‘essential’ and ‘high priority’, with industrial waste heat/cold recovery receiving the highest ranking, followed by innovative energy efficiency services.

The lowest ranked topic was joint actions with a 50% ranking of ‘essential’ and ‘high priority’.

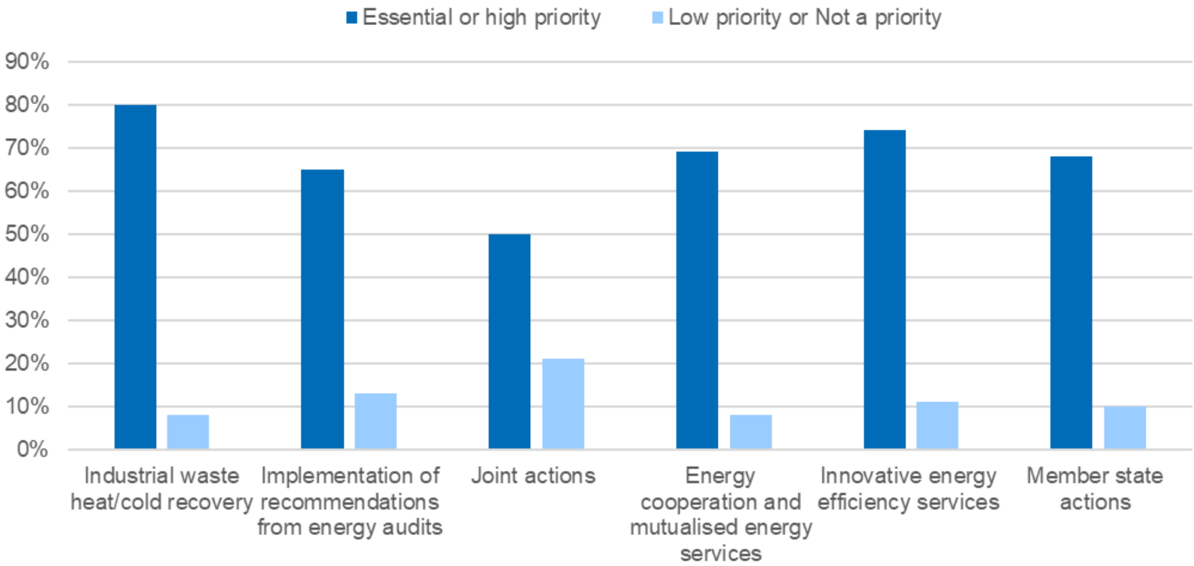


Figure 8-1: Overview of responses on existing topics

A range of measures that could be included in LIFE to continue support SMEs in these areas were mentioned by respondents, across the different topics. These included measures that focus on information sharing and capacity building activities. For example, there were several suggestions that sharing best practise of successful projects would be particularly useful, and some called for SMEs to be offered expert support in these topic areas. Another popular theme was the provision of financial support (long-term financing, grants and models achieved within H2020 projects) tailored to the different topic areas. Others suggested support should aim to progress new business models, new methodologies, or labelling schemes.

Respondents also discussed barriers to uptake that remained among SMEs, including the upfront costs (training, software, and hardware), shorter-term savings vs. long-term savings, lack of suitable financial support and the difficulty of gaining and keeping the necessary technical knowledge in small enterprises.

Finally, several pieces of existing EU legislation, such as Energy Performance Contracting (EPC), and energy audits, were highlighted as being beneficial for small companies with limited time resource to help achieve energy efficiencies.

These suggestions are similar to those proposed to support future opportunities and overcome challenges in Section 8.2 below.

8.2 Future challenges and opportunities

Section 4 of the survey looked to the future of the LIFE Clean Energy Transition sub-programme (LIFE CET) and asked respondents to consider future opportunities and challenges where LIFE CET support could help make a difference. The section of the survey sought to understand the scale of challenge and opportunity that certain topics offered to progressing uptake of energy efficiency and renewable energy measures. Respondents were asked to consider the following topics:

- Digitalisation
- Electrification
- Industrial symbiosis
- Locally integrated partnerships
- Sustainable energy value chain

For each of these five topics respondents were asked to rank each as an opportunity and as a challenge, using the following two separate scales:

- Significant opportunity
- Small opportunity
- Not an opportunity
- Do not know

- Significant challenge
- Small challenge
- Not a challenge
- Do not know

Regarding future challenges and opportunities, respondents appeared to be optimistic and consistently rated the topics presented as more significant opportunities than challenges. Figure 8-2 shows an overview of responses from this section of the survey.

The average number of 'significant opportunity' responses for a topic was 73% in relation to energy efficiency and 76% in relation to renewable energy, whereas the equivalent 'significant challenge' received 60% in relation to energy efficiency and 59% when considering renewable energy. Regarding the individual topics, digitalisation received the highest proportion (86%) of respondents indicating that it was a 'significant opportunity' for energy efficiency and locally integrated partnerships received the highest proportion (79%) in relation to renewable energy. Industrial symbiosis is perceived to be the biggest challenge both in relation to energy efficiency and to renewable energy (66% and 68% significant challenge respectively).

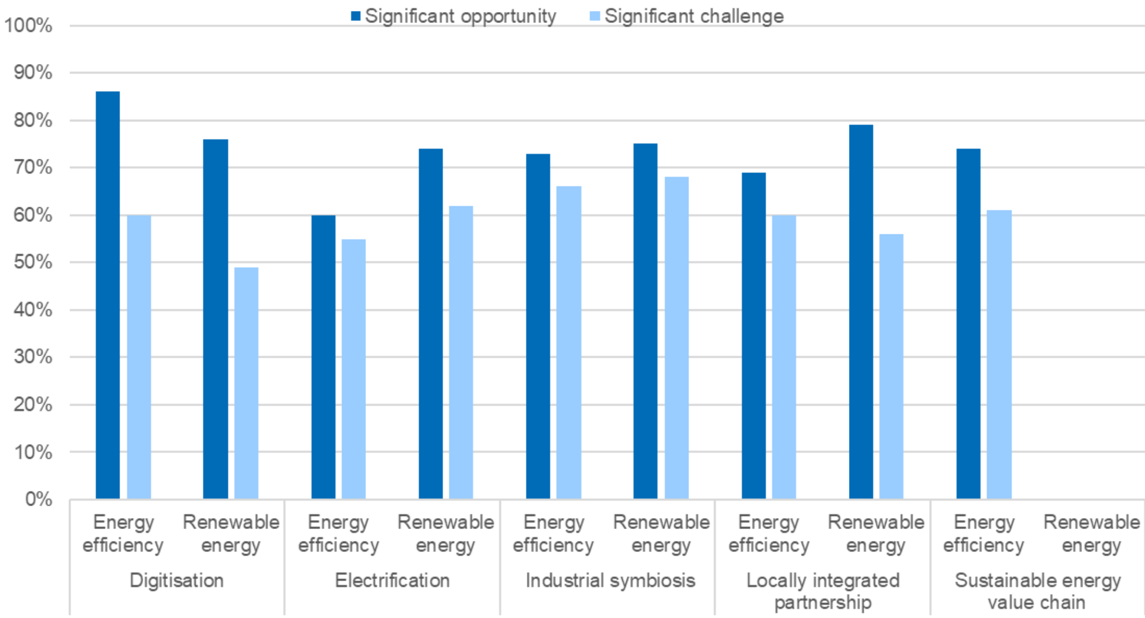


Figure 8-2: Overview of responses on future challenges and opportunities[89]

The following five tables present an overview of responses provided to questions on the five topics listed above. Each table organises comments into the perceived opportunities and challenges associated with the topic, considerations, and implications specific to SMEs, followed by recommendations for LIFE.

Table 8-1: Overview of open text suggestions from respondents - Digitisation

<table>
<tr><th colspan="2">Digitalisation</th></tr>
<tr><th>Opportunities</th><th>Challenges</th></tr>
<tr><td>• Optimising production and consumption (including products and energy).
• Smart heating, smart metering, and smart grids.
• Remote management of Energy Audits.
• Optimisation of supply and demand-side management.
• Energy storage.
• Real-time pricing.
• Residential heating optimisation.</td><td>• Data management and GDPR-issues.
• Cybersecurity of digital data and physical infrastructures.
• Costs linked to reception and collection of data.
• Deployment of renewables dependent on topic.
• Some industries (e.g. heat and cold) are resistant to digitalisation.
• Disruption to staff.
• The need to ensure digitisation doesn't increase energy use.</td></tr>
<tr><th colspan="2">Considerations for digitisation specific to SMEs</th></tr>
<tr><td colspan="2">• SME attributes: SMEs are diverse and disparate, and therefore need varying tailored solutions; The typical size of an SME, and how they identify their priorities, i.e. energy is often not a priority.
• Cost: SMEs would need to cover the costs of relevant training and software licenses. Some respondents warned that any investment will need to be carefully considered for an SME.
• Competitiveness: SMEs would need to keep up with digitisation progress to remain competitive. Smaller companies will not have the means and the resources to implement optimum digital transformation, whereas larger ones will be able to.</td></tr>
</table>

[89] Note that the question on sustainable energy value chain did not include questions on renewable energy.

• **Information/Knowledge:** Technical knowledge of energy efficiency will be low in some SMEs. Therefore, any energy expert or other personal who is aiming to share knowledge should be able to engage without over burdening with technical details.
Recommendations for LIFE
General recommendations: • Foster cooperation between SME stakeholders. • Development of tools, service, and skills, to support industry and services. • Capacity building, information sharing and best practice. • Provide support through energy experts with expertise in industry and the service sector. • Include a focus on research, development, and innovation (R&D&I). • Provide financial incentives and support (Co-financing training). **Recommendations specific to digitisation:** • Focus initially on 'low-hanging fruit', that is easy to digitalise before addressing the harder sectors. • Legislation and EU/MS strategic targets that require action from the industry and service sector.

Table 8-2: Overview of open text suggestions from respondents – Electrification

Electrification	
Opportunities	Challenges
• Electrification opportunity to increase efficiency in industrial processes. • Enable higher penetration of renewable energy in the industrial processes due to the required increase in capacity. • Innovative energy storage solutions to share electrical demand to support other changes in electricity demand.	• Electrification may be harder for businesses in remote areas compared to urban locations. • Infancy of key technologies in certain sectors (e.g. cement and metals). • High level of coordination and thorough planning required in the early phases of any project/ refurbishment/ energy efficiency upgrade programme. • Renewables interaction issues (such as grid integration and hydrogen integration, energy storage technologies and capacity related issues). •
Considerations for digitisation specific to SMEs	
• **SME attributes:** SMEs solutions need to be appropriate for this size of enterprise; There is a lack of suitable solutions for some sectors and business sizes such as SMEs; SME's size means they may not be the ideal operators to move electrification ahead. Instead it was suggested that larger enterprises should lead on this topic. • **Cost**: SMEs will have to react to changes in infrastructure, which could be technically and financially difficult. • **Knowledge:** within SMEs still varies significantly across Europe.	
Recommendations for LIFE	
General recommendations: • Capacity building, information sharing and best practice. • Support projects which aim to raise the profile of proposals to policymakers. • Research and development and innovation actions. • Support for new processes and equipment	

- More funding for renewables (to cover the increasing energy demand from electrification)
- Support companies to assess new solutions (e.g. site visits, energy audits)
- Support for low TRL levels/supporting pilot projects/ demonstration projects
- Supporting environmental management schemes and environmental labelling
- Provide financial incentives (long-term financing and grants)
- Link support for electrification to other potential topics in LIFE (e.g. Industrial symbiosis and waste heat/cold)

Recommendations specific to electrification:

- Respondents highlighted specific technologies that should be focused on within the topic of electrification, including: heat pumps; district heating; energy intelligent solutions, such as better management and optimisation of the energy flows; energy storage; specific renewable energy sources (e.g. wind, hydrogen, solar, thermal); real time pricing; encouraging the sharing of resources; promoting self-consumption and prosumers-model.

Table 8-3: Overview of open text suggestions from respondents – Industrial symbiosis

<table>
<tr><th colspan="2">Industrial Symbiosis</th></tr>
<tr><th>Opportunities</th><th>Challenges</th></tr>
<tr><td>• Ability to improve energy efficiency and renewable energy uptake
• Economic savings, increases in competitiveness and business opportunities.
• Encourage synergies with other topics (such as digitalisation, district heating and energy efficiency accuracy).
• Opportunity for greater circularity.
• Benefits to other resource use (e.g. water use, materials, reduced transportation requirements, waste, hydrogen).</td><td>• Costs.
• Developing centralised energy storage and local energy networks.
• Need to introduce feedstocks or fossil fuel replacements in other industries.
• Projects difficult to establish between businesses (e.g. aligning business cycles, contractual and financial complications).
• Industries must invest in more sustainable processes before industrial symbiosis, to avoid inefficient process being locked in.</td></tr>
<tr><th colspan="2">Considerations for digitisation specific to SMEs</th></tr>
<tr><td colspan="2">• SME attributes: SMEs solutions need to be appropriate for this size of enterprise; There is currently a lack of suitable solutions for some sectors and business sizes such as SMEs; SME’s size means they may not be the ideal operators to move electrification ahead. Instead it was suggested that larger enterprises should lead on this topic.
• Cost: SMEs will have to react to changes in infrastructure, which could be technically and financially difficult for them.
• Knowledge: Lack of knowledge is a barrier that will particularly effect SMEs (topic requires technical, financial, and contractual skill).</td></tr>
<tr><th colspan="2">Recommendations for LIFE</th></tr>
<tr><td colspan="2">General recommendations:
• Capacity building, information sharing and best practice (e.g. Cogeneration plants to highlight public and private actors working together).
• Coordination and Support Action (CSA) focused calls.
• Involvement of experts ((consultants, local institutions, public bodies, associations of enterprises).
• Support for low TRL levels/supporting pilot projects/ demonstration projects.
• Provide financial incentives (on the socialisation of costs and tax benefits).
Recommendations specific to Industrial Symbiosis:
• Offer Contract and implementation support.</td></tr>
</table>

- Support development of innovative industrial symbiosis business models and management systems.
- Legislate to enable this market functionality in the energy market (e.g. to support energy/exergy metering).
- Offer long term support for contracting in joint ventures for energy supply and use and supporting cooperation between different industries.
- Finance common projects between nearby companies to generate the industrial symbiosis opportunity where appropriate.
- Offer auditing and consulting support, as well as support for IT solutions required by symbiosis.

