European Commission

EEFIG

ENERGY EFFICIENCY
FINANCIAL INSTITUTIONS GROUP

Further improvements of energy efficiency in industry

Final report

UN environment programme | finance initiative

EUROPEAN COMMISSION

Directorate-General for Energy
Directorate B: Just Transition, Consumers, Energy Efficiency & Innovation

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LAUNCH AND FACILITATE THE IMPLEMENTATION OF A NEW EEFIG WORKING GROUP ON "FURTHER IMPROVEMENTS OF ENERGY EFFICIENCY IN INDUSTRY"

FINAL REPORT

4TH MARCH 2022

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ENERGY EFFICIENCY in Industrial Processes

COWI

Manuscript completed in 2022

PDF	ISBN 978-92-76-58460-5	doi: 10.2833/91030	MJ-04-22-160-EN-N

Luxembourg: Publications Office of the European Union, 2022

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ABBREVIATIONS

B2B	Business to Business
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CMVP	Certified Measurement and Verification Professional
DEEP	EEFIG De-risking Energy Efficiency Platform
EC	European Commission
EE	Energy Efficiency
EED	Energy Efficiency Directive
EEFIG	Energy Efficiency Financial Institutions Group
ELENA	European Local Energy Assistance (Facility)
EII	Energy Intensive Industry
ESCO	Energy Service Company
ESG	Environmental, Social and Governance
ETS	Emission Trading System
GHG	Greenhouse Gas
ISO	International Organization for Standardization
MFF	Multi-annual Financial Framework
MS	Member State
PF4EE	Private Finance for Energy Efficiency
SME	Small and Medium Enterprise
RRF	Recovery and Resilience Facility
TJ	Terajoule
WG	Working group

Executive summary and policy recommendations

European and global energy and climate policies are having an important impact on all aspects of our economy. All end-use sectors must identify and invest in both energy efficiency measures and renewable energy sources if Europe is to achieve carbon neutrality by 2050 and meet its long-term Paris climate objectives. Europe's industry is being called upon to play a key role. Europe's industry is complex with globally recognised energy-intensive industries and about 25 million small and medium-sized enterprises. Given the complexity of the sector, there are no simple solutions that fit all.

A working group on Industry was set up under the third phase of EEFIG in order to better assess the complex array of industrial practices dealing with energy efficiency, identify and assess the main obstacles and drivers for improving energy efficiency in industry (energy-intensive, non-energy intensive and SMEs), develop a portfolio of best practices examples on driving investments and overcoming obstacles, and provide recommendations to the European Commission and other stakeholders on what tools and policy instruments are likely to be most effective for increasing the energy efficiency investments in industry. The working group builds on the work of the first two phases of EEFIG, that included important recommendations in the EEFIG 2015 report on how to accelerate investments in energy efficiency in industry.

The policy context has changed significantly with the EU becoming much more ambitious in its efforts to meet its Paris climate obligations through the European Green Deal and the recently published 'Fit for 55' package. Achieving energy efficiency improvements, reducing GHG emissions and decarbonising industry becomes a higher priority. Importantly, the New EU Industrial Strategy (March 2020 and updated in May 2021) seeks to balance the objectives of a globally competitive and world-leading industry and an industry that paves the way to climate-neutrality by a number of initiatives supporting industry on their path towards climate neutrality. In March 2020, the EC adopted a new Circular Economy Action Plan – one of the main blocks of the European Green Deal. The action plan includes both legislative and non-legislative measures. In November 2019, the High-Level Group on Energy-intensive Industries developed a Masterplan to advise the Commission on the enabling policy framework needed to manage the transition to low-emissions while keeping industry competitive.

The policy context shows that industry is on a path of climate neutrality, as part of the policy framework of the European Union, led by the European Green Deal. Becoming more energy efficient is a key starting point. Becoming more energy efficient and climate neutral may come at a cost. But it is more complicated than simply handing over money to companies. There is a need to understand the technical and decision-making dynamics as well as the priorities that companies must apply to stay competitive.

Energy-intensive industries

Energy intensive industries (EII) are increasingly looking at "deep decarbonisation" and make major changes in their production and their carbon footprint, primarily through a combination of improved energy efficiency, renewable energy, electrification, new products, circular business models, and any other means to decarbonise.

Industries are willing to go that way but seek partnerships with the EC and national governments on stable long-term policy frameworks, markets for new low carbon products, access infrastructure for renewable energy (electricity, hydrogen and biogas), grants supporting technology innovation, and a levelled playing field for products with international.

Small and Medium-sized Enterprises

SMEs generally understand that there is a need to improve their competitiveness through energy efficiency improvements, but they face many factors that lead to inertia. Typically, small-sized and non-energy-intensive industrial SMEs do not have enough capacity and capital to work with energy efficiency improvements and are thus in need of a more supportive approach from intermediaries such as external experts.

SMEs, however, lack of capacity to build a business case on any possible energy efficiency measure that they can take to financial institutions and funding sources. Concerns about financing have been exacerbated in the current Covid-19 crisis, with SMEs reluctant to take on any more debt. The uncertainty of future energy trends, also proven by the recent rises in natural gas and petroleum, have motivated SMEs to reduce their energy consumption to avoid profit losses.

Financial institutions

Since industry needs a steady flow of financing to meet its long-term energy and climate obligations, financial institutions (both private and public) are central to the energy and climate strategy. FIs provide an important signal to industry when they actively participate in climate and clean energy financing initiatives. With the EU sustainable finance strategy and the implementation of the action plan on financing sustainable growth, Financial Institutions will increasingly look to the EU Taxonomy in their engagement with corporate clients.