Table 8-4: Overview of open text suggestions from respondents – Locally Integrated Partnerships

Locally Integrated Partnerships	
Opportunities	Challenges
• Economically benefits participants. • Tailored to local level. • Benefits impact locally.	• Local authorities are key actor but might not have necessary knowledge. Additionally, local political priorities can impact whether these are prioritised. • Local or regional nature means conditions of partnerships vary. • A lack of financial incentives/ financing models. • Lack of supporting schemes at EU level.
Considerations for digitisation specific to SMEs	
• **SME attributes:** SMEs are not currently active in the energy markets; Organisation of partnership can be challenging for SMEs (e.g. timelines between the different partners may not align in a mutually beneficial way, trust and legal understanding of partnerships required). • **Knowledge:** Awareness and knowledge is low in SMEs.	
Recommendations for LIFE	
General recommendations for Locally Integrated Partnerships: • Information sharing and best practice. • Provide financial incentives (co-financing energy monitoring/ management systems). • Citizen engagement. • Member State policy alignment. • Development of tools. **Recommendations specific to Locally Integrated Partnerships:** • Involve Local Authorities and Business Park Associations. • Support for the risk and management side.	

Table 8-5: Overview of open text suggestions from respondents – Sustainable Energy Value Chain

Sustainable Energy Value Chain	
Opportunities	Challenges
• Significant potential GHG emission and energy use reduction. • Wide application, through sectors and geographies. • Part of the transition to a circular economy.	• Complex logistical cooperation necessary. • Existing production processes may need modification to be compatible with RES. • Fragmentation in the current supply chain (composed of both SMEs and large industry).

• Potential to deliver increases in competitiveness for business who adopt this approach.	• New ways of working between parties that do not traditionally cooperate. • Issues with competition and confidentiality. • Changes to EU legal and financial framework (e.g. EU ETS) would be required.
Considerations for digitisation specific to SMEs	
• **SME attributes:** models used in smaller companies that could be replicated in larger entities, possibly re-modelling certain ideas at a larger scale. once large players commit the others (SMEs) will follow suit. • **Competitiveness:** Some SMEs may only adopt these once there is a need to win work (e.g. through standards). However, if SMEs engage, they can gain access to innovation routes, new technologies and processes as well as their respective networks. • **Knowledge:** challenging topic for SMEs, complex supply chain and several areas of expertise needed.	
Recommendations for LIFE	
General recommendations for Sustainable Energy Value Chain: • Information sharing and capacity (particularly on potential energy savings and highlighting circular economy projects). • Best practice (demonstration examples cases to demonstrate that the sustainable energy value chain is less risky, more competitive, and resilient; Examples of using energy efficiency as a decision-making driver when configuring flexible value chains). • Research, development and Innovation. • Provide financial incentives. • Citizen engagement. • Member State policy alignment. • Development of tools. • Improvement/introduction of industry standards. • Citizen engagement/participation. • Create links to other topics here: Digitalisation initiatives and industrial symbiosis. **Recommendations specific to Sustainable Energy Value Chain:** • Identify champions from SMEs and large business sectors who are willing to promote the benefits of such value chains. • Combine efforts between projects/enterprises and focus activity at the association level to change a sector or an industry. • Energy management policy programs. • Develop of software to connect integrated partners with monitoring and management systems (Also see digitalisation). • Finance qualification activities for regional energy efficiency managers. • Support initiatives on sustainable raw materials value chains related to the Energy Transition. • Identify large and SME industry participants in the early stages and developing appropriate models would be beneficial, so that organisations can learn throughout the process.	

As demonstrated by Table 8-1 to Table 8-6, the details of a topic's challenges and opportunities tended to remain specific to different topics. However, there are some repeating themes. For example, respondents often described how the actions to improve energy efficiency reduce energy costs for enterprises. Another frequent challenge related comment was to ensure the increased demand for energy can be supplied from renewable sources.

Results from the survey show that SMEs face a range of barriers to the deployment of these technologies. A popular comment regarded the size of a typical SME's workforce which could limit their capacity to expand knowledge or resources to support take-up of new technologies/models. Another barrier mentioned was the initial or upfront cost to SMEs of investing. It was also noted that SMEs vary considerably, meaning it can be difficult to identify solutions that apply to all.

A range of measures that could be included in LIFE to support were highlighted by respondents, across the different topics. These included:

- Capacity building and assistance
- Information sharing and best practise
- Citizen engagement
- Support involvement of experts
- Coordination and Support Action (CSA) focused calls
- Support for new processes and equipment (e.g. subsidies)
- Support companies to assess new solutions (e.g. site visits, energy audits)
- Provision of financial support (long-term financing and grants)

Additionally, respondents suggested areas for support to be focused. These included:

- Support for the development of innovative business models.
- Support for projects which aim to raise the profile of proposals to policymakers.
- Focus on research, development & innovation.
- Support for low TRL levels/supporting pilot projects/ demonstration projects.
- Supporting environmental management schemes and environmental labelling.
- Utilising links between these topics and other areas in LIFE.

8.3 Prioritisation of Measures

The final section of the survey aimed to understand what measures should be prioritised for the LIFE programme. The options were taken from topics in past programmes (IEE II, H2020), along with some new suggestions (all are shown in Figure 6-8 below). All measures received a high level of support. As shown in the figure below, the highest level of priority was given to 'support for developing, demonstrating, and mainstreaming innovative technologies, methodologies, and processes' with nearly 90% of respondents ranked this as essential or of high priority.

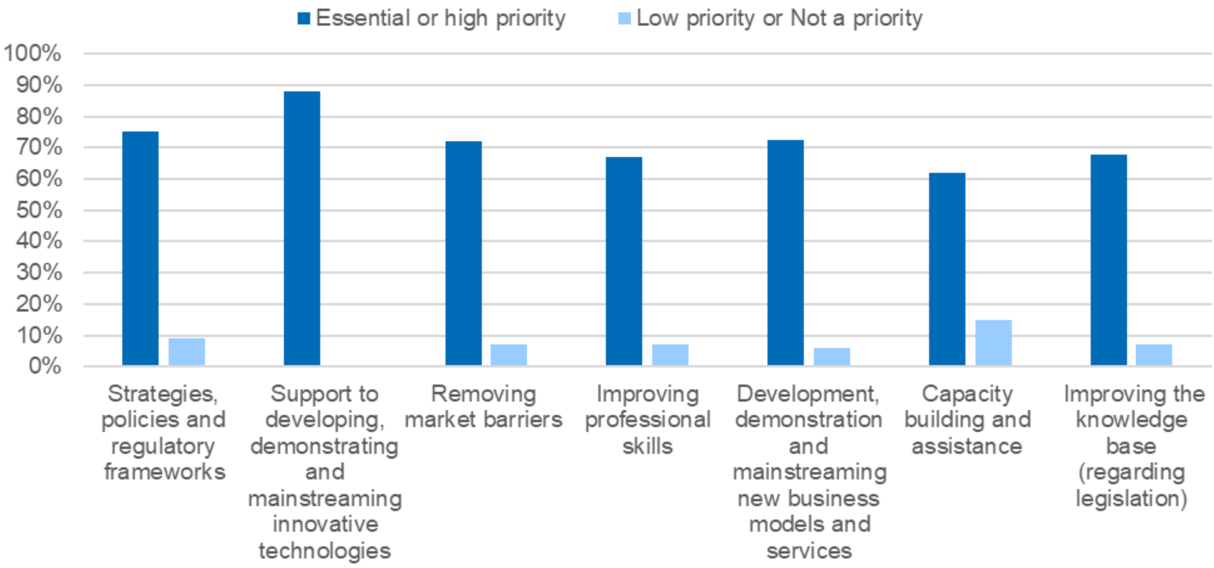


Figure 8-3: Overview of prioritisation of measures

In open text responses, several technologies were identified as requiring support to facilitate the areas of focus in the survey. In particular, these were energy and heat storage, and system integration that also considers likely future developments such as e-mobility as well as the energy efficiency and renewable energy systems currently identified. However, in the main, it was identified that technological limitations are not a barrier. Rather the market for the developments was underdeveloped and faced barriers.

For example, with the issue of waste heat/cold, it was noted that the technology exists for harvesting this; far more challenging is identifying where this resource can be utilised and the cooperative arrangements necessary between parties to achieve this in the long term.

Market facilitation was more important than technology development. The mismatch between the short-term focus on business as usual, and relatively quick investment returns, versus the long-term requirements of cooperative energy efficiency arrangements or even of less challenging but still non-trivial energy efficiency installations were apparent throughout. It was identified that support to SMEs needed to be available over a longer timeframe to give ongoing support for installations and facilitation of cooperative arrangements. It was identified that such support will enhance the level of implementation and consideration of measures beyond the company envelope/building envelope.

It was repeatedly stated that Member States should utilise their own funds to provide financial incentives and support for these areas, as this allows Member States to identify their own priorities. It was however also noted repeatedly that there is a language barrier between finance leaders and energy efficiency and renewable energy project developers. The activities within the LIFE CET should focus on market facilitation and the necessary frameworks to enable this.

Table 8-6: The level of priority given to each of these measures by the survey respondents

	Essential or high priority	Low priority or none
(1) Development and implementation of strategies, policies, and regulatory frameworks	75.3%	8.9%
(2) Support to developing, demonstrating, and mainstreaming innovative technologies, methodologies, and processes	88.1%	0.6%
(3) Removing market barriers to the uptake of digital solutions, renewable energy, and energy efficiency	72.0%	7.0%
(4) Improving professional skills	67.1%	7.0%
(5) Development, demonstration and mainstreaming new business models and services	72.4%	5.8%
(6) Capacity building and assistance to project promoters to mobilise investments	62.1%	15.0%
(7) Improving the knowledge base to support a more effective implementation of energy efficiency and/or renewable energy legislation	67.9%	7.1%

Additionally, in the open text questions on opportunities and challenges (section 4 of the survey), respondents were asked to suggest measures that could be included in LIFE to support the different topics. Some of these were repeated across the different topics. These are summarised here and, where possible, are grouped into the predefined list of support options presented in the final section of the survey.

The most common measures are summarised in the table below, note that not all options suggested (particularly those specific to the topic areas) are included in the table below. Best practise guidance, support for demonstration projects and financing were all mentioned by respondents for the vast majority of the topic areas.

Table 8-7: Overview of measures that could be included in LIFE to support the topics

Topic	Digitisation	Electrification	Industrial symbiosis	Locally integrated partnership	Sustainable energy value chain	No.
(1) Development and implementation of strategies, policies, and regulatory frameworks						
Legislative measures (e.g. compulsory industry standards, policy changes)	Y		Y		Y	3
Financing/fiscal incentives	Y	Y	Y	Y	Y	5
Site visits, energy audits		Y				1
(2) Support to developing, demonstrating, and mainstreaming innovative technologies, methodologies, and processes						
R&D&I	Y	Y	Y			3
Demonstration topics	Y	Y	Y		Y	4
(3) Removing market barriers to the uptake of digital solutions, renewable energy, and energy efficiency						
Links with other topic areas	Y		Y		Y	3
(4) Improving professional skills						
Training activities for SMEs	Y		Y	Y	Y	4
(5) Development, demonstration and mainstreaming new business models and services						
Development of new tools	Y			Y		2
(6) Capacity building and assistance to project promoters to mobilise investments						
Support collaboration between projects/companies	Y	Y	Y	Y		4
(7) Improving the knowledge base to support a more effective implementation of energy efficiency and/or renewable energy legislation						
Best practise guidance	Y	Y	Y	Y	Y	5
Energy experts with relevant expertise	Y		Y	Y	Y	4
Other						
			Y	Y	Y	3

Y = Topic suggested to be included in LIFE

8.4 Survey Conclusions

This survey is understood to be a useful snapshot of views on these energy efficiency and renewable energy topics for SMEs, however, it unlikely to be fully representative. First, it is worth noting that participation in the survey is self-selecting, meaning the results are likely to be skewed to the views of organisations who: have some existing knowledge in these areas; already engage with EASME/CINEA, the EC or an association; and/or have the capacity to engage in surveys. Having the resources and the skills available is a common barrier within SMEs. Secondly, respondents from 24 Member States took part in the survey, nearly half (45%) of responses came from five countries (Belgium, Spain, Italy, France, and the Netherlands).

The survey necessarily ran relatively early in the project, before the interview phase of the work elsewhere. Potentially, had the survey been able to be run later, some of the later project insights may have shaped matters differently. As it was the presence of open text questions meant wider comments and concerns relating to future LIFE measures from respondents were captured.

The survey clearly identified that the most important topics from the current energy efficiency priorities were industrial waste heat/cold recovery which received the highest ranking, followed by innovative energy efficiency services. Regarding future challenges and opportunities with regard to the uptake of energy efficiency measures, respondents were optimistic and consistently rated the topics presented as more significant opportunities than challenges across all the topics:

- Digitalisation
- Electrification of industrial processes and services
- Industrial symbiosis
- Locally integrated partnerships
- Sustainable energy value chain

A 'significant opportunity' average response for energy efficiency responses was 73% and for renewable energy responses was 76%. The equivalent 'significant challenge' for energy efficiency was 60% and for renewable energy was 59%. Regarding the individual topics, digitalisation received the highest proportion of respondents indicating it was a 'significant opportunity' for energy efficiency (86%) and locally integrated partnerships received the highest proportion for renewable energy (79%). Industrial symbiosis is perceived to be the biggest challenge for both energy efficiency and renewable energy (66% and 68% of responses, respectively).

Results from the survey show that SMEs face a range of barriers to the deployment of these technologies, these are focused in the areas of the size of the enterprise (e.g. capacity of a small team to take on new responsibilities internally), the costs (e.g. training and new equipment/machinery) and the lack of knowledge across a number of topics (e.g. technical, financial, and contractual). Additionally, respondents noted the are potential synergies between several of these topics, however there is an additional risk for SMEs that utilising more than one of these topics could further compound these barriers further.

In terms of understanding what measures should be prioritised to actually foster the market uptake of EE and RES measures for the future LIFE Programme, all measures proposed in the table received a high level of support. The highest level of priority was given to 'support for developing, demonstrating, and mainstreaming innovative technologies, methodologies and processes' with about 88% of respondents ranking this as 'essential' or 'high priority'.

Additionally, respondents provided additional suggestions. A common one was to focus dissemination activities sharing real world best practise examples with similar organisations. Various forms of financial support were also popular, for example to support for new processes and equipment, to tackle upfront costs or provision of longer-term financial support and grants.

9 Lessons learned

Through the investigation of the achievements and impacts of the 41 supported projects, including interviews with project participants and the evaluation of project reporting various lessons learned were identified and these are described below. Throughout this section relevant success stories and key insights from projects and companies are highlighted to provide useful lessons to carry forward into future funding programmes.