In contrast to renewable energy financing, industrial energy efficiency does not allow for large scale asset backed financing but tend to be embedded in corporate balance sheet-based lending programs and therefore a corporate risk rather than a project risk. While, FIs have been expanding their services, investors do not perceive the profitability of energy efficiency measures to a high extent, as they do not increase the investment's cash flows directly, discouraging them from stirring their capital to such kinds of investments. Market-leading banks have a plethora of green products, such as Green Loans, but this does not apply to smaller, regional banks that SMEs usually do business with.

Summary of recommendations

Chapter 5 provides the full list of recommendations from the Working Group to industry, Member States, EU institutions and financial institutions. The key ones that need immediate attention are:

Industry should implement Energy Management Systems (EMS), audits and identified projects, engage with governments on stable long-term frameworks for ambitious climate commitments, and use available EU funding vehicles for low-carbon technology development and roll-out:

- Monitor and manage their energy consumption using Energy Management Systems (such as ISO 50001 standards), conduct energy audits, and implement recommendations of such audits.
- Engage with EC and Member States authorities on stable framework conditions, markets for new low carbon and bio-based products, support for measures to improve their energy performance, and access to infrastructure that can enable electrification through sector organisations.
- Use the EU ETS and EU funding opportunities with grants supporting technology innovation (Horizon Europe, Innovation Fund, etc.) as a strategic tool for the carbon-neutral energy transition.

Member States should engage with industry on the long-term framework for decarbonisation, provide targeted support, and embed EE 1st in public procurement decisions:

- Develop partnerships with business and sector associations on decarbonisation, such as voluntary agreements, to ensure they work towards meeting the long-term climate and energy objectives.
- Develop support programmes to facilitate the uptake of cost-effective measures identified in mandatory audits and energy-intensive industrial SMEs.
- Support development of markets for green products including through green public procurement.

EU institutions should continue to embed EE 1st principles into climate and energy policies, support R&D in innovative technologies for EII, support dedicated business models for SMEs, and support development of industry sector roadmaps for climate neutrality:

- Continue to ensure that the 'Energy Efficiency First' principle is integrated into relevant climate and energy policies as an element in the broader decarbonization policy framework.

- Keep contributing to R&D investment in energy efficiency technologies in industry sectors where solutions for deep decarbonisation are not yet commercially available

- Keep contributing to develop innovative business models facilitating the market uptake of energy efficiency measures and renewables within SMEs in the industry and services sectors.

- Support the development of sector specific industrial roadmaps for climate neutrality at European level as well as to encourage their adoption and implementation at local level by mobilising relevant stakeholders.

Financial institutions should embed EE 1st principles in lending policies, integrate EE in risk assessment and product development, and use available de-risking tools to support EE financing market development:

- Give priority to energy efficiency investments - in industry as well as buildings - in support of the strategy for sustainable finance and the Energy Efficiency First principle.

- Systematically evaluate the benefits of EE projects in their risk assessments of industrial clients and provide their clients dedicated energy efficiency finance lines.

- Use EEFIG tools like the underwriting's toolkit[1] and DEEP database[2] and participate in de-risking projects to show commitment to improved energy efficiency and to show that EE investments can be sound financial investments.

[1] https://ec.europa.eu/eefig/going-activities_en#ecl-inpage-106

[2] https://deep.eefig.eu/

1 Introduction

This Final Report is prepared in the context of the assignment "Launch and facilitate the implementation of a new EEFIG Working Group on Further improvements of energy efficiency in industry".

The report is structured as presented in Table 1-1 below:

Table 1-1 Report structure and content overview

CHAPTER	CONTENT
Executive summary and policy recommendations	› A separate executive summary.
Chapter 1 – Introduction	› An introduction to the scope and background for the working group.
Chapter 2 - Results of the EEFIG working group	› A description of the work of the working group, with milestones and presentation of the meetings.
Chapter 3 - Trends, obstacles and drivers for increasing energy efficiency investments in industry	› An updated assessment of the main trends, obstacles and drivers for increasing energy efficiency investments in industry.
Chapter 4 – Best practices for increasing energy efficiency investments in industry	› A collection of best practices in the field and an assessment of their potential for being replicated.
Chapter 5 - Conclusions and recommendations	› The conclusions and the recommendations of the working group.
Appendix A, PowerPoint presentation	› A PowerPoint presentation of the main results, conclusions, and recommendations.
Appendix B, Composition of the working group	› The composition of the working group.
Appendix C, Data on which the analysis is based	› The Background Paper for the first WG meeting, which includes an overview of the EIIs, SMEs and non-energy intensive industries in EU and the related policy framework at EU and MS level.

The positions expressed in this report do not necessarily claim or represent the positions of each of the Institutions that Members of the Working Group belong to. Rather, the report constitutes a consensus description of the ongoing work.

1.1 Scope and background for the working group

Purpose of the working group

A working group on Industry was set up under the third phase of EEFIG, similar to other working groups on a range of topics. The aim of the working group is to assess the industrial practices dealing with energy efficiency, identify and assess the main obstacles and drivers for improving energy efficiency in industry, identify best practices, and provide recommendations to DG ENER on what tools and policy instruments are likely to be most effective for increasing the energy efficiency investments in industry. This objective was confirmed at the first working group meeting in July 2020 and is unchanged from the request for services. The working group has addressed various aspects of energy efficiency within energy-intensive industries and industrial SMEs and non-energy-intensive industries.

In its 2015 report[3], EEFIG identified many of the barriers to the long-term financing for energy efficiency and proposed policy recommendations and market solutions to them. The purpose of the EEFIG is to get the financial institutions and other relevant stakeholders to help find ways to overcome the investment blockage. There is financing available, but banks have poor capacity and interest to finance energy efficiency, and consumers (in this case industry or businesses or institutions) are reluctant to decide to undertake such measures. While there are some investments, they are not at a scale that will have a real impact that is needed to meet our long-term objectives. The working group looked into these issues.

Against this background, the key objectives of the WG have been to:

- Identify and assess the main obstacles and drivers for improving energy efficiency industry (based on the already extensive literature on barriers to industrial efficiency and the real-world experience of WG members);
- Identify best practices, their key features and possible obstacles they have to face, assessing the potential to replicate them under which circumstances; and
- Formulate both general and specific recommendations on what tools and policy instruments are likely to be most effective for increasing energy efficiency investments in industry.

The exchange within the working group was based on six half-day meetings, which because of the Covid pandemic, were held online. The working group did not seek to add to the already extensive literature on barriers to industrial efficiency. Rather, it summarised their conclusions and utilized the real-world experience of its members to identify potential solutions and draw a roadmap to the deployment of these solutions. This resulted in a set of actionable recommendations for the Commission, financial institutions, industry stakeholders and Member States. It is hoped

[3] http://www.eefig.com/index.php/the-eefig-report

that these findings will also provide a source of insight for providers of energy services to industrial companies, and for advocates within industrial companies seeking to develop more ambitious, impactful projects.

Composition and work of the working group

There was a call to all members of EEFIG to see whether they wanted to participate in this working group. At the same time, other relevant stakeholders were identified and encouraged to join.

The members of the working group came from various stakeholders concerned about improving energy efficiency in industry: the financial community, industry representatives, technology and service suppliers, academics and policy analysts.

There were normally over 40 regular participants at the WG meetings showing the strong interest in the topic. The list of WG members is included in Appendix B.

After almost two years of activity, including holding six half-day thematic meetings the work programme has concluded with this final report which documents the activities of the Working Group.

The report builds on key themes around energy-intensive industries, SMEs, accelerating investments in the context of the EU recovery package, the role of financial institutions, mechanisms, and instruments in financing industrial energy efficiency and analysing the multiple benefits of energy efficiency and how they impact on corporate decision-making.

There is an updated assessment of the main trends, obstacles and drivers for increasing energy efficiency investments in industry. While these have been assessed for decades, it is important to regularly go back to them, since the context changes. Also, with new policies and new policy tools, the drivers evolve.

There is also a growing wealth of best practice examples for increasing energy efficiency investments in industry. Some of these come from national policies and industry initiatives, some from financial institutions, while some come from projects funded or co-funded with the EU funds. It is important to see how they can be replicated or built upon for next generations of measures.

The report finishes with conclusions related to the various themes discussed throughout this phase of the Working Group and provides recommendations to industry, Member States, EU institutions and financial institutions. Hopefully these conclusions and recommendations will build on the strength of EEFIG as a platform for open and constructive dialogue amongst the major stakeholders.

The thematic focus of the six WG meetings

The scope of the WG topic is complex covering the range from large Energy Intensive Industries (EIIs) as well as Small and Medium Enterprises (SMEs), the role of financial institutions, mechanisms, and instruments in a sector where most investment financing is through a combination of equity and corporate loans rather than asset based, the role of non-energy costs and benefits in decision processes, as well as the role of national and EC incentive schemes and funding opportunities including the RRF.

Against this background the WG process was structured around a series of thematic meetings with context specific inspirational presentations and discussion of the specific issues.

The timeline, WG meetings and reporting milestones for this EEFIG WG are shown in the table below.

Table 2-2 WG Timeline and key milestones

ACTIVITY	TIMING	THEMATIC FOCUS
Inception Report	20 March 2020	Framing the scope of the working group
1. WG Meeting	15 July 2020	360-degree review of financing industrial energy efficiency
2. WG Meeting	1 October 2020	Energy efficiency investments in Energy Intensive Industries
First Interim Report	19 November 2020	Presenting the working group and the outcome of the first working group meetings
3. WG Meeting	5 February 2020	Accelerating industrial EE in the context of the EU Recovery Package
Second Interim Report	20 February 2021	Reporting on intermediary results and detailing next steps
4. WG Meeting	5 May 2021	Energy Efficiency in SMEs
5. WG Meeting	23 September 2021	The role of financial institutions, mechanisms, and instruments in financing industrial energy efficiency
Draft Final Report	20 October 2021	Reporting on the results of the working group, its conclusions and recommendations
6. WG Meeting	16 November 2021	Multiple (non-energy) benefits of industrial energy efficiency & Review of conclusions and recommendations of the working group
Final Report	20 December 2021	Reporting on the results of the working group, its conclusions and recommendations

1.2 The policy context for industrial energy efficiency

Policy framework

The policy framework at the EU and national levels is important for driving forward actions to increase the investments in improved energy efficiency in industry. This framework has evolved significantly in the past two decades as the EU and national governments raise the level of ambition to address important energy, climate, sustainability and competitiveness objectives. Now with its 'Fit for 55' package, the European Commission has raised the level of ambition even more.

The "Fit for 55" package proposes many revisions to current directives and other policy initiatives. For industry, the main changes were in the draft changes to the Energy Efficiency Directive[4].

The new proposal includes several important changes for industry:

- Enterprises with an average annual consumption higher than 100TJ of energy over previous 3 years are to implement an energy management system;
- Enterprises with an average annual consumption higher than 10TJ of energy over previous 3 years (that do not implement energy management system already) are subject to an energy audit. Energy audits are to be carried out every 4 years in an independent and cost-effective manner by qualified or accredited experts;
- The results of the audits must be transmitted to management of the enterprise, and they are to be published in the enterprise's annual report, where applicable;
- Member States are to establish transparent and non-discriminatory minimum criteria for energy audits including those carried out as part of Energy Management Systems (two new minimum criteria are set out: identify energy efficiency measures to decrease energy consumption; and identify the potential for cost-effective use or production of renewable energy);
- Member States shall develop programmes to encourage SMEs that are not subject to an energy management system or energy audit to undergo energy audits and the subsequent implementation of the recommendations; and
- Member States may set up support schemes for SMEs, including if they have concluded voluntary agreements, to cover costs of an energy

[4] The current EED has primarily regular mandatory energy audits for large companies, promotion of energy management systems and encouragement of support for SMEs.

audit and of the implementation of highly cost-effective recommendations.