1. **Projects continue to find it challenging to engage SMEs in exploring their energy efficiency potential, both in terms of initial recruitment and ongoing involvement.**

A significant number of projects flagged this as a challenge in their final reporting, and some projects were unable to reach their final number of intended participants due to this. A number of projects reported that SMEs who had originally signed up to participate did not carry through this commitment, either from the application phase or from a recruitment phase during project operation. Below are a few examples of the comments made with respect to engaging with SMEs:

- The Reg-Cep project found it difficult to motivate companies to participate, due to lack of expertise, cost of renewables, and administrative difficulties because they did not have the relevant processes in place for data collection
- The STEEEP project found it challenging to maintain the interest of companies over a longer period. As reported at interview, companies were initially motivated, willing to collaborate with each other, provide data, and participate in workshops. In the long term, they required more support than foreseen in the framework of this project, particularly for financing of investments
- The EINSTEIN II project highlighted the challenge in recruiting 72 companies willing to participate in their project and providing their data for a present state evaluation, even anonymously. Confidentiality was an issue flagged by a number of projects
- Energywater noted that they reached out to engage 5,172 companies, and ultimately 311 carried out an EMSA evaluation, i.e. a 6% full engagement rate.

It was flagged that recruitment and engagement was a significant challenge during the financial crash of 2008 and the years afterwards.

- The COOLSAVE project noted as a major challenge that SMEs were reluctant or not able to plan the return of investment costs
- The ERASME project highlighted that the economic crisis, and related difficulties of companies in obtaining an adequate credit rating, strongly limited and conditioned participation in the financing lines offered within the project
- EU Plast Voltage noted that, due to the recession, authorities had other priorities and were unable to support the project
- The IND-ECO project flagged that the initial targets were determined to be unfeasible due to the prevailing economic conditions and lack of available financing during the implementation of the project.

There is a likelihood that a similar scenario may unfold following the COVID-19 pandemic and its resultant economic impacts across Europe. Projects that were active at the time of the 2008 financial crisis particularly cited the economic situation as a major obstacle to SME engagement, attributed to the lack of funding available to make investments in energy efficiency and renewable energy projects. It was reported that even free audits were not taken up during this period, as the focus was day to day survival for small companies.

Currently ongoing projects are reporting challenges arising from the pandemic (INDUCE, SPEEDIER, E2DRIVER, ICCEE). The E2DRIVER project noted challenges in implementing the training, part of which had been intended to take place through face-to-face meetings, and the ICCEE project has reported some difficulties in obtaining remote data compared to collecting more complete on-site data, so the challenges of delivering at distance are already having an impact. That said, the COVID-19 recovery package[90] was launched promptly in the EU in response to the pandemic, while the recently announced European Green Deal[91] and Industrial Strategy[92] provide support and include specific measures to help industry achieve a green transition. Ongoing projects report that they are incorporating the shifting landscape into their projects in a positive way. There may be some benefits from the recovery package, but it is likely recruitment and engagement of SMEs will be challenging in the near future for projects.

[90] https://ec.europa.eu/info/strategy/recovery-plan-europe_en
[91] A European Green Deal, https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en
[92] A New Industrial Strategy for Europe, https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1593086905382&uri=CELEX:52020DC0102

Some of the later H2020 projects have faced other challenges in recruiting SMEs to participate, such as the following:

- The priority of energy efficiency at company level was observed to be low, corresponding to the lack of requirements for smaller companies to undertake energy audits and a lack of priority given to the topic by company decision makers
- Of companies that did engage, some wanted to progress through the project with their own suppliers, and not with those designated by the project
- Again, some participating SMEs had negative experiences working with energy auditors previously, often due to technical barriers, and often needed accompanying measures or external advice to improve their energy processes
- Technical difficulties can prevent measures being implemented, such as the complexity of electrical supply. In some cases, even simple challenges such as a lack of space prevented some solutions being progressed.

A general observation coming from the interviews was that recruitment and retention of SMEs was hugely challenging and time consuming, for all the reasons stated above. There was evidence that some projects at the set-up stage were forming consortiums with partners who had an established network of SME contacts already, rather than anticipating that the establishment of such a network could be a core component of the project activities. Such an approach has long been established, with partners such as Chambers of Commerce involved in many of the projects considered here, but more recent projects may be thinking a little more widely. This breadth of approach though, brings with it the challenge of justifying to the awarding process the inclusion of a partner who may have none of the relevant technical experience yet potentially brings an active network of SMEs to be involved.

At the G7-workshop on energy efficiency networks (2016)[93] it was commonly understood that the recruitment of companies (including SMEs) to energy efficiency networks required around 1 year, which is a significant proportion of an IEE-II or H2020 project duration. A more efficient and streamlined approach may be to consider having potential participants already engaged with the project proposal at the application stage, either through the application including letters of intent (LoI) from companies that are interested to participate, or though the inclusion of partners with an established network such as industrial associations/trade associations where driving and achieving participant engagement is their responsibility. Such an approach may provide better value for public funds, helping to ensure that projects with, potentially excellent methodological approaches, but low participation are less likely to occur.

2. **Many SMEs lack knowledge and awareness of the benefits of energy efficiency, such as boosting competitiveness. Evidence from ongoing projects shows that this is an ongoing challenge.**

Earlier projects, particularly those implemented in the early stage of the IEE-II programme, noted that knowledge of the topic of energy efficiency for SMEs was still in its infancy or virtually non-existent, and so workshops to introduce energy efficiency tools and other measures did not deliver value to participants or lead to the expected outcomes for the project. It was reported that some companies were wary of undertaking audits due to negative experiences from previous engagements with energy auditors.

Although there may be considerable general energy efficiency information available, relevant information may be challenging for companies to interpret and to transpose to their own sector and company context. Many projects identified such gaps and focussed on establishing a knowledge base, building on direct interaction with the sector and energy efficiency experts, to develop benchmarks and tools that allow companies to identify the potential more intuitively for energy savings in their business. Projects funded under the IEE-II and H2020 programmes successfully developed this knowledge base in sectors that previously lacked dedicated energy efficiency information, aiding companies in these

[93] G-7 Energy Efficiency Workshop, held in Berlin 2016, insight provided by P. Thollander during review.

sectors to recognise how they compare to the wider sector and opportunities to improve their performance.

The evidence of CSA projects continuing to identify a low level of interest and action from small and medium companies to address energy efficiency suggests that intervention to encourage such activity is still needed and still likely to deliver energy saving impacts that would otherwise be missed. It also suggests that the evolving approach of addressing a wide range of barriers may deliver benefits, and the purely financial arguments have had limited success.

3. **SMEs that do participate may not fully deliver on their commitments within the project, such as not sharing the full data sets they have been asked to, or not having the data collection equipment necessary, such as smart meters, to gather such data.**

As seen across a range of projects reporting quality at times varied significantly across companies within the same projects. Below are a few examples, but this challenge was highlighted by many projects:

- In the STEEEP project, the collection of data proved to be a challenge. Some companies participating had access to smart meters and good data, while others did not. Furthermore, only a portion of companies (380 out of 628, or 60.5%) provided regular data via the project questionnaire, necessary for project reporting.
- Observations from the EECC project also drew out disparities in company reporting, particularly as not all companies had access to energy meters, or provided sufficient data, which made the evaluation of the data throughout the project challenging.
- The FOUNDRYBENCH project also noted the lack of detail in survey responses for benchmarking as an issue.
- In the SURFENERGy project many SME respondents did not have access to the data required, e.g. separation of process energy from total energy use, power meter readings for individual processes or equipment, etc.

In some cases, there is insufficient monitoring data. While it is recognised there may be valid reasons why SMEs do not share such data, ranging from a lack of time and resources within the SME through to data confidentiality issues, the matter of poor data quality is compounded by projects themselves then potentially not having the time available or the resources to follow up on these data gaps and work to fill them. A potential solution might be a centralised platform specifically targeting such data and with inbuilt quality check processes. The wide range of project areas targeted by such programmes brings with it a significant challenge to such an approach. That said a centralised collection of good quality, verified, data results, that is a live resource for programme participants and programme developers to draw upon may have considerable value for both sides.

4. **Company decision makers do not always consider energy efficiency improvements to be a strategic investment and the multiple benefits are not fully recognised.**

It was noted by a number of projects, and through the Industry Contractors meeting[94] discussions, that nearly all SMEs profess an interest in the topic of energy efficiency, but due to their often relatively low energy use as a company, and it correspondingly not being a significant cost for them, do not consider energy audits to be necessary and do not see energy efficiency as a priority. This often translated into a lack of involvement from senior management and minimal engagement with the data collection aspects necessary to establish baselines and understand improvement potential.

It is recognised that there are multiple benefits generated through the implementation of energy efficiency measures. Projects such as M-BENEFITS and STEAM-UP are demonstrating the value of these non-energy benefits (NEBs) or multiple benefits of energy efficiency investments. Such projects have recognised that non-energy benefits can play a role in bringing energy efficiency investments

[94] Contractors meetings aim to allow participants of ongoing projects to exchange views on common issues, share knowledge and good practices and build synergies. In October 2020, EASME organised a contractors meeting where a number of ongoing H2020 projects, focusing on the market-uptake of Energy Efficiency measures in the industry and services sectors, were participating.

higher up the agenda in the company decision process, because the value proposition for the company is increased.

However, there remains a knowledge gap of the non-energy benefits that are often delivered through a focus on energy efficiency improvements. Economic incentives can serve as a starting point for action, but energy culture in SMEs still needs to move to a place of recognising the value of the topic for action and the value of the range of impacts at the company level. Project activities need to recognise and reflect SME priorities, and address the knowledge gap particularly for decision makers within companies.

5. **Project partners found it difficult to carry out all of the planned project activities within the project timeframe.**

In seeking to be ambitious with CSA project design, a commonly flagged theme was the time available to complete the stated actions in, particularly the more complex activities and especially where a lack of SME engagement had been experienced. Specific examples highlighting this challenge include:

- Within the STEEEP project it was reported that more time was needed for particular activities, such as the establishment of Local Energy Communities (LECs), which could have constituted an entirely separate project altogether.
- The CODE2 project also faced significant challenges in adhering to the timeframe, particularly while carrying out Work Packages 2 and 3 at the same time, and both suffered in quality as a result.
- The ECOinFlow project faced a similar challenge given the amount of work required to establish a network of sawmills, develop energy management systems and strategies, and implement those systems.
- The SMEEnergyCheckUp project developed a toolkit and ran into software development-related issues that delayed the project significantly. That said, since its end, this project has still led to additional usage of the tool by about 400 SMEs in the Netherlands, with various follow on projects developed around the tool. For instance, two substantive development projects were initiated in the Netherlands using the tool as part of the methodologies, and one of the partner organisations is currently in contact with municipalities in specific regions in the Netherlands to gain their participation. The usability and features of the tool have also been updated and improved in the various follow-up projects.
- INDUCE flagged that the project had been set up with initial SMEs already identified, but after ‘kick off’ many of these did not progress and new companies had to be engaged, establishing delays in the timeline almost immediately.

In terms of project design, it was reported that project partners often found it difficult to establish networks of experts or contacts in new areas. In many cases, partners with more successful engagement levels were those that already had networks established in their respective countries and hence were more able to adhere to the timelines originally envisioned, even if their technical experience was not that strong.

Implementing activities such as establishing working groups, creating materials and translation activities were often noted as having taken longer than anticipated. In terms of technical challenges experienced, the design and release of tools and materials through project websites caused several projects delays and coordination challenges which often resulted in time pressures. This was reported for both IEE and H2020 projects.

An interesting aspect of current working conditions (Dec 2020) with much of Europe having to work remotely, will be to see the impact this may have on timeline of delivery for different aspects of project work. While some aspects will undoubtedly be negatively impacted, other areas may indeed benefit from working groups being able to be run online for example.

6. **Projects did not have detailed information on impacts achieved after the end of the project.**

A number of concluded projects were identified that were not able to provide evidence either through their final reporting or through interview, to determine to what extent the after project lifetime impacts had been achieved. Partners and coordinators were sometimes unaware of whether outputs of the projects, such as toolkits or platforms, were still in use, and if so, by how many companies. In some cases this was due to the length of the time that had passed since the project finalisation, particularly for the early IEE projects, due to various people leaving the participating organisations, lack of time and budget for follow-up actions, or any combination of such reasons. It is also likely due to their being little motivation for keeping such activities going when there are no funds available to do so.

Further, it was noted by a number of projects that the timelines for companies to make investment decisions did not align with project timelines, and so obtaining the detailed reporting desired, such as for example, number of measures implemented at SME facilities, was not possible within project timelines.

The lack of evidence made the re-estimation of impacts after the project lifetime challenging and this is reflected both in the reliability rating and in the level of the conservative assumptions taken.

A focus of more recent calls has been for sustainability of project learnings and outputs, beyond the lifetime of the project. The evidence from the stakeholder interviews suggests that previously it has often been assumed action will continue to be taken, but that it rarely does at the levels anticipated. The current focus on project sustainability has meant that the path taken by projects successful in this aspect, such as the EUREM family of projects, has attracted attention, with recognition that self-sustaining capacity building programmes achieve this position by creating a high value proposition with international recognition. A number of projects that are currently underway have sought to design training programmes that will be embedded in third party delivery providers beyond the project lifetime, with some being recognised as a qualification at a national level.

7. **Economic incentives alone are often not sufficient to incentivise companies to implement renewable energy or energy saving measures. In more recent projects within H2020, there has been somewhat of a shift in focus from purely cost savings to understanding of behavioural barriers and other motivations in SMEs.**

It can be observed that there are a number of barriers related to financial costs at the SME level for installation that have been flagged by CSA projects:

- In earlier IEE projects often the cost of renewables was reported as too high compared to conventional electricity to make installation an attractive proposition for many of the SMEs involved in projects.
- Offering funding support for the implementation of energy efficiency measures could have been beneficial in that many companies were made aware of possible measures but may not have had the financial means to implement them due to high capital costs and/or lack of finance.
- Within the GREENFOODS project it was reported that there is often a challenge working with industries since they have long term investment plans in place. Although the value of energy efficiency may be recognised, retrospectively integrating these investments into their existing plans is a barrier.
- For smaller companies particularly, securing a sufficient amount of funding could be difficult or even virtually impossible, and, following the 2008 financial crash, the credit rating required to secure financing options by companies posed an even more significant challenge.

A point noted by the PINE project, was that some SMEs, even though they recognised the value of implementing energy saving measures, feared that the changes or the new equipment may adversely affect the quality of their offering, and hence were reluctant to make significant changes even if there was an energy and a financial saving to be made.