These must also be put in the context that the EU Emissions Trading System (EU ETS) has been strengthened for large industry. The fourth phase which began in 2021 is designed to help the EU meet its 2030 GHG emissions targets to comply with the Paris Climate Agreement.

In 2019, the European Commission presented the European Green Deal[5]. It sets the ambition of making the EU climate neutral by 2050. The European Green Deal provides a roadmap with actions to boost the efficient use of resources by moving to a clean, circular economy; and restore biodiversity and cut pollution. Furthermore, the European Green Deal outlines the additional investments needed to achieve climate neutrality by 2050 and EU financing tools available and explains how to ensure a just and inclusive transition.

In January 2020, the Commission presented its European Green Deal Investment Plan[6]. The European Green Deal Investment Plan will mobilise EU funding and create an enabling framework to facilitate and stimulate the public and private investments needed for the transition to a climate-neutral, green, competitive and inclusive economy. The plan is to mobilise at least €1 trillion of sustainable investments over the next decade.

In March 2020, the Commission presented, in the context of the European Green Deal, its proposal for the EU Climate Law[7] that proposes a legally binding target of net zero greenhouse gas emissions by 2050, and the intermediate target of reducing net GHG emissions by at least 55% by 2030.

Research is important, particularly related to innovation in new technologies and techniques. For EIIs, much is co-ordinated through a public-private partnership, Processes4Planet Partnership[8] , an EC supported partnership which aims at circularity and an extensive decarbonisation of European process industries, with a strong focus on competitiveness.

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[5] COM (2019)640 final

[6] https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_24

[7] Proposal for a Regulation establishing the framework for achieving climate neutrality and amending Regulation 2018/1999 (European Climate Law), COM (2020) 80 final.

[8] A.SPIRE is the European Association which is committed to manage and implement the Processes4Planet co-programmed Partnership. It represents innovative process industries, 20% of the total European manufacturing sector in employment and turnover, and more than 170 industrial and research process stakeholders from over a dozen countries spread throughout Europe. A.SPIRE brings together cement, ceramics, chemicals, engineering, minerals and ores, non-ferrous metals, pulp and paper, refining, steel and water sectors, several being world-leading sectors operating from Europe. See https://www.spire2030.eu/.

For broader sustainable policies, the New EU Industrial Strategy[9] (March 2020 and updated in May 2021) seeks to balance the objectives of a globally competitive and world-leading industry and an industry that paves the way to climate-neutrality by a number of initiatives supporting industry on their path towards climate neutrality. In March 2020, the EC adopted a new Circular Economy Action Plan[10] – one of the main blocks of the European Green Deal. The action plan includes both legislative and non-legislative measures. In November 2019, the High-Level Group on Energy-intensive Industries developed a Masterplan to advise the Commission on the enabling policy framework needed to manage the transition to low-emissions while keeping industry competitive.

At the Member State level, there are many types of policies related to industry. These include voluntary agreements, promotion of energy efficiency networks, funding, technical support from national energy agencies and many more.

Financial incentives

As lack of capital often is considered as a key-barrier towards increasing energy efficiency in the industrial sector, financing schemes and ways of de-risking investments are often seen as important initiatives to stimulate greater investments in this area.

While more funding is necessary for the industrial sector, there are many mechanisms in place and there are new funding sources through the EU that will be able to provide support. Below in Chapter 4 there are some excellent best practice examples on how to increase investments. Here it is useful to give an overview of the types of funding used to support industry.

The European Union has several initiatives to increase investments in energy efficiency in industry.

The European Investment Bank provides loan and guarantee instruments for energy efficiency including for industrial projects, particularly for SMEs. The 2019 revision of the EIB's energy lending policy[11] states that energy efficiency investments in buildings and industry represent approximately three-quarters of the total energy investment required in the period 2021-30, equal to EUR 281 billion per year, so there is still a significant unrealised potential. The instruments include lending through the PF4EE initiative and the ELENA programme. Many relate to ESCOs that play an important intermediary role towards industry and with Energy Performance Contracts.

[9] https://ec.europa.eu/growth/industry/policy_en

[10] https://ec.europa.eu/environment/strategy/circular-economy-action-plan_en

[11] European Investment Bank, EIB ENERGY LENDING POLICY, 14 November 2019, p. 10.

The EU Innovation Fund[12] is one of the world's largest funding programmes for the demonstration of innovative low-carbon technologies. It will provide around EUR 20 billion of support over 2020-2030, depending on the carbon price, for the commercial demonstration of innovative low-carbon technologies, aiming to bring to the market industrial solutions to decarbonise Europe and support its transition to climate neutrality. The goal is to help businesses invest in clean energy and industry to boost economic growth, create local future-proof jobs and reinforce European technological leadership on a global scale.[13]

Further to these, other EU funding and de-risking instruments are available under the MFF 2021-27 for industrial decarbonisation from pilots and demos under Horizon Europe over scale-up under the LIFE programme to Roll-out under Invest EU, RRF (subject to inclusion in national Recovery and Resilience Plans), and ERDF & CF (subject to inclusion in the Operational programmes). The mechanisms have a strong focus on SMEs and process innovation for EEIs. For EEIs, the funding is often through the public private partnership of Processes4Planet which leverages private funding together with Horizon Europe support.

[12] https://ec.europa.eu/clima/policies/innovation-fund_en

[13] The EU Emissions Trading System (EU ETS), the world's largest carbon pricing system, is providing the revenues for the Innovation Fund from the auctioning of 450 million allowances from 2020 to 2030, as well as any unspent funds from the NER300 programme.

2 The work of the EEFIG working group

2.1 The 1st WG meeting – 360-degree review of financing industrial energy efficiency

The first WG meeting was held on 15 July 2020 and focussed on scoping on the priorities for the Working Group throughout this phase of EEFIG.

The first WG meeting included a 360-degree review of financing industrial energy efficiency covering the perspective of end-users in both energy-intensive industries and non-energy-intensive industries, both larger enterprises and SMEs, the perspective of technology providers and solution providers, the perspective of financial institutions, the perspective of analytical/academic environment and finally the perspective of the policy makers.

In terms of format and content of future WG meetings, the first WG meeting showed that:

- It is important to have a tour-de-table so that everyone can express who they are and why they are interested in the working group.
- The 360-degree review of the problem was a valuable exercise allowing the issues at stake to be viewed from all angles.
- The format of the meeting should ideally balance short presentations with practical examples and longer discussions.
- A brief issues paper shall again be sent out prior to the next meetings.
- WG meeting conclusions should be framed for easy communication.

It is important to note that the meeting confirmed there are major obstacles that are holding back investments in energy efficiency, especially given the need to accelerate investments to meet the ambitious aims of the European Green Deal. It was also expressed that industry have many issues to contend with, from improved competitiveness to decarbonisation. The obstacles are different for EEIs and SMEs and are often different within those broad categories. Energy efficiency, understandably, will play a different role and has to be seen in the broad context. There are no simple solutions and all stakeholders, including the financial sector, have a role to play to mitigate GHG emissions, as much as possible through improved energy efficiency.

The discussion also gave an important perspective for how the remaining four WG meetings should move forward. The following sections show the progression of the discussions through the WG meetings.

2.2 The 2nd WG meeting – Energy Intensive Industries

The second WG meeting was held on 1 October 2020 with focus on financing measures in energy intensive industries. A total of 37 WG members and alternates participated.

The central theme for the WG meeting 'Energy efficiency in the energy-intensive sectors' was structured in a presentation of the main points, followed by four strong presentations by key industry representatives (SPIRE, the European steel industry, a European cement producer and a European dairy products producer), and a discussion session. This WG took place knowing that much of Europe's energy-intensive industry is covered by EU Emissions Trading Scheme (EU ETS) and have a requirement to undertake regular mandatory audits under the Energy Efficiency Directive. Nevertheless, there are still issues and obstacles that need to be discussed, especially given the importance of this industrial sector in Europe's economy.

The following cross-cutting conclusions on energy efficiency in the energy-intensive sectors emerged from the meeting's presentations and discussions:

- Energy intensive industries are increasingly looking at "deep decarbonisation" and make major changes in their production and their carbon footprint, through a combination of energy efficiency, renewables, electrifications, new products, circular business models, etc.

- Industries are willing to go that way but seek partnerships with the EC and national governments on stable long-term policy frameworks, markets for new low carbon products, access infrastructure for renewable energy (electricity, hydrogen and biogas), grants supporting technology innovation, and a levelled playing field for products with international competition.

- Such partnerships and mutual commitments between governments and industries can create a framework for deep decarbonisation combined with long term competitiveness that facilitates access to long term commercial financing for green transition.

This WG discussed conclusions and recommendations in relation to EII that are expressed below in Chapter 5.

2.3 The 3rd WG meeting – Accelerating industrial EE in the context of the EU Recovery Package

The third WG meeting focussed on opportunities for accelerating industrial energy efficiency investments in the context of the EU recovery. A total of 45 members, alternates and observers participated.

The post-Covid Recovery and Resilience Facility entered into force in February 2021 after being approved late 2020. It was important for this WG to discuss how recovery can be accelerated using newly-available EU funding and own sources. The discussions around the central theme for the WG meeting 'accelerating industrial energy efficiency investments in the context of the EU recovery ' were structured in two roundtable discussions; the first on "What is there for industry in the EU recovery package, what are the potential accelerators" including DG GROW, Triple-A (H2020 project on EE investment) and INVEEST (French capacity building on EE); the

second on "How can financing sector unlock investments in industrial energy efficiency" including the European Investment Bank (EIB), CIVIESCO (Italian ESCO), and MAC Energy & Water (consultant).

The first roundtable concluded that potential concerning financing of industrial energy efficiency projects under the recovery mechanisms remain uncertain based on an initial review of the draft Recovery and Resilience Plans. It was also discussed that acceleration of private investment funding for industrial energy efficiency may require capacity building for Bankers, CEOs/CFO and industry partners on the financing of energy efficiency and low carbon projects.

The second roundtable on the role of financial institutions to unlock investments was very encouraging. EIB has successfully scaled up its funding of energy efficiency which of now is the largest energy lending sector for EIB. In this context, the 2019 EIB energy lending policy differentiates between large companies (financing larger plant conversions of long-term clients in EEIs) and SMEs (risk sharing mechanisms and guarantees as financing is never enough due to limited capacity to develop projects and less borrowing capacity). It was also noted in the context of the recovery, that most Energy Intensive Industries have been less affected by the pandemic than other sectors.

It was discussed that the One Stop Shop approach, which is very well developed for building renovation (in particular for the residential sector) could help SMEs in the complex energy efficiency financing journey from audits to financing and implementation. Furthermore, the role of ESCOs was discussed and a best practise example from Italy of the relationship between one ESCO and its parent bank was highlighted as a model that shows potential for replication throughout Europe.

Finally, it was discussed that the European Green Deal is shifting lending priorities towards broader and deeper long-term decarbonisation of industry and that energy efficiency financing for industry increasingly has to be seen in this context. It was agreed that these should be discussed in future WG meetings.

Importantly, concerns about financing investments in SMEs were raised many times in the meeting and participants expressed the importance in focussing solely on SMEs in the next meeting since there were many obstacles to be addressed and many best practice examples that could play an important role in the future.