More recent projects, notably M-BENEFITS, but also identified through discussions with SPEEDIER and INNOVEAS, highlight that the wider approach of energy efficiency CSA projects continues to evolve. While the opportunities for energy efficiency and cost savings remain significant within SMEs, the focus of such projects has shifted from delivering audits and expecting the implementation to occur because it is self-evidently financially worthwhile, to seeking to understand the day to day barriers at the SMEs level and to understand their priorities, then demonstrating how energy efficiency improvements can help to address these issues. Along those lines, the ICCEE project, focussing primarily on coordination and knowledge sharing, seeks to enhance energy culture along entire supply chains rather than just in individual companies.

8. **Participating SMEs may need considerably more support over a longer time period to facilitate the concrete changes sought, and ownership of the action within the SME is needed.**

Ongoing support to participating SMEs was flagged by more recent projects and interviews. It was suggested that where projects conduct energy audits, long term engagement and support is necessary, beyond the delivery of the audit report, to achieve installation of energy efficiency measures. Such aspects of ongoing support needed by SMEs included training of staff and decision makers at the company involved, provision of more information where necessary and support for pricing and evaluation of proposals at installation stage. Such ongoing support would also facilitate the data collection of whether measures were actually implemented following audits.

Projects highlighted that to achieve successful implementation of energy efficiency measures in an SME it is necessary for someone within a company to be responsible for taking the energy efficiency strategy forwards. Furthermore, support for SMEs must be practical at the point of delivery. Such support may be appropriate from other programmes, such as the LIFE Programme, with structural funds to foster the actual implementation of the recommended energy saving measures identified during the project.

9. **Successful consortiums often contain long standing relationships and new innovative partners.**

From the perspective of the project consortia, project participants indicated that they benefitted greatly from collaboration with project partners that have different expertise, work in different sector segments, have knowledge from different parts of the value chain or have insights into different geographic areas. Bringing together this range of skills proved valuable for the project as a whole and for the project participants individually, and in many cases forged the basis for long standing relationships between the partners. It was strongly felt that strong, long standing partnerships were the core of successful project delivery, with innovative partners bringing new elements. Furthermore, projects can also benefit from knowledge sharing and synergies established between different projects.

10. **Projects can benefit from knowledge sharing and synergies between themselves.**

Evidence from cooperation between recently awarded Horizon 2020 projects, namely SPEEDIER, E2DRIVER, ICCEE, SMEmPower Efficiency and INNOVEAS, shows that projects can mutually support each other's' dissemination activities, help each other identify appropriate project participants, and develop synergies. So far, this collaboration has helped these projects broaden their reach and promote their ideas and will likely continue to prove useful and even essential as projects continue to adapt to the current economic situation in the context of COVID-19.

10 Conclusions

Programme Level

Conclusion 1: The 41 projects assessed by this study have reportedly reached nearly 5 million people with over 10,000 people trained and over 3,600 audits undertaken

The reach across all 41 projects, as well as the number of people trained, and the number of audits conducted within the projects is shown below in Table 10-1. This gives a useful insight into the activities of projects but is by no means representative of their full activities. Furthermore, only 7 out of the 15 H2020 projects have been completed, meaning that many have yet to undertake their main project activities.

Table 10-1: Total project reach and activities, across all 41 projects and number of projects contributing to the total reported.

	IEE-II (26)	H2020 (15)	Total
Project Reach (through dissemination activities)	4,395,249	130,137	4,525,386
People Trained	3,835	6,412	10,247
Audits conducted	2,448	1105	3,553

Conclusion 2: The aggregated key performance indicators of the project portfolio during project lifetimes using reliable and acceptable calculations only (36 projects) were 1,754 GWh/year primary energy savings, 586 ktCO$_2$/year greenhouse gas reduction and €232m investment triggered. Similar levels of aggregated impacts were calculated after project lifetimes from the 13 projects with reliable or acceptable calculations.

The impacts of the 41 projects, including both completed projects, and projects underway (with planned impacts) are given below for the four key performance indicators of energy savings, GHG reduction, investment triggered, and renewable energy triggered. The figures provided below are a sum of the impacts recalculated within this work, composed of the impacts rated as reliable and acceptable, as established through the reliability assessments for each KPI within each project. Note the impacts after project lifetime of the policy-based projects are not included due to the difficulties in tracking them .

Table 10-2: Calculated impacts achieved during and after the project lifetimes for the 41 projects, for the reliable and acceptable rated impacts. Number of projects with contribution indicated in brackets.

Energy savings (GWh/year)	IEE-II	H2020	Total
During project lifetime	1,090 (22)	664 (14)	1,754
After project lifetime	1,485 (8)	252 (4)	1,737
Total	*2,574*	*916*	*3,491*
GHG reduction (ktCO$_2$/year)	**IEE-II**	**H2020**	**Total**
During project lifetime	416 (22)	170 (14)	586
After project lifetime	463 (8)	48 (4)	511
Total	*879*	*217*	*1,097*
Investment triggered (€m)	**IEE-II**	**H2020**	**Total**
During project lifetime	131 (22)	102 (14)	232
After project lifetime	194 (8)	31 (4)	225
Total	*325*	*132*	*457*
Renewable energy triggered (GWh/year)	**IEE-II**	**H2020**	**Total**
During project lifetime	183 (5)	42 (3)	225
After project lifetime	2 (0)	0 (0)	2
Total	*186*	*42*	*227*

The total estimated primary energy saved by completed projects and ongoing projects, taken from those with reliable and acceptable impact calculations was 3.5 TWh/year. The total GHG reduction resulting from the project outputs and activities was estimated at 1,097 ktCO$_2$/year. The total investment triggered as a result of project outputs and activities was estimated at EUR 457 million. Total renewable energy production triggered as a result from project outputs and activities was estimated at 227 GWh/year. The renewable energy indicator was rarely reported by the projects, generally only the earlier IEE projects had a focus on this metric, and hence the renewable energy production triggered could reliably or acceptably only be estimated for 8 projects.

It has proved challenging to conduct a retrospective analysis against a set of metrics which some projects were not specifically asked to report on at the time. For example, even a relatively simple metric such as the number of audits conducted can be challenging to consistently identify, as projects may not refer to them as audits and the level of detail in an audit can vary significantly. Earlier projects often did not report against some of the assessment categories used in this study, and there have been large data gaps.

Conclusion 3: Energy efficiency projects of the type supported by IEE/H2020 deliver savings of 4.5% final energy use on average. A 4.5% saving in final energy use across the EU industry sector would represent almost a third of the total 15% reduction targeted by 2030 in the New Industrial Strategy. While literature values suggest that 10% potential savings are possible from no and low cost measures, and up to 20% potential savings are possible with all measures, it was identified here that overall, from the measures confirmed to be implemented, 4.5% was the confirmed value for an audit for implemented energy savings. The potential savings rate and implementation rate identified through this work, based on project reporting, averaged about 18% and 25% respectively (hence potential savings rate * implementation rate yielding 4.5%). These figures are reflective of real-world activities and can help inform policy makers of the likely impact of future support in this area, particularly for SMEs or other organisations which are not required to undergo energy audits.

Project Level

Conclusion 4: Some contractors overstate the likely impacts of their projects in their proposals and grant agreements, either through optimism bias or being too ambitious. The expected 'within project lifetime' impacts in grant agreements were often reduced in final reports and have been reduced further by this study's recalculations in some cases. There appears to be less of an overstatement of 'after project' impacts overall but there is also less evidence here as many projects do not re-estimate 'after project' impacts in their final reports and this study has been able to re-calculate 'after project' impacts to a reliable or acceptable level for only 13 of the 41 projects.

Conclusion 5: During the project lifetime projects involving audits and capacity building appear to have greater impacts, although there is wide variation, ranging from 2 to 184 GWh/year primary savings per project. Impacts within the project lifetime from tools and events were typically lower than those from audits and capacity building, and in the range 7-68 GWh/year per project. Furthermore, capacity building programmes typically provided more information on the financial aspects of energy savings measures, leading to greater impacts, with respect to audits.

Conclusion 6: The key metric of primary energy saved has been fairly consistently reported, especially when within project lifetime impacts are considered, and a few outlier projects removed through clustering. The development work for common factors, if applied to live projects and future projects would likely enhance the comparability of future projects.

Conclusion 7: There was observable variation between projects in the approach taken for the period of attribution of activity impact. The approach employed here is that where impacts arise from activities undertaken within the project lifetime, they have been counted as arising within the project lifetime, for example an audit undertaken within a project, or application of a tool, both are "during" the project lifetime. Where they arise from activities conducted after the end of the project, they are "after" the project lifetime, for example if the project was focused on training people, and audits conducted due to this training after the end of the project were conducted. This has enabled a consistent approach to be applied across all projects and provided a better distinction between funded activities within the projects and project sustainability or replication after the end of a project.

Conclusion 8: Policy projects may have large 'after project lifetime' impacts but there is insufficient evidence to include these impacts as reliable or acceptable. Clustering these projects and evaluating them separately from projects with other types of activity provided both additional insight into their potential impacts and eased the evaluation of projects focussed on individual actions. There was no clear pattern in terms of activity type from the 13 projects for which the study was able to recalculate reliable or acceptable 'after project lifetime' impacts. Two of these projects are expected to deliver zero impacts beyond the lifetime of the project while nine are expected to deliver greater impact after the project than during it.

Conclusion 9: Reported KPI impact data quality is much improved from more recent projects. The guidance and focus on this topic appear to be assisting projects to better record and report the data they can collect, and to focus on good data collection from the outset. There has been a shift, away from reporting aspects such as the number of workshops held and the number of website visits or tool downloads, towards reporting of meaningful and valuable data encompassing numbers of organisations with which contact has been established and the number of people from within these who have received training. This reflects a maturing approach through the programmes, both in terms of guidance offered and weight of importance attached to projects carrying this out well, and also in terms of the developing experience of projects and project co-ordinators knowing what they are likely to be able to collect and striving to do so from an earlier point in the project timeline.

The evaluated reliability of data within the H2020 projects that have completed is markedly improved compared to the earlier IEE projects, and this is reflected in the proportion of projects achieving a reliable or acceptable rating for their reported impacts. However, it continues to be extremely challenging to extrapolate from project activities the outputs and achievements that EASME is keen to identify, such as the number of implemented measures at individual SME facilities. To date such data has rarely been collected. It is recognised that the guidance materials provided to projects are well developed and provide good guidance. That said, feedback from projects during the interview stage highlighted that much effort and attention is given to calculating the potential impacts, and it was still felt to be hugely challenging. There may be an opportunity for further full and ongoing dialogue between EASME and projects after project award to yield a set of impact data that both parties understand to be as accurate as possible.

Conclusion 10: Calculating the within project lifetime impacts has benefited from the creation and use of a set of common factors and establishing and using a common process. This enhances the data quality across the programme and enables a programme level estimation of realistic impacts to be calculated. When calculating the impacts for after project lifetime, even with the application of common factors and common processes, most project impacts are still rated as uncertain.

Conclusion 11: Although most projects expected significant activity to continue after the end of the funded project and based their 'after project lifetime' impacts estimates on this expectation, evidence from interviews suggests this was rarely the case. In most cases there was little or no data gathered for what was carried out and achieved after the conclusion of a project. Activities that were reported as achieving after project lifetime impacts were mostly training programmes and tools, which require upfront input, but little maintenance after the end of a project, hence can continue to be offered and continue to hopefully have an impact. Projects whose main activity was the provision of audits require significant ongoing input to carry out audits after the end of a project, which is unsustainable at this point.

Ongoing challenges to be addressed

Conclusion 12: Projects continue to find it challenging to engage SMEs in exploring their energy efficiency potential, both in terms of initial recruitment and ongoing involvement and reporting. This has been a theme throughout the IEE programme and into the H2020 Programme. It is noticeable that the more recent projects are working to address the challenge of engagement through expanding the descriptions of the benefits to those SMEs (multiple benefits), and in seeking to identify additional positive messages that companies can take back out into their workforce or their market place for example. This ongoing engagement challenge suggests a continuing need for intervention to encourage the energy efficiency progress especially for smaller companies for whom reducing their energy use is still not a recognised priority at the decision maker level. It also suggests that exploring other alternatives may yield results, such as a more diverse range of partners within projects, for example who bring communication and design expertise to assist with creating appropriate information for participating SMEs.

The results of the Stakeholder Survey showed that energy efficiency solutions aren't limited by technology options, but rather that more significant barriers are the underdeveloped market and issues of cooperation for optimisation of energy resources. This observation illustrates the value projects such as these market uptake CSA activities have with respect to the ongoing market transformation needed. The identified mismatch between the short-term focus on business as usual versus the long-term requirements of cooperative energy efficiency arrangements or even of potentially less challenging but still non-trivial energy efficiency installations was apparent throughout the consultation, and continues to be seen in the challenge of engaging meaningfully with SMEs on this topic.

Conclusion 13: A lack of financing options remains a key barrier, as does the long payback time of significant measures. One of the ongoing barriers to energy efficiency in SMEs is the lack of financing available to them. To address this, sector specific performance benchmarks for the energy efficiency measures, alongside an overview of the best available techniques, can provide Energy Service Companies (ESCOs) or banks with more certainty over the potential return on their investment and thereby facilitate the financing of energy efficiency measures within SMEs. Multiple projects recognised this need and provided industry SMEs with key sector specific knowledge to unlock financing. Thereby the projects opened the door to more investment and potential future securitisation of SME energy efficiency investment, and the sustainability of their impact is shown beyond the project lifetime.

A further barrier is the long payback time of some energy saving measures and a lack of appreciation for the potential savings and benefits stemming from investments in energy efficiency. To address this, the first step many projects took was to underline the energy and cost savings associated with the investment. A further approach to this barrier was to highlight the potential of recognising non-energy benefits, such as reduced maintenance costs, improved safety, as explored within STEAM-UP and recently within M-BENEFITS. Some projects addressed this from a cost side, identifying what further savings a company can unlock with investments in energy efficiency and thereby reduce the payback time associated with the investment. Another approach taken was to highlight the potential for revenue growth as a result of a stronger value proposition that focuses on the improved sustainability of the companies' production, or on developing a unique 'green' selling point for companies. A further aspect addressed was future-proofing the business in an economy that will increasingly decarbonise in the coming decades.

Conclusion 14: The COVID-19 pandemic will likely have significant implications for project performance. Projects have flagged that there were significant implications from the 2008 financial crash that affected delivery, and in some cases meant that delivery could not be successfully achieved. Projects from that time which had significant impacts on live projects include ERASME, COOLSAVE, EU Plast Voltage, and IND-ECO. Another project from this period, REG-Cep, sought to facilitate regional cooperation in the context of this crisis.

Current ongoing projects in their later stages have faced significant difficulties, with all four requesting and being granted extensions. The INDUCE project was particularly severely impacted, being unable to hold planned face to face workshops, and with insufficient time available instead to conduct the workshops remotely. Hence in the recalculations of this project, assessment has been based on the INDUCE pilot phase and the projected savings had INDUCE been able to complete their replication phase.

Current ongoing projects that are at an earlier stage of work, report the same challenges, but these projects have more time available to alter their course and amend their programme. This is not to understate the challenge they face to deliver the original work programme. It has been particularly noted by these projects that while they can and have moved to remote delivery of training, they cannot know to the same degree how well the training is received and understood. Engagement with SMEs for describing the benefits of energy efficiency, energy data collection, and auditing, although possible remotely, is far harder, the data can be of lower quality and remedial steps are not easily available to them. It will likely continue to be a challenging environment in which to deliver projects, and to realise the originally anticipated energy impacts.

That being said, ongoing and future projects can work to support each other in the promotion of their activities, as shown in collaboration between SPEEDIER, E2DRIVER, ICCEE, SMEmPower Efficiency and INNOVEAS.

Conclusion 15: There are barriers experienced by SMEs which mean they may not recognise the benefits of energy efficiency, and therefore may not seek to understand where they can make energy efficiency improvements. Even for those SMEs that do wish to better understand where they can make energy savings, other barriers can prevent them from implementing identified energy efficiency measures.

In particular, for many SMEs a lack of information on the financial benefits of energy efficiency can present a major barrier to action, and therefore early projects sought to address this by providing information, awareness raising and the provision of audits. Since these projects typically identified a number of cost-effective measures, i.e. where financial benefits outweigh the costs, it was hoped that overcoming this information barrier would lead to the increased implementation of energy efficiency measures by SMEs.

Through our review of project final reporting and the interviews conducted, our findings indicate that providing information on potential cost savings was not always sufficient to prompt the uptake of energy efficiency measures. This suggests the barriers for SMEs are not just informational, and that recognising the financial benefits of energy efficiency may not alone be sufficient motivation for companies to take action.

Project reporting reveals that barriers include a cost barrier to obtaining an energy audit as a company does not know whether they will reap the equivalent financial savings, then further financial barriers relating to any investments that may be needed to adopt the recommended measures from the audit, and the corresponding financing options available as discussed above. Some SMEs may be relatively low users of energy, and hence reducing energy costs is not a business priority.

Even if the cost of the audit itself is addressed, and any capital costs of the measures to be implemented, there are still costs to a company in terms of the time required to support the visiting auditor, to gather the necessary baseline data (if this is even possible), the interruption to processes and other company activities. If measures are recommended, there is then again both the time cost to implement and the time cost to understand and maintain the processes and the additional complexity added to company systems, and companies may feel they have a significant knowledge gap here. For example, the installation of an energy management system (EMS) may seem self-evident to achieve good baseline data and energy efficiencies by those with experience of such matters. From a company's perspective an EMS system will require the presence of a skilled person and their time to run, monitor and gain best value from it. The skills, time and willingness are all barriers, even if it would deliver the savings to make it financially viable. In some sectors, for example the events sector, previous projects have noted that energy managers are rare so the knowledge base is low, and the time cost high to engage. SMEs are already overloaded with activities that are necessary but are not their core business, as highlighted in recent project conclusions and energy efficiency is one such activity. If standards, benchmarks or regulatory changes are part of the process, this potentially increases all these barriers for SMEs, and lowers the perceived benefits due to the increasing complexity.

Behaviour barriers, including skills and available time resource, as well as a lack of comittment or resource from senior levels, a lack of interest, a reluctance to disrupt current operations all serve to hinder companies from investing in becoming more sustainable through energy efficiency's strategic value not being recognised. To address this, many of these projects have focussed on developing detailed insights into the wider benefits of improving energy efficiency and thereby forging an energy culture within a company that generates a willingness to continue pursuing energy efficiency beyond a momentary project interaction. Many projects found that one of the key drivers to build this energy culture is to develop knowledge and appreciation for energy efficiency within companies. Ensuring that the driver behind an energy audit is the company, rather than the auditor, will increase the likelihood of future implementation of suggested measures. This aspect was also highlighted in the survey, indicating that an energy audit on its own will not have the same impact in the absence of a positive energy culture within the company.

The evolving focus of more recent projects also support this conclusion. Projects currently underway include one that is seeking to identify and quantify the multiple benefits of energy efficiency; another that is exploring ringfencing energy efficiency savings and ensuring these savings are re-invested in higher cost energy efficiency measures. Current projects are also seeking to improve SMEs' access to finance as well as improve their relationship with third-party energy experts. A further approach taken has been to develop databases of benchmarks and best available techniques (BAT), which could facilitate the identification of profitable energy saving measures for SMEs and, more importantly, for ESCOs. Audits, benchmarking and BAT based assessments of SMEs' potential energy savings allow ESCOs to more effectively screen which SMEs have potential for cost-effective energy efficiency investments and therefore which SME investments should be financed by the ESCOs.

With regards to multiple benefits, there is indications that SMEs are aware of these, but there is a lack of consideration of non-energy benefits (NEBs) in investment decisions. With NEBs potentially equalling or surpassing the energy benefits, this lack of consideration for NEBs has an adverse effect on SMEs' investment decision making. Recent projects have identified this issue and have aimed to quantify the NEBs of potential measures, seeking to increase the implementation rate.

Our survey results showed that technology barriers are not believed to be significant anymore, and the above points would indicate that a straightforward informational barrier is also no longer the case. Rather the picture that emerges is of a more complex web of barriers that are context specific for each SME, and are a mix of informational, financial and risk/reward balance barriers.

Conclusion 16: Drivers for action within SMEs include energy, cost and efficiency savings, strategic positioning, leading with a green USP and recognising the wider non-energy benefits. There are a number of different drivers that may result in a company seeking out an energy audit and implementing the recommended measures. The primary driver for many companies is a desire to save energy and the associated costs. Other drivers include responding to the need to stay competitive within their field, providing the company with a green USP (unique selling point), responding to supply chain pressures or recognising the wider non-energy benefits.

All of the 41 EU-funded projects sought to have a significant effect in encouraging companies to reflect on their energy use, whether these companies were relatively far along their energy efficiency journeys or as was perhaps more often the case, at an earlier stage. Many projects reported that companies found the interaction encouraged them to recognise energy efficiency beyond a financial decision, and also to see it as the right thing to do in a wider context by playing their part in decarbonising the economy. Furthermore, some companies recognised the potential for adjusting their strategic positioning in their sector by building their offer around a greener product or service.

A further driver identified is supply chain pressure. As the wider economy decarbonises larger companies that have to comply with the various energy efficiency regulations start to look beyond their own production, and may further consider the carbon intensity of their suppliers' products, applying pressure to improve energy efficiency along the supply chain. Therefore, although SMEs may not have to directly comply with energy efficiency regulations such as Article 8 of the EED, they are incentivised to improve their sustainability to align with their customers' sustainable supply chain ambitions.

11 Recommendations

This study has developed project level and programme level recommendations for the consideration of project participants, programme managers and policy makers. These recommendations outline steps to address the aforementioned barriers and propose additional approaches that may have a positive impact on encouraging the uptake of energy efficiency measures in industry sector SMEs and other companies.

Recommendations at project level

Recommendation 1: Provide further clarification and guidance over the impact data that should be collected by projects during their lifetime. Good impact data is necessary to reliably measure success. While this is challenging, both in terms of what is available from the companies involved, and in terms of project timelines, it is possible. Good data starts from the companies involved in projects having the appropriate metering solutions in place, smart meters able to extrapolate timely, disaggregated and reliable energy consumption data, and extends through to projects knowing their data needs to illustrate their impact.

Particular focus should be given to:

- Require all applicants to provide an intervention logic diagram for their project, and provide guidance on an appropriate format and terminology to be used, including clear definitions of outputs, outcomes, impacts, to dovetail with the terms used by the Better Regulation Toolbox[95] to ensure standardisation of terms. Such an intervention logic diagram could then inform the evaluation of the proposal at the application stage and could be returned to throughout the project and used by an external evaluation after completion.
- Consider requiring a standardised report format for activity reporting, to include aspects such as number of people trained, audits, individuals whose behaviour is changed. Provide clear definitions for all categories for scenarios that are to be included and those that are out of scope. Excluding this from the application phase will help ensure simple numbers will not influence the application assessments but would allow more consistent data gathering during project lifetime across the portfolio of projects.
- Consider opening a dialogue between CINEA and recently awarded projects over the calculation of impacts, with the focus on discussion, to establish whether the methodologies employed are deemed acceptable and whether improvements could be made. This would provide an opportunity to explore relevant common factors, address the level of data availability in the companies likely to be targeted, and ensure projects will collect consistent data across the programme. For maximum benefit this should be carried out by those experienced with this type of data and its implications for the duration of the project, potentially with a single point of contact working with all projects.
- Adopt the approach taken in this study over the attribution of impact timelines when calculating impact KPIs. Actual or anticipated impacts arising directly from funded activities within the project lifetimes are attributed to within the project lifetime impacts. Activities that occur that are not funded, such as the continuation of training courses, or audits subsequently provided by people who were trained within a project, are the after-project lifetime impacts. Confirming this clear split in the guidance provided to projects will enhance the accuracy of the calculations made and ensure consistency between projects in their reporting.

Recommendation 2: Cluster projects by type and by programme for future impact assessments as this yields greater insight and improved data accuracy**.**

Recommendation 3: Make the learnings developed regarding common factors and common processes available to projects. Maintain and share a set of common factors for impact calculations. Projects may not be obliged to use these, but availability of common factors sets an expectation for the range that has been identified as reasonable in recent times for similarly themed projects, and a discussion and justification to move away from these for project calculations would likely yield interesting learnings for evaluators. Such a set of information should be kept live and available for ongoing update. Projects may be inclined not to report impacts where they lack data, especially given the increased focus on evidencing impacts. Providing such a resource may assist projects to make educated estimates for some of these impacts rather than excluding them.

Recommendation 4: Where evidence and data are wanted for insights into multiple benefits, or unexpected project outcomes, consider alternative ways of gathering these within the project lifetime. When reviewing the final reports from projects and from EC desk officers, evidence on multiple benefits was rarely present. Even during the interview stage of our research project participants found this a challenging topic to discuss and provide examples. Hence final reporting may not be an appropriate method to gain this evidence. Alternatives such as focused workshops or interviews with

[95] https://ec.europa.eu/info/sites/info/files/file_import/better-regulation-toolbox-46_en_0.pdf

coordinators on an ongoing basis during the lifetime of the project may yield more detail and more insightful responses. Asking future projects to consider the quantification of multiple benefits may also yield insightful results. This is potentially the key approach to engage SMEs in considering the range of benefits from energy efficiency improvements and it may be an appropriate way for projects to think about it as well. Guidance could be provided (and is already available through the approaches taken within M-BENEFITS and STEAM-UP for example).

Recommendations at programme level

Recommendation 5: Consider supporting projects through a defined follow up phase, to gather the longer-term data of interest, such as the level of implemented impact measures, the transformations achieved, the level of policy developed and adopted. There does not appear to be strong motivational factors for coordinators and partners to keep track of impacts after the end of a project. Lack of budget and time are likely the key reasons why there seem to be limited follow up actions. Furthermore, participants involved in older projects were very likely to have moved on and there was little memory of detailed project activities. To obtain high quality data regarding the project sustainability and activities undertaken after the project end, it may be beneficial for a reporting period to run for a time after a project completes, potentially revisiting active participants at pre-agreed intervals to understand and capture their progress.

Recommendation 6: Define a distinct monitoring and evaluation strategy. An effective evaluation requires both good data from the projects themselves, as well as timely monitoring and evaluation. Building on the recommendations 1-5 above, through providing clarification and guidance to projects with regards to what and how data should be collected would benefit both project and programme in monitoring progress and success. In parallel, a monitoring and evaluation strategy conducted by the individual projects or by a third party on a programme level could be introduced. To ensure smooth functioning, a pilot for such an approach may be useful. It is recommended that monitoring design is a focus at project/programme outset, and that evaluation is undertaken once all individual project data is available, potentially a set time after project completion.

Recommendation 7: Leverage the value that success stories can bring by gathering materials for such success stories on a regular or pre-determined timetable. This should ideally occur within two years of the project's conclusion to ensure all the relevant information is still accessible, yet sufficient time has passed that implementation of measures has progressed. This could potentially be incorporated into a longer project reporting phase if appropriate, or through separate follow up at a later date.

Recommendation 8: Consider a dedicated follow-up phase for projects, either as part of the project from the outset, or as a funded extension for certain projects to serve to both deliver implementation advice to SMEs and to facilitate obtaining accurate implementation rates. The implementation phase of energy efficiency measures is crucial to ensure a successful outcome from a project's interaction with an SME, yet often currently this phase occurs after the timeline of the original project has completed.

An alternative would be to consider **a parallel programme that is dedicated to implementation support**. This could be a collaborative effort by bodies such as chambers of commerce, for example, to link SMEs in each country to local funding programmes or relevant procurement routes. Such a programme could support SMEs in their next steps including securing funding, procurement, implementation and optimisation of the energy efficiency measures recommended by the original project effort.

Recommendations for national policy makers

Recommendation 9: Facilitate the financing of SME energy efficiency improvements at the Member State level through building trust in the ESCO model and exploring the securitisation of energy efficiency loans by SMEs.

Financing has been highlighted as a key barrier to energy efficiency investment. Stakeholder feedback clearly demonstrated that this topic should be addressed at national level.

One approach that has proved promising is energy service companies (ESCOs). ESCOs can support the financing of energy efficiency measures and profit from the cost savings the company achieves. Encouraging such business could be most effective on a national, regional or municipal level. Creating local initiatives that build trust through establishing these relationships at municipal buildings for example, could kick start the market both from the perspective of SMEs and ESCOs. Municipalities and governments could utilise sustainable procurement approaches in their own supply chains, addressing aspects that directly interact with the market, for example requiring energy management policies to be in place and asking about improvements made.

A further financial tool that could unlock large scale investments could be the securitisation of energy efficiency loans by SMEs. The considerable risk associated with loans to SMEs results in high interest rates for SMEs. Combining the risk of these loans across a large number of SMEs can lower the overall risk profile and unlock more investment at a lower interest rate. Supporting such an initiative on a national level could be a key driver for developing the market.