2.4 The 4th WG meeting – Energy Efficiency in SMEs

The 4th WG meeting continued the WG's work to assess obstacles, identify best practises for financing energy efficiency investments in SMEs and provide recommendations for improving the policy framework. There were two main problems that were addressed:

- How to encourage energy audits and EMS in SMEs
- How to foster investments in EE measures in SMEs

To set the context for the meeting, the Institute for Energy Efficiency in Production (IEEP) presented a short overview of the challenges for Small and Medium Enterprises (SMEs) regarding financing energy efficiency and EU-Framework based on research undertaken in Germany.

The European Network of National Energy Agencies Industry and Enterprises WG presented the main challenges in policy making and implementation when it comes to SMEs. Two new methodologies to assess SMEs energy consumptions at Country levels have been introduced in support of policy makers of nine EU Countries.

As stated in the meeting, SMEs are important to the European economy and jobs creation. SMEs predominantly finance their investments in EE through equity. The investment decision criteria for SMEs are investment sum, energy saving and lifecycle cost whereas return is less important. Leaders decide on whether to act, whether to invest. The smallest companies are less satisfied with and have less uptake of support schemes than other SMEs. At the same time SMEs are often suppliers to large companies and therefore affected by the decisions of large companies to decarbonise including in their supply chain.

From the discussions concerning how to encourage more energy audits and how to foster more investments in energy efficiency in SMEs, it was stressed that the narrative around energy audits needs to move from energy audit to climate & energy audit. Furthermore, many non-technical barriers such as lack of time, lack of information, lack of trust in potential results, low energy costs, and lack of access to finance have to be addressed, the Energy Efficiency Networks is one possible answer. The experience shows that the full energy efficiency potential could be found when combining energy efficient technology implementation with successful energy management practices and enhanced knowledge of the SME energy end-using processes.

There was broad agreement that standardisation, aggregation and easy access to knowledge are key parts of the solution. Many EU projects/initiatives like Energy as a Service (EaaS), SEAF (standardised project processing) and eQuad (matchmaking for investors) and LAUNCH (sustainable energy assets as tradable securities) show innovative solutions and promising results for SMEs.

However, market drivers pushing SMEs to act are also needed. It was discussed that the most likely market drivers are higher CO2 prices, pressure from larger customers through the supply chain, and pressure from smaller customers and other stakeholders for climate action. Furthermore, product passports will be more in the focus in the future (initially for batteries but possibly for other products, see the Sustainable Product Initiative of the EC) and has the potential to motivate SMEs to make more in terms of EE and decarbonisation.

2.5 The 5th WG meeting – Financing industrial energy efficiency

The fifth WG meeting focused on the role of financial institutions, mechanisms and instruments in financing industrial energy efficiency.

Findings from previous WG meetings on energy intensive industries (2nd WG) and SMEs (4th WG) were incorporated into the planning of the WG meeting, in particular the idea that the options available for financing industrial energy efficiency depend strongly on (i) the energy intensity of the industrial process in question, and also (ii) the size of the host organisation. Participants were invited to complete a simple exercise in advance of the WG meeting to capture their views on the availability and accessibility of finance for small and large industrial firms in both EI and non-EI categories. This was achieved via an online canvas that formed the basis for discussions during the WG meeting.

The aims of the WG meeting itself were:

- to capture and characterise the financing solutions that are available to industrial energy users seeking to improve energy efficiency, and the opportunities and challenges that relate to each;
- to discuss how flows of capital into industrial energy efficiency might be increased, and the business models and financing mechanisms that will enable this.

To begin the discussion, the consultant presented a short overview of the results of the pre-workshop exercise, which indicated:

- Companies across all segments tend to use their own funds for industrial energy efficiency, limiting the size, scope and depth of impact that these measures can achieve.
- Industrial SMEs may only have access to their own funds and bank credit lines, depending on their creditworthiness.
- Larger companies have more options for access to finance and services but may have additional constraints around balance sheet treatment.
- Larger firms have more mature investment appraisal procedures and they have a lower internal cost of capital.
- Asset-based finance is available for some EE technologies via vendor finance schemes etc, and more energy-intensive SMEs may be able to secure finance against big-ticket assets.

The WG participants then heard from a small number of presenters. Representatives of a private financial institution, a public financial institution and an industrial energy user reflected on the market for financing of industrial energy efficiency and broader green transition.

- Natixis (FR) presented their Green Weighting Factor (GWF), an in-house mechanism that links capital allocation to the degree of sustainability to facilitate long term alignment with the Paris agreement. The tool supports individual lending decisions and also helps measuring the analytical portfolio risk and assessing climate risk. It is used for product development and for client engagement, where all clients now have both a credit rating and an environmental rating (7-point scale from brown to green).

- EIB explained that EE in industry is more developed than other sectors but that a significant residual potential exists in SMEs and in less energy intensive industries. Industrial EE is less standardised than EE in buildings and for industrial EE an energy audit is always needed for the specific situation. He noted that a well-planned ESCO tender requires some engagement with market participants prior to the tender and furthermore requires relatively long contract durations. Both are often a challenge for public authorities. Finally, he underlined that although ELENA was initially targeted to public authorities, it can now also be used with private counterparts and for EE in industry. Furthermore, the PF4EE program can be used for industrial EE.

- Torrecid (ES) outlined the business of the Torrecid group in mainly energy intensive sectors. The decarbonisation approach of Torrecid is based on energy efficiency including heat recovery, clean fuels and innovation on industrial processes. Energy efficiency is important, and many small actions are implemented each year, with all investments internally financed from the company's own sources.

The WG participants then conducted two round-table discussions:

- The first discussion focused on business models that provide access to finance for industrial energy efficiency. The group discussed how the business models needed to implement radical decarbonisation of EII may need to extend beyond energy efficiency and are highly specialised in scope. This sector may be best served by 'servitised' models and a number of examples were discussed. There was general agreement that the SME sector is very hard to reach, and that going beyond simple asset-based lending instruments is an area that requires further innovation. 'As-a-service' models are also relevant here, but should take into account the particular needs of SMEs and the higher cost of underlying finance.