Recommendations for EU policy makers

Recommendation 10: Strengthen the synergies between different EU programmes, including the LIFE programme, through structural funds to foster the specific implementation of recommended energy saving measures. These projects as a whole strive to strengthen the incentive for SMEs to implement energy efficiency measures, with financial and knowledge support. Such efforts continue to be identified as necessary, and further implementation support may yield higher implementation rates. Strengthening the synergies between the different relevant EU programmes through structural funds to foster the specific implementation of the recommended energy saving measures identified during a project. Financial support to SMEs may be most appropriate at the MS level, and the EC could support this by sharing best practice examples from the national level as it has for other energy efficiency priorities,[96] and through targeted support from the European Investment Bank (EIB).[97] This might involve partnerships between the EIB and commercial banks in Member States to offer credit lines specifically targeting energy efficiency in SMEs, enhancing existing EIB activities.[98] For example, low or zero interest rate loans could be made accessible to SMEs that have had an audit, and the support could be delivered as part of a revolving fund to ensure the sustainability of the finance.

Recommendation 11: Leverage the value in sustainable supply chains. A further aspect to consider is how to leverage large companies' aims for sustainable supply chains. As described above, this can be a driver for the take up of energy efficiency measures. Recent projects have considered how this aspect can be leveraged and will likely yield interesting results that can be built on. Reviewing how larger companies can be incentivised to support investment in energy efficiency in SMEs in their supply chain could prove promising, and could be tied to the existing Product Environmental Footprint (PEF) and Organisational Environmental Footprint (OEF) methodologies. This may potentially create the beneficial situation for the end users whereby the costs within the supply chain are reduced through energy efficiency measures hence products become cheaper, as well as having a lower footprint.

Recommendation 12: Promote a centrally coordinated European energy efficiency knowledge hub to support companies. One of the key findings from the analysis and interactions with stakeholders was that although projects generate a large amount of outputs and learnings with great value to the industry services sectors, they are not always used, or readily available, after the project lifetime. The creation of a knowledge hub would help to ensure that the outputs are not lost, and ensure they remain accessible to a wide audience. The hub could capture the sector specific benchmarks and best practice guides generated, the methodologies, potentially a register of suitably qualified auditors for a regional approach, and the success stories. Networks could be retained and potentially re-awakened with a related project. Providing a centralised hub would offer companies and wider institutions with a one-stop-shop for energy efficiency information, all generated by the projects to date.

[96] Feasibility study to finance low-cost energy efficiency measures in low-income households from EU funds, 2016, https://ec.europa.eu/energy/sites/default/files/documents/low_cost_energy_efficiency_measures_-_final_report.pdf
[97] SMEs and mid-caps, https://www.eib.org/en/about/priorities/sme/index.htm
and When 'low-energy' is not an insult https://www.eib.org/en/cartoons/smes-energy-efficiency-finance#
[98] Cleaner laundry for the Czech Republic, https://www.eib.org/en/podcasts/czech-energy-efficiency-laundries-pragoperun.htm

New evidence of the benefits, such as the multiple benefits approach, would be shared faster and more directly to more audiences with such an approach.

Furthermore, such a hub could be proactive with its content and mission, providing both the technical content and a network environment. The success stories, on the regular production timetable, could be developed within such an arrangement and the hub could facilitate the training programmes the projects developed, where there was still demand. The focus could be cross collaboration and engagement, seeking behaviour change, creating communities, dissemination and adoption, and activating the area at a national level. Examples of hubs that seek to deliver a similar service include the European Local Transport Information Service (ELTIS) and the Transport and Research and Innovation Monitoring and Information System (TRIMIS), both for DG MOVE.

Glossary

Abbreviation	Definition
CCI	Chamber of Commerce and Industry
CHP	Combined Heat and Power
CPI	Common Performance Indicator
CSA	Coordination and Support Actions
EA	Energy Audit
EASME	Executive Agency for Small and Medium-sized Enterprises
EC	European Commission
EED	Energy Efficiency Directive
EMS/EnMS	Energy Management System
EPC	Energy Performance Contracting
ESCO	Energy Services Company
EU	European Union
EUREM	EURopean EnergyManager
GDPR	General Data Protection Regulation
GHG	Greenhouse Gas
H2020	Horizon 2020 programme
IEE	Intelligent Energy Europe programme
KPI	Key Performance Indicator
LA	Local Authority
PR	Public Relations
N/A	Not Applicable
NGO	Non-Governmental Organisation
PPI	Project Performance Indicator
USP	Unique selling point
WWTP	WasteWater Treatment Plant

Annexes

A1 List of projects

Funding programme	Project
H2020	E2DRIVER
H2020	EE-METAL
H2020	Energywater
H2020	ENERWATER
H2020	EUREMnext
H2020	ICCEE
H2020	IMPAWATT
H2020	INDUCE
H2020	INNOVEAS
H2020	M-Benefits
H2020	SCOoPE
H2020	SMEmPower Efficiency
H2020	Speedier
H2020	STEAM-UP
H2020	WaterWatt
IEE-II	CARE +
IEE-II	CHANGE
IEE-II	CODE2
IEE-II	COOLSAVE
IEE-II	ECOinFlow
IEE-II	EE Music
IEE-II	EECC
IEE-II	EINSTEIN II
IEE-II	EMSPI
IEE-II	ERASME
IEE-II	EU Plast Voltage
IEE-II	EUREM PLUS
IEE-II	FOUNDRYBENCH
IEE-II	GO-ECO
IEE-II	GREENFOODS

IEE-II	IND-ECO
IEE-II	Night Hawks
IEE-II	PINE
IEE-II	REG Cep
IEE-II	SESEC
IEE-II	SET
IEE-II	SME EnergyCheckUp
IEE-II	SPICE3
IEE-II	STEEEP
IEE-II	SURFENERGy
IEE-II	TESLA

A2 Success stories

The ENERWATER H2020 project methodology was approved as a European Standard that will guide how wastewater treatment plants assess and improve their energy efficiency

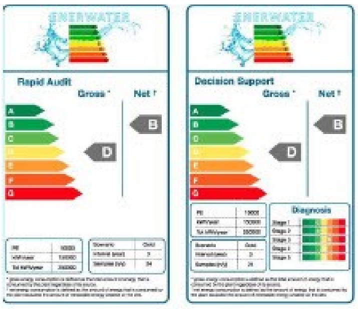
ENERWATER

Wastewater Treatment Plants (WWTPs) are one of the **most expensive public industries** in terms of energy requirements, accounting for more than 1% of electricity consumption in Europe.

The main objective of ENERWATER was to **create, develop, validate and disseminate a standard methodology** for continuously assessing, labelling and improving the energy performance of WWTPs. No such supranational standard existed previously. To create this a collaborative network was established, including research groups, SMEs, water management companies, city councils, water authorities and industry.

The project activities included a study of WWTPs to **identify best practices**, establishment of energy consumption benchmarks, definition of a standard methodology, development of an online web application, dissemination of the methodology and supporting the transition of the ENERWATER methodology to a new European Standard.

Project duration: March 2015 to October 2018
Funding: €1,731,087
Grant agreement ID: 649819
Project website: http://www.enerwater.eu/
Cordis: https://cordis.europa.eu/project/id/649819



The energy label developed by ENERWATER for WWTPs

The European Standard CEN/TR 17614

The ENERWATER methodology received a very positive reception by the CEN technical committee responsible for water and wastewater engineering (CEN/TC165). Turning the ENERWATER methodology into a Technical Report with support and feedback from the working group required significant extra effort and time from the project consortium, but the project participants knew that this action would greatly increase their impact.

The **CEN/TR 17614 Standard method for assessing and improving the energy efficiency of wastewater treatment plans** was approved January 2021. This means that the ENERWATER methodology is now the European standard for defining and measuring energy efficiency in wastewater treatment plants.

"The application of this Standard will bring a competitive advantage to the European water industry by facilitating evidence of energy reduction and by driving the adoption of new technologies, as well as the development and roll-out of new products."

Potential energy savings through improved energy efficiency in European WWTPs	
Average potential energy savings per European WWTP	0.24 GWh/year
Shifting all inefficient European WWTPs to average energy efficiency	5,500 GWh/year
Shifting all European WWTPs to the 10th percentile of energy efficiency	13,500 GWh/year

Urban wastewater treatment plant

STEAM-UP H2020 project helped Fahnen-Gärtner reduce their energy consumption by 1 GWh/year

STEAM-UP

The STEAM-UP project aimed to assess and target the energy saving potential of **steam installations in energy-intensive industries** across several countries.

STEAM-UP's activities included defining the "state of the art" of industrial steam to develop a **steam audit methodology and energy management system**, as well as developing a capacity building programme for energy auditors to learn about steam audits. A total of 393 energy auditors were trained using this programme during the project and more are being trained after the project.

"There used to be a lack of interest and knowledge for energy efficiency for steam installations – STEAM-UP tried to address this."

The project carried out detailed steam audits across 44 SMEs and 33 large enterprises, which triggered €6.8 million in investments and reduced energy consumption by 124 GWh/yr.

Project duration: March 2015 to February 2018
EU contribution: €1,528,655
Grant agreement ID: 649867
Project website: https://steam-up.eu/
Cordis: https://cordis.europa.eu/project/id/649867

The newly installed 600 m² PV system covers 20% of Fahnen-Gärtner's electricity consumption

Fahnen-Gärtner GmbH

Fahnen-Gärtner is a market leader in the production of **promotional and national flags** and has 100 employees at its site in Mittersill in Austria. The company produces half a million square metres of fabric annually through screen and digital printing on fabric.

Fahnen-Gärtner is ambitious when it comes to sustainability and energy and is following an "Energy master plan" to reduce its greenhouse gas emissions.

The company benefitted from STEAM-UP's audit, which identified that its steam system was operating inefficiently. To address this, Fahnen-Gärtner **invested in several measures**: a new steam generation boiler, an exhaust gas heat exchanger with heat recovery and buffer storage. They also installed an Energy Monitoring System and a PV system to cover 20% of the total electricity consumption.

"By implementing a comprehensive Energy Monitoring System, we now have an eye on all our energy needs and savings but can also connect this data with our production data to identify inefficiencies and optimise energy use."

Fahnen-Gärtner savings due to STEAM-UP	
Energy savings	996 MWh/year
Cost savings	35,000 €/year
Investment	432,900 €
Payback time	12 years
Year of implementation	2017

Fahnen-Gärtner GmbH in Mittersill, Austria

Multiple benefits of energy efficiency

Swiss Workplace Solutions

Nestlé's Swiss Workplace Solutions department have adapted their activities following participation in the H2020 project M-BENEFITS

'Swiss Workplace Solutions' is the department in charge of administrative buildings for Nestlé in Switzerland.

Multiple Benefits (M-BENEFITS)

The goal of the M-BENEFITS project is to **train and build the capacity of energy-efficiency experts** to evaluate all benefits of industrial and tertiary sector-focused energy efficiency projects.

The project is aiming to deliver best-practice examples, tools and trainings on the **importance of multiple benefits for investment decisions in companies**. These tools developed within M-BENEFITS will allow energy managers and practitioners to improve the business case of energy-efficiency projects.

The approach takes into account three pillars that are critical to upper managers when considering project investment: contribution of energy-efficiency projects to cost reductions, the impact and improvement to value proposition, and risk reduction. Thanks to this broader approach, the contacts and champions of projects in companies will **cut across all company functions**, including top management.

Project duration: March 2018 to June 2021
Funding: € 1,866,490
Grant agreement ID: 785131
Project website: https://www.mbenefits.eu/
Cordis: https://cordis.europa.eu/project/id/785131

Nestlé Swiss Workplace Solutions

Established over 150 years ago, **Nestlé** is the world's largest food and beverages company. The department in charge of administrative buildings for Switzerland, "Swiss workplace Solutions" has participated in the M-BENEFITS project.

A **retrospective analysis** was initially performed on the multiple benefits associated with refurbishment of a part of the HQ buildings (including the façade, technical distribution and lighting). Having seen the value of the approach and the additional benefits associated with energy efficiency improvements, the company are **currently using this method on two strategic projects**.

"We are convinced that the M-BENEFITS methodology can be a useful tool to reinforce messages delivered to management regarding energy improvement actions."

Participation in the project has shown the company that investing in energy efficiency measures resulted in **increased employee engagement and productivity** and reduced maintenance costs within the company.

Energy efficiency measures implemented by Nestlé

Multiple benefits of energy efficiency

Swiss Workplace Solutions

The EUREMnext project helped the Olympic Sports Centre in Riga save 330 MWh/year

EUREMnext

The EUREMnext project is part of a series of projects expanding the European EnergyManager (EUREM) training programme. The EUREM training is offered by about 60 training providers across **30 countries** and has trained over **6,000 participants**. On average, 75% of 'EnergyManagers' implement identified energy saving measures following participation in the qualification.

The EUREMnext project is aiming to transfer the training to **six more countries** (Albania, Bosnia and Herzegovina, Estonia, Latvia, Serbia and Turkey) by also establishing **national accreditation and recognition** for the EUREM training. Furthermore, it will revamp the curriculum and training materials to be more closely linked to the energy audit process and standards, as well as to cover additional up-to-date topics. It will also develop add-on implementation **support activities** for in-depth practical support on implementing measures.

Project duration: March 2018 to June 2021
EU contribution: €1,809,556
Grant agreement ID: 785032
Cordis: https://cordis.europa.eu/project/id/785032

The new swimming pool circulation pumps

Olympic Sports Centre Riga

The Olympic sports centre in Riga is a multifunctional centre suitable for practice facilities and for organising national and international competitions in basketball, volleyball, handball, football, track and field athletics, gymnastics, wrestling, swimming, and other sports.

The head of technical operations of the sports centre participated in the 9-month EUREM training programme introduced to Latvia by the EUREMnext project.

"The EUREM training unlocked significant energy savings for the company and allowed me to grow in my role as the company's energy manager."

The learnings allowed the sport centre to install new circulation pumps for the swimming pool that improved energy performance by 44%. Furthermore, all halls were switched to more efficient lighting and switches were replaced with sensors.

Next to the energy-related benefits, the changes had positive impacts on productivity, security and overall product quality.

The Olympic Sports Centre's energy savings	
Energy saved (GWh/year)	0.33
Investment in energy saving measures (€)	200,000
Payback period for investments (years)	6
GHG savings (tCO_2/year)	32
Years of implementation	2021

Basketball court in the sports centre

The IMPAWATT project highlighted the importance of creating an energy culture within a company

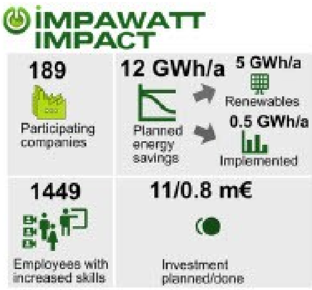
IMPAWATT

The H2020 project **IMPlementAtion Work and Actions To change the energy culture** (IMPAWATT) created a staff training and capacity building programme to enhance corporate policy towards energy efficiency, energy culture and sustainable supply-chain initiatives. The aim of these activities is to address the barriers faced by actors in the industrial and service sectors with regards to implementing energy efficient investments.

The programme was developed into a web platform that provided tailored content adapted to each company's needs, covering **educational material** to raise awareness and train teams, and a **tool for monitoring energy use and implemented actions**.

A total of 189 companies and SMEs registered to the platform. As a result of the Covid-19 pandemic, IMPAWATT pivoted towards offering more webinars than in person trainings. As a result, over 50 webinars were held and recorded, covering topics linked to energy efficiency and management, and offer companies the expertise and tools to improve energy efficiency. **Almost 1,500 people were trained** as a result of the very successful webinars.

Project duration: June 2018 to March 2021
EU contribution: €1,101,264
Grant agreement ID: 785041
Cordis: https://cordis.europa.eu/project/id/785041
Website: https://www.impawatt.com/



Impacts of the IMPAWATT project

Creating an energy culture

Energy culture in a company is shaped and determined by the energy policy defined by the management, but also **heavily depends on the energy behaviour of the employees**. Assessing the energy culture in a company and developing an understanding and roadmap for improvement is not an easy task.

To address this, IMPAWATT created exhaustive collections of information, motivational material, and guidelines on how to build a company's energy culture framework. Thereby, **IMPAWATT assisted companies in identifying the factors influencing the energy culture** and developing a strategy to improve it.

Areas covered by IMPAWATT Web platform (online toolbox)

Swiss luxury watch company

A Swiss luxury watch manufacturer operating an optimised, high-tech ultra-modern factory participated in the IMPAWATT programme, but signalled they did not believe there would be any serious energy efficiency measures the project could identify. However, **IMPAWATT turned out to be a trigger moment for the company.**

"The energy audit we conducted on site not only helped to identify several small and large measures to be implemented quickly, but also led to the management deciding to go further. It is currently discussing to deepen the energy optimization issues."

INDUCE

GRUPO CARINSA

The INDUCE H2020 project worked with Grupo Carinsa to reduce their energy consumption and change the culture surrounding energy efficiency in the company

Grupo Carinsa create flavours and ingredients for the food industry and fragrances for the perfume industry.

INDUCE

The objective of the INDUCE project was to develop an **open access platform** where training materials, online lessons, guidelines and tools were available for companies aiming to increase their energy efficiency.

A **'human-centred design approach'** was used to develop the INDUCE methodology, including specific training courses and interventions that are tailored to companies' needs. This methodology was more focused on developing an energy efficiency culture within companies that enables actions to be carried out more effectively and with long-term impact.

"INDUCE developed a toolkit for motivating and empowering key actors within the company towards a more energy efficient behaviour and culture."

The INDUCE methodology was validated within the food & beverage sector during this project.

Project duration: February 2018 to July 2020
Funding: € 1,998,224
Grant agreement ID: 785047
Project website: https://www.induce2020.eu/
Cordis: https://cordis.europa.eu/project/id/785047

Grupo Carinsa

Grupo Carinsa are a multinational company dedicated to the creation of flavours and food ingredient preparations for the food industry and fragrances for the perfume industry. During the INDUCE Project, multidisciplinary training actions on efficiency and energy consumption have taken place in the company.

Following participation in the project, Carinsa have implemented energy saving measures, including the **purchase of equipment for a new encapsulation production line**. The investment in this line has consisted of the installation of two, more efficient reactors for a total value of € 300,000.

Overall, the company estimates **energy savings of 10%**. The involvement of different departments of the company has been important in realising these changes.

"Participation in this project has led to increased employee engagement and reduced maintenance costs"

New encapsulation production line installed by Carinsa

RICARDO INDUCE GRUPO CARINSA European Commission

The WaterWatt H2020 project helped Deutsche Edelstahlwerke reduce their energy consumption through optimisation of their water cooling pipelines

Cooling tower and water pump at Deutsche Edelstahlwerke

WaterWatt

The WaterWatt project aimed to **improve energy efficiency in industrial water circuits** using online self-assessment, benchmarking and economic decision support.

"Industrial water circuits are considered auxiliary systems and have therefore previously not been the focus of energy efficiency measures."

Companies could evaluate potential improvement measures themselves by means of **online circuit modelling** provided through the project website, before engaging with the project partners.

During the project, 70 companies created 118 water circuit models, which is expected to have triggered €7.1 million in investments and reduced primary energy consumption by 62 GWh/yr.

Project duration: April 2016 to March 2019
Funding: € 1,782,533
Grant agreement ID: 695820
Cordis: https://cordis.europa.eu/project/id/695820

"The approach of modelling water circuits proved a success. It allowed companies to visualise the potential savings in a comprehensive way and could be further used by the customer during circuit operation."

Deutsche Edelstahlwerke

Deutsche Edelstahlwerke Specialty Steel GmbH & Co. KG (DEW) is a leading producer and processor of stainless-steel products. With a workforce of 4,200 employees, it processes a total of about **one million tonnes of stainless steel per year**. Products from DEW are used in automotive, aerospace and mechanical engineering industries and energy and plant technology.

"The WaterWatt project was a great opportunity to utilise industry expertise and evaluate our energy efficiency in comparison to benchmarks."

Several investments were performed in order to optimise the flow of cooling water and reduce the amount of pumped water, and correspondingly energy demand. Furthermore, an **automated pump malfunction alarm** was developed based on the energy demand metering. When the specific energy demand of the pumps increases above a threshold, an automatic alarm is initiated, and the maintenance team is alerted.

Several alarm cases have taken place so far. Either one of the pumps had a malfunction or there were problems with the pipeline such as sand deposits. Due to the alarm the **malfunction was repaired at once** and increased energy consumption over longer time periods or total pump failure and replacement were avoided.

Flow meter installed following WaterWatt project at DEW

AgriAmbiente Mugello

SCOoPE Saving Cooperative Energy

The H2020 project SCOoPE conducted an audit for the Agriambiente Mugello cooperative which resulted in the installation of energy efficiency measures in their new stables

SCOoPE

The project objective was to reduce energy consumption, by implementing **cost-effective energy solutions in the targeted agro-food subsectors** (namely arable crop drying, meat and poultry, dairy, and fruit and vegetables transformation), and to further spread this knowledge within businesses technicians and managers of the 62,000 European businesses belonging to these subsectors.

Audits and benchmarking reports were completed for 84 agro-food companies during the project, more than originally planned. Clusters that enabled different industries and companies to share data were also set up during the project. This enabled information to be shared and stored in a database that could be accessed by project participants.

"Some of the technical materials produced as part of SCOoPE have continued to be used as reference documents for relevant SMEs."

Project duration: April 2016 to March 2019
EU contribution: € 1,796,004
Grant agreement ID: 695985
Cordis: https://cordis.europa.eu/project/id/695985
Project website: https://scoope.eu/

Inauguration of the new energy efficient stable at Agriambiente Mugello

Agriambiente Mugello

Agriambiente Mugello is a multifunctional cooperative that carries out various activities including forestry interventions, hydraulic arrangements, naturalistic engineering and construction and maintenance of large green spaces.

The cooperative operates on about **1600 hectares** and produces cereal crops that are used to support livestock activities, with 1,400,000 litres of certified organic milk produced per year.

"In agriculture, little attention is paid to energy efficiency as energy needs are not the most influential expenditure item in the company budget. However, in the long term, increased efficiency leads to many advantages such as waste reduction and impact on the environment, which is important in the context of our production."

During the SCOoPE project, the cooperative was audited by technicians measuring energy consumption of a part of the company, the stable, and received a report with the results of measurements and some proposals of energy saving solutions.

Following the audit, the cooperative made a planned extension to the stables, with **a number of technical solutions aimed at improving energy efficiency**. In the new stable LED lighting and thermal insulation systems were installed. Furthermore, the previous electric motor in the cooling system was replaced by new, more efficient motors.

***Agriambiente Mugello* savings due to SCOoPE**	
Energy saved	0.035 GWh/a
Investment	60,000 €
Payback time	5 years
Year of implementation	2018-2019

Overcoming challenges associated with the COVID-19 pandemic

The COVID-19 pandemic has caused disruption across European industry, causing significant economic hardship for SMEs and in some case disrupting their day-to-day activities.

The challenge of COVID-19

For five ongoing Horizon 2020-funded projects, **SPEEDIER, E2DRIVER, ICCEE, SMEmPower Efficiency** and **INNOVEAS**, there are significant disruptions as a result of the COVID-19 pandemic. The pandemic has presented an additional barrier to engagement of SMEs, who have urgent competing priorities, and has meant project activities have had to be adapted in the wake of restrictions in travel and face-to-face contact.

Collaboration between project partners has been largely unaffected or even strengthened by the pandemic. Interviewees from ICCEE, INNOVEAS and SMEmPower Efficiency have stated that their projects have adapted well to the COVID-19 outbreak to date, with a successful **shift from physical to virtual modalities**. In this regard, the pandemic might have had a positive effect since people may be more inclined to participate in online meetings rather than travelling to physical sessions with the additional time requirements and travel expenses. By moving to virtual modes of communication, training activities in particular can be spread to wider audiences.

However, an interviewee from SMEmPower Efficiency has noticed the effect of COVID-19 on the **willingness of SMEs to participate** in courses. Interviewees from the E2DRIVER project also highlighted that, although they had been successful in recruiting 12 pilot companies, finding other replication companies in the later stages of the project may be more difficult now.

"The main obstacles faced by the project have been from COVID-19, particularly as trainings were planned to have a blended approach with a face-to-face component. Project partners have overcome this with the use of other technologies." - E2DRIVER

Knowledge sharing

The ongoing projects periodically come together to share their status with each other, to support each other in identifying the most appropriate SMEs for their activities, and to **develop synergies** in their project work. The projects also mutually support their **dissemination activities**, such as sharing survey links through each other's newsletters and presenting their findings together at the Sustainable Places 2020 conference.

This approach may have offered benefits as these projects continue to navigate the changing economic landscape of COVID-19 impacting Europe, altering their project approaches to deliver online rather than face to face trainings, to deliver remote data gathering and energy advice. The projects are able to **share approaches that work**, and those that are less successful. These steps have helped them continue to make progress with the project programmes, in spite of the challenging times being faced by European SMEs.

Ongoing projects have adapted well to the challenges of the pandemic

steeep
Support & Training for an Excellent Energy Efficiency Performance

Air Liquide HEALTHCARE

The STEEEP project led to significant energy savings by providing training and guidance

Air Liquide Healthcare in Schelle, Belgium

STEEEP

The **STEEEP** project provided 600 SMEs across various sectors with **tailored training and guidance on effective energy management tools and practices** targeted towards specific national or regional needs, with the intention of reducing their energy consumption.

Chamber of Commerce and Industry advisors exchanged their experience through **comprehensive training and regular cross-border learning network meetings**. Their support was provided to SMEs via workshops, bilateral coaching and helpdesks.

Pilot projects were implemented in seven different countries across Europe, setting up Local Energy Communities which aimed to shift energy management from an individual to a collective approach.

Project duration: March 2014 to February 2017
Funding: € 2,050,459
Grant agreement ID: IEE-13-844
Project link:
https://ec.europa.eu/energy/intelligent/projects/en/projects/steeep

Air Liquide Healthcare

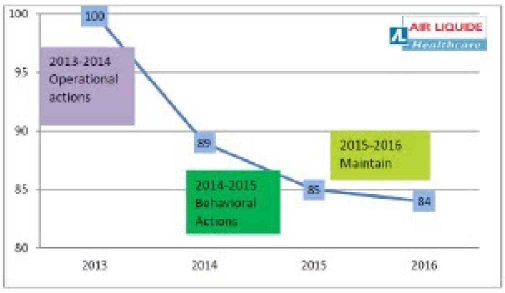
Participating SMEs received **individual company visits,** helpdesk support and participated in workshops covering energy management tools, financial incentives, and technical equipment.

Air Liquide Healthcare in Schelle, Belgium was one of 10 companies featured in a final Success Stories report upon completion of the project. The company produces medical equipment, including ventilation and respiratory equipment.

As part of the STEEEP project, the company participated in behavioural-based trainings to achieve energy savings.

From 2013 to 2014, the company undertook **operational actions,** such as automating lighting, and upgrading filling equipment such as pumps and compressors.

From 2014 to 2016, the company implemented monthly **awareness-raising actions and training.** Employees were encouraged to propose and implement energy saving actions. Some of the technical actions outlined by the energy scan and by the staff included technical programming of the air compressors, pumps, and lighting.



Percentage energy savings at Air Liquide Healthcare

COOL-SAVE

ITCL TECHNOLOGY CENTRE

The IEE project COOLSAVE worked with the Nueva Pescanova group to reduce the energy consumption of their factory by 835 MWh/year

The COOLSAVE project focused on reducing energy consumption associated with refrigeration

COOLSAVE

The COOLSAVE project aimed to reduce **industrial energy consumption in cooling installations** in the food and drink sector through the dissemination of cost-effective energy efficiency strategy implementation.

Energy efficiency strategies were developed from **cost-benefit analyses of real data** taken from a representative sample of 25 refrigeration plants covering all the different climates across Europe.

A **guide of good practices** was developed, tested and disseminated in order to make decision-makers in the food and drink industry aware of the different available options they have to improve their cooling systems.

Project duration: April 2012 to April 2015
Funding: € 1,313,658
Grant agreement ID: 615920

Nueva Pescanova BAJAMAR7 factory

BAJAMAR7 is a factory situated in the northwest of Spain, in Galicia. This factory belongs to the Nueva Pescanova Group, a Spanish company specialising in the **fishing, farming, processing and commercialisation of seafood products,** specifically frozen prawns.

The energy consumption of the cooling plant in BAJAMAR7 was approximately 5.3 GWh/year before participating in the COOLSAVE project.

Studies performed during the project showed many **opportunities to improve energy efficiency,** including correct use of the compressor sequence and development of a personalised expert control system.

An **improved management plan** was also developed to ensure the cooling plant was used according to the real needs of production each day.