- The second discussion considered how greater flows of third-party investment into industrial energy efficiency could be facilitated. Accepting that business model innovation is needed, the participants also highlighted the need for the underlying finance to be cheaper and more accessible. This presents a clear role for governments and public agencies to provide credit support and guarantees to create a more active market for industrial energy efficiency. There was agreement that the objective should be to offer cash-neutral decarbonisation solutions to industrial SMEs so they can continue to invest in their core

business, noting that the energy efficiency interventions needed are likely to have relatively long return on investment periods (perhaps 7 years or longer) as it is no longer sufficient to address only 'low hanging fruit' projects. In addition, stimulating demand for low carbon industrial products will help to boost the business case for investment in decarbonisation in industrial firms of all sizes.

2.6 The 6th WG meeting – Multiple benefits of industrial energy efficiency

The 6th and final meeting of the WG had the theme of the role of multiple benefits in investment decisions for industrial energy efficiency. Multiple benefits have grown increasingly important and EEFIG had one working group (SR09) dedicated to the topic. However, given the resources, that WG restricted itself to issues related to buildings. The theme for this 6th meeting allowed us to start general and then quickly move to discuss what drives industrial EE investments, what role does multiple benefits play in industry, and what can be done to activate knowledge about these benefits and get them integrated in the investment decisions.

There have been efforts to analyse and quantify the multiple benefits and there is a large body of literature on the topic including the recent Horizon 2020 project, MBenefits[14].

Fraunhofer Institute presented the learnings from the EEFIG Working Group on Multiple Benefits (mainly addressing buildings and financing) and from the H2020 M-Benefits project (focussed on industry). Importantly, the WG on multiple benefits stressed that multiple benefits are not yet widespread knowledge for stakeholders working in financial institutions. In particular, for financial institutions, it is unclear, how the consideration of multiple benefits improves their business. Multiple benefits are not yet widespread knowledge for stakeholders working in financial institutions. The M-Benefit project which was one of the first focussing on the decision-making procedures of the companies had as a main goal to make energy efficiency strategic and that fit well with the theme of this project.

There was a single panel on what role can multiple benefits play in driving industrial energy efficiency investment. Linkoping University Sweden presented research on multiple benefits in industrial energy efficiency. In large industry there is emerging understanding of the non-energy benefits, but in SMEs this understanding is not yet as developed as in large industries. She noted that often one non-energy benefit can lead to others. It is really important that energy engineers and consultants are trained in non-energy benefits and are able to integrate this in their work at industrial enterprises.

Your Energy noted that SMEs range from large SMEs which largely make decisions on the same basis as larger companies to the smallest SMEs

[14] https://www.mbenefits.eu/

where decisions are more like in a household. He noted that increasing focus on green transition has significantly moved the dialogue and created demand for a more holistic approach including business and process consultancy together with the traditional technically oriented advisory.

Fraunhofer Institute, noted that maybe the story we tell outside should be about great projects and their opportunities for companies, rather than specifically energy efficiency or non-energy benefits.

The following discussion provided a range of views how multiple benefits can be embedded in investment decisions. It was suggested that it is important to have the benefits quantifiable. There is also a need to communicate documented examples. It was also noted that noted that non-energy benefits are currently not vested in the EED and national regulation. Importantly, it was announced that the Sector Forum Energy Management of CEN/CENELEC will be setting up a new working group on multiple benefits.

For the group, what helps drive decision-making to promote industrial energy efficiency investments is a fundamental question. The concept of analysing and integrating multiple benefits in decision-making in all industrial sectors is seen to be quite important from the information gathered to date and definitely requires further exploration in the future.

Since this is the last meeting of the WG, the group discussed the reaction to the SR10 final report to date. Many WG members contributed to the draft conclusions and recommendations.

Concerning messaging, the EEFIG comms team lead discussed the dissemination approach of the WG deliverables. He further suggested that there is a need to connect to specific opportunities/events and existing discussions for communication of the WG results. He underlined that the messages should be actionable rather than descriptive and that the messages should be customised to specific target groups.

2.7 Other WG activities

The EEFIG Members Survey 2020

The EEFIG Members Survey 2020 included a dedicated set of question for the members of the WG on Industry related to how EEFIG can help accelerate investments in industrial energy efficiency. The survey results which were discussed at the third WG meeting and subsequently shared with the EEFIG 2021 Plenary provided important feedback in the following areas.

Energy intensive industries are increasingly looking at deep decarbonisation through a combination of energy efficiency, renewables, electrifications, new products, circular business models etc. In this context, Financial

Institutions may work with energy intensive industries on financing ambitious long-term decarbonisation through:

- Maintaining ambitious minimum criteria and reserving the "green finance" products for projects that truly contribute to market transformation;
- Supporting contractual standardisation;
- Requiring compliance with generally accepted green bond framework or similar standards;
- Financing decarbonisation and energy transition projects adopting the EU Taxonomy criteria; and
- Ensuring that projects are carefully designed, e.g. by ESCOs, funded by FI and insured by (RE) insurance agents.

SMEs face many pressing day-to-day challenges apart from energy efficiency. Financial Institutions and public authorities may make energy efficiency investments relevant and attractive for SMEs through:

- Standardising instruments;
- Assuring availability of dedicated staff with sound knowledge regarding energy efficiency at public authorities and one-stop shops; and
- Providing small grants to improve the bankability/business case of truly pioneering projects to reduce risk and encourage involvement of SMEs.

The survey was important to highlight the need for the Working Group to focus on certain priorities and to expand some of its activities. This includes:

- Collecting and sharing even more best practice examples;
- Helping standardise and prioritise SME measures. Encouraging the Sector Forum Energy Management under CEN/CENELEC set up a Working Group on Blockchain and Distributed Ledger Technology (DLT).
- Facilitation of support to get CEOs/CFOs eyes opened to investments in Energy Efficiency; and
- Encouraging FIs and (RE)insurance companies to work closely with sector experts and there was one WG meeting dedicated to relations with financial institutions.