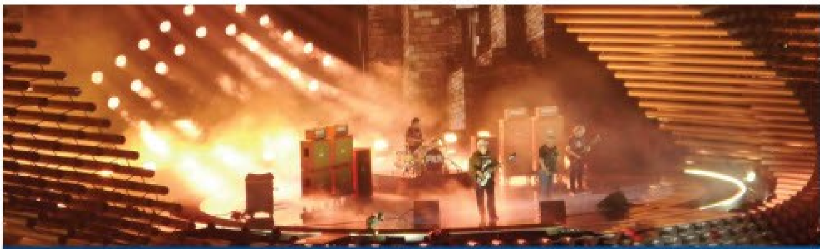
The BAJAMAR7 factory implemented these improvement strategies **without the need for investment.**

The result of these improvements was a **reduction of 28% of energy consumption** during 2015, corresponding to 835 MWh/year of energy savings.

BAJAMAR7 factory savings due to participation in the COOLSAVE project	
Energy saved	853 MWh/year
	28%
Year of implementation	2013-2014

"It was very interesting to work with complementary partners with different approaches to the companies as well as different knowledge fields to obtain results that could benefit companies across the EU." -ITCL

RICARDO COOL-SAVE ITCL TECHNOLOGY CENTRE European Commission



EE MUSIC

The IEE project EE MUSIC performed an audit on the 2015 Eurovision Song Contest, which reduced the energy consumption of the event by 440,000 litres of diesel

The 2015 Eurovision Song Contest was organised as a 'Green Event' and was watched by over 200 million people.

EE MUSIC

The aim of the EE MUSIC project was to achieve a change in the **European music event production market** by shifting its production processes to be more energy efficient and eco-friendly.

Outreach, training, capacity building and energy audit activities were carried out during the project. The project connected with key stakeholders by implementing 9 'Train-the-Experts' workshops with 111 participants and 5 Festival trainings with134 festival promoters and technical staff.

A comprehensive common **EU-knowledge base** was compiled, creating a valuable resource beyond the project's lifetime. Tools developed during the project are still being used today.

"EE Music ambassadors are still doing work in this area and heading up new initiatives and projects, including a European consultancy helping venues with energy management."

Project duration: May 2013 to January 2016
EU contribution: € 1,401,999
Grant agreement ID: 644763

Eurovision Song Contest 2015

A special energy audit was provided by experts from the EE MUSIC consortium for the 60th edition of the **Eurovision Song Contest** (ESC) that took place in Vienna from 19th – 23rd May 2015.

The main scope of activities was related to the venue of the ESC finals 2015, the **Wiener Stadthalle,** and all of its associated processes such as catering, sound, light, energy supply, and cooling.

An **audit was carried out** following two workshops with members of the Austrian public service broadcaster and the ESC production team. Data was gathered in ten face-to-face meetings with the relevant service providers taking place during ESC production period and during the final TV broadcast.

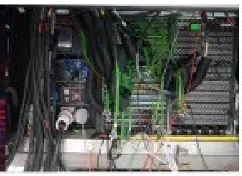
"The Eurovision Song Contest 2015 was certified not only by the Austrian ecolabel, but also by the City of Vienna's ÖkoEvent criteria."

Measures implemented included:

- LEDs 15-times more efficient than conventional lamps, which were reusable after the event
- The power supply for the event came from 100% renewable electricity
- Collection and recycling of secondary materials and waste avoided 203 tCO_2 emissions

In total, around 862 MWh of electric energy was used at the ESC, which is **measurably less than what is typically used in an event of this size.**

Eurovision Song Contest 2015 savings due to EE MUSIC	
Energy saved	440,000 litres diesel
GHG savings	>1,000 $tCO_{2}e$
Year of implementation	2015



Using energy efficient LED lights and connecting to renewable power from the grid improved the energy efficiency of the event

EE MUSIC ENERGY EFFICIENT MUSIC CULTURE

EUROPEAN ENTERPRISES CLIMATE CUP

Ekodoma

The EECC project led to enterprises reducing their overall energy consumption through an energy savings "competition" and better energy management

EECC

The European Enterprises Climate Cup brought together **175 participating SMEs, from 10 countries (Austria, Bulgaria, Denmark, France, Germany, Ireland, Italy, Latvia, Malta and Spain)**.

Participants had one year to implement measures in their own enterprise in order to reduce their overall energy consumption in a competition to see which enterprise could achieve the largest energy savings.

Participating companies benefited from **free energy advice and access to the iESA energy management system,** while selected companies were offered funding opportunities and energy audits.

Through dissemination activities, companies' energy savings results were publicised and incorporated into their Corporate Social Responsibility (CSR) targets.[1]

Project duration: 26/02/2014 to 25/08/2016
Funding: € 1,412,064
Grant agreement ID: IEE-13-669
Link to project:
https://ec.europa.eu/energy/intelligent/projects/en/projects/eecc

Uponor Latvia

Uponor Latvia Ltd. was one of the companies participating in the project. Uponor offers piping systems for various uses including water supply, heating and cooling, and infrastructure. Its Latvian office is located in Riga and had only 14 employees and was 220 m² in area when it participated in the project.

The following activities were implemented during the project, with the help of project partner Ekodoma:

- Installation of timers for electrical heaters
- Changing employee habits regarding use of lighting, resulting in around 30% of electricity savings
- Changing of lighting to LED solutions
- Installation of air heat pumps instead of electrical heating
- Installation of electrical monitoring devices
- Change to more energy efficient internet router and servers
- Workshop to disseminate information on energy savings in the company

These actions helped the company improve its indoor climate and encouraged employees to apply a similar approach in their own homes.

The total **energy consumption saved** during the competition timeframe was **36%.**

After the competition the company used its prize money as the third-place winner to co-finance a **2.23 kW PV system,** which cost **4,400 EUR.**

EUREMplus European EnergyManager

EUREMnext European EnergyManager

The European EnergyManager (EUREM) training programme

Map of EUREM training providers

European EnergyManager (EUREM)

The European EnergyManager (EUREM) training programme was initiated in 1999 by the Nuremberg Chamber of Commerce and Industry. Since then, the training and networking programme has grown considerably in scope and geographical coverage through various EU funded projects.

The EUREM training is now offered by about 60 training providers across **30 countries** worldwide. A partner institution is identified in each new country to customise the training to country-specific needs.

"EUREM is a truly European initiative that uses a tried and tested concept to expand its offerings globally."

More than **6,000 training participants** have benefitted from the EUREM training. These 'EnergyManagers' learn to describe technical and financial aspects of their measures in a standardised way to facilitate managerial decision making and, on average, **75% implement identified energy saving measures** following participation in the qualification.

Average impact per training participant	
Energy saving potential	750 MWh/year
Cost saving potential	30,000 €/year
GHG reduction potential	200 tCO_2/year
Investment in measures	100,000 €
Payback period	4 years

(Based on EUREM.NET EU project results)

EUREMplus (2013 - 2015)

The EUREMplus project made the EUREM training programme accessible to more businesses by bringing it to **six additional countries**: Bulgaria, Cyprus, Croatia, North Macedonia, Poland, Romania. It also helped EnergyManagers exchange knowledge and experiences and provided the basis for a **new governance structure** for the international EUREM training providers (EUREM International GmbH).

The course has continued to be offered in three of the new countries, and additional countries have joined the group in subsequent years (Belgium 2015, Slovakia 2015, Belarus 2016, Ukraine 2017).

EU contribution: €1,101,264
Grant agreement ID: 644736

Presentation of EUREM Awards at the 2018 EUREM Conference in Prague attended by 170 EnergyManagers.

EUREMnext (2018 - 2021)

The EUREMnext project will transfer the training to **six more countries** (Albania, Bosnia and Herzegovina, Estonia, Latvia, Serbia and Turkey) by establishing **national accreditation and recognition** for the EUREM training. Furthermore, it will revamp the curriculum and training materials to be more closely linked to the energy audit process and standards, as well as to cover additional up-to-date topics. It will also develop add-on implementation **support activities** for in-depth practical support on implementing measures.

EU contribution: €1,809,556
Grant agreement ID: 785032
Cordis: https://cordis.europa.eu/project/id/785032

How the GREENFOODS project continued to have an impact after the project time

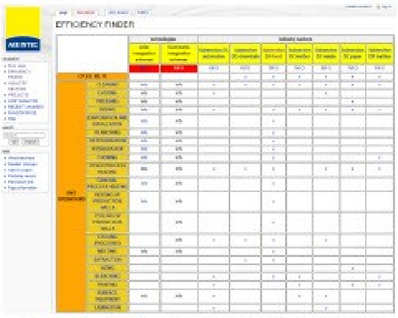
GREENFOODS

The IEE project GREENFOODS set out to foster the global competitiveness of the **European food and beverage (F&B) industry** by helping it achieve reduced production costs and greenhouse gas emissions. The project followed a clear standard and procedure on how to support SMEs in increasing their energy efficiency and uptake of renewable energy.

The **GREENFOODS branch concept** was a tool developed to help the F&B industry identify and evaluate energy efficiency measures and the uptake of renewable energy. This was supported by the **"wiki web"**, which comprises crucial information on operating units, process technologies, energy supply, energy efficiency, renewable energy and best practice examples.

GREENFOODS carried out **over 200 energy audits** and directly supported 11 F&B SMEs with the implementation of energy efficiency measures. The project also developed tailor-made **funding and financing schemes** for the European F&B industry. Further, GREENFOODS set up a **training course** with a focus on energy efficiency and renewable energy in the F&B industry and established a network of **Virtual Energy Competence Centres** (VECC) to act as one-stop-shops for all questions related to energy efficiency and renewable energy.

Project duration: January 2013 to July 2015
EU contribution: €1,495,353
Grant agreement ID: 645697
Website: https://www.aee-intec.at/greenfoods-122



Wiki Web - "Matrix of Industrial Process Indicators"
http://wiki.zero-emissions.at/

Continued use of outputs after project end

Many projects struggle to capitalise on the work they do during the project with continued impacts after the project. This may be due to a lack of a plan on how outputs will be used and maintained after the project ends. To avoid this the GREENFOODS project plan set out a **strategy for how its outputs would continue to have an impact after the project ended.**

"Every proposal should highlight what the strategy for continued impacts is and who is responsible for them. We are still using all the outputs from GREENFOODS."

The **regularly updated "wiki web"** is a free database that supports identification and decision making on energy efficiency and renewable energy in industry. Contributing the project's learnings to expand the database's subsection on the F&B industry ensures the outputs find continued use.

Several components of the training module developed by the project were **integrated into the European EnergyManager (EUREM) training programme** in some countries, which is offered by over 60 providers worldwide. This means that the GREENFOODS training is still being provided annually. The GREENFOODS branch concept tool is also included in the training and is still in use by many SMEs and reaches 400 annual downloads. It was also expanded to other industry sectors.

Energy savings triggered by GREENFOODS	
Energy saved	409 GWh/year
Renewable energy triggered	25 GWh/year
Investment in energy saving measures	61 million EUR
GHG savings	119 ktCO2/year

Source: Ricardo estimates

Beverage factory conveyor belt

CANTINA SANTA MARIA LA PALMA

tesla
Transfering
Energy Save
Laid on Agroindustry

The IEE project TESLA helped the Santa Maria La Palma winery reduce their energy consumption by 2.93 GWh/year and encouraged them to invest almost € 2 million in energy efficiency measures

TESLA

The objective of the TESLA project was to **extend best available practices** for the evaluation of energy efficiency and the adoption of measures aimed at improving energy efficiency amongst European SMEs in the **agrifood sector**. The project particularly focused on wineries, olive oil mills, animal feed factories, and fruits and vegetables processing plants.

For the fulfilment of this main goal, staff from the project partners were **trained in Energy Auditing**. The knowledge and practice acquired during the training courses and during the execution of the energy audits have contributed to **capability building and skills acquisition** throughout the sectors in the targeted countries.

In Italy some **synergies arose with the national policy** of boosting renewable energy, and some cooperatives took advantage of the work of auditors in order to assess the installation of Solar PV panels in their facilities.

Project duration: March 2013 to March 2016
EU contribution: € 1,570,318
Grant agreement ID: 644752
Cordis:
https://ec.europa.eu/energy/intelligent/projects/en/projects/tesla

Inverters and electrical cabinets of the PV plant and new building wing with thermal insulation on the roof at Santa Maria La Palma

Santa Maria La Palma sc

The **Santa Maria la Palma Winery** is an Agricultural Cooperative Company based in the hamlet of Santa Maria La Palma, in the municipality of Alghero. The winery oversees the collection, processing, transformation and marketing of **over 700 hectares of vineyards** and has approximately 300 members.

During the TESLA project, the cooperative was **audited by technicians**, resulting in a report with the results of measurements, the analysis of flow production and total electrical and thermal consumptions, and proposals for energy saving solutions. The cooperative also participated in meetings with key actors organised by auditors.

"We have learnt many lessons including greater awareness of the cooperative's potential to improve from a consumption, management and productivity point of view. Also, staff are more aware of these issues- at all levels from production to management"

Following the audit, the company constructed a new building wing with **thermal insulation** and self-ventilation, as well as **LED lighting** and servers with thermal self-regulation. A **photovoltaic plant** for self-consumption of electricity and a **heat pump** for reuse of hot air were also installed.

Equipment on the bottling line was also replaced to enable **higher productivity at lower energy consumption**. Finally, lightning rod systems were installed to protect the electrical equipment in the cooperative.

***Santa Maria La Palma* savings due to TESLA**	
Energy saved	2.93 GWh/year
Investment	1,905,000 €
Payback time	5 years
Year of implementation	2014-2015

RICARDO
tesla
Transfering
Energy Save
Laid on Agroindustry
CANTINA SANTA MARIA LA PALMA
European Commission

GETTING IN TOUCH WITH THE EU

In person

All over the European Union there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: https://europa.eu/european-union/contact_en

On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

– by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),

– at the following standard number: +32 22999696, or

– by email via: https://europa.eu/european-union/contact_en

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: https://europa.eu/european-union/index_en

EU publications

You can download or order free and priced EU publications from: https://op.europa.eu/en/publications. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see https://europa.eu/european-union/contact_en).

EU law and related documents

For access to legal information from the EU, including all EU law since 1952 in all the official language versions, go to EUR-Lex at: http://eur-lex.europa.eu

Open data from the EU

The EU Open Data Portal (http://data.europa.eu/euodp/en) provides access to datasets from the EU. Data can be downloaded and reused for free, for both commercial and non-commercial purposes.

EA-03-21-101-EN-N

Publications Office
of the European Union

ISBN 978-92-9460-432-3