Furthermore, it was suggested that EU institutions, national governments and the financial community may help encourage greater investments in energy efficiency in the industry sector through:

- Developing stricter energy efficiency obligation schemes;
- Strengthening article 8 of the EED to require implementation of measures with relatively short payback times;
- Widening requirements for CSR reporting;
- Introduction of mandatory standards, protocols and /or practices promulgated by financial regulators; and
- De-risking energy efficiency projects with targeted incentive programmes and clear, stable framework conditions.

Based on this, it was proposed that the EEFIG WG on financing industrial energy efficiency during the second and last year could give priority to:

- Best practices on effective and innovative measures, tools, schemes;
- Developing options for technical and financial frameworks for SMEs;
- Linking energy efficiency with broader decarbonisation and ESG criteria; and
- Assessing emerging Blockchain and DLT technology.

Industrial Energy Efficiency at the EEFIG Plenary 2021

At the EEFIG Plenary of 9 February 2021, the Industry WG was represented by EiiF[15]. He explained that a thematic assessment of energy efficiency in the context of decarbonising energy intensive industry while keeping or improving its competitiveness was being prepared and that further work on the challenges of energy efficiency investments in SMEs is planned for 2021.

He noted that the upcoming issues paper on energy intensive industry underlines the need to stable framework conditions and opportunities for financial institutions to engage with industrial clients. He also noted that energy efficiency does not always come first in industry in competition with other pressing investment needs and that the EU taxonomy will have an important role in moving this and that increased CO2 prices will also create strong incentives to invest.

Finally, he underlined the need for best practise examples and emphasized the potential for energy efficiency in SMEs but also the many challenges. He noted that ESCOs could be an approach but only Italy where there are special framework conditions for ESCOs have been really successful in developing this market.

At the EEFIG Members Workshop on 10 February, 2021, the panel discussed the subject "Energy efficiency in industry – A part of the broader decarbonisation agenda for large industries, but what about the SMEs?".

The discussion highlighted the following:

- CEO and CFO buy-in to energy efficiency financing is key to success. Energy efficiency competes with a lot of other investment priorities including new product development and accessing new markets. However, companies are increasingly responding to sustainability requirements. Furthermore, ISO 50001 certification in itself is a key trigger for energy efficiency investments.
  Access to finance is improving, e.g. through the PF4EE scheme, but for many SMEs both financial and management resources are limited.

- Ongoing research on quantifying multiple benefits of energy efficiency for industry, could have an impact on management decisions, but

[15] European Industrial Insulation Foundation – https://www.eiif.org/

mainly in Energy Intensive Industry. Typical SMEs are focussed first on the bottom line and second on compliance with regulation.

- H2020 has funded many de-risking and aggregation projects which also includes good examples of ESCOs working with SMEs. These may be inspiration for scaling and replication, but a standardised approach is difficult across enterprises and in practise a dedicated study is needed at each participating enterprise.

- It is difficult for SMEs to sustain loan financing for energy efficiency. Sometimes it is challenging for an SME even to develop a 2-page business plan to support an application. Financial institutions therefore need to scale up their advisory capacity, but SMEs also need to allocate resources if they want to access funds or be less reluctant to pay for external advice.

- The ISO 50001 culture and approach could benefit SMEs but rather than making EMS mandatory for SMEs, it would be better to combine implementation of EMS at SMEs with a system of incentives and with simple and available tools, so it becomes attractive and meaningful to SMEs to participate.

- In this context energy efficiency networks for SMEs that facilitate knowledge sharing may contribute. Finally, it was noted that although energy efficiency is not a priority for most SMEs, the SMEs that are part of the supply chain for larger companies will need to engage as their customers are increasingly looking at scope 3 emissions[16].

[16] See https://ec.europa.eu/environment/emas/emas_for_you/news/news21_en.htm

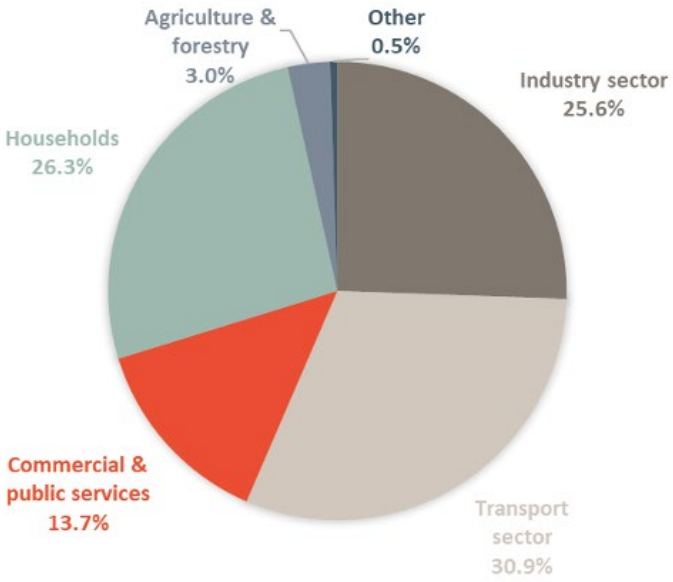
3 Trends, obstacles and drivers for increasing energy efficiency investments in industry

This chapter presents the main trends, obstacles and drivers for energy efficiency investments in industrial enterprises based on the discussions within the working group. The analysis led to the development of the conclusions and recommendations that form the main messaging of the working group in Chapter 5.

3.1 Trends in industrial energy efficiency in EU-27

The industrial sector is a major energy consumer as well as a major source of GHG emissions in EU-27. Industry represents over 25% of final energy consumption as shown in figure 3-1. It is about the same percentage for GHG emissions.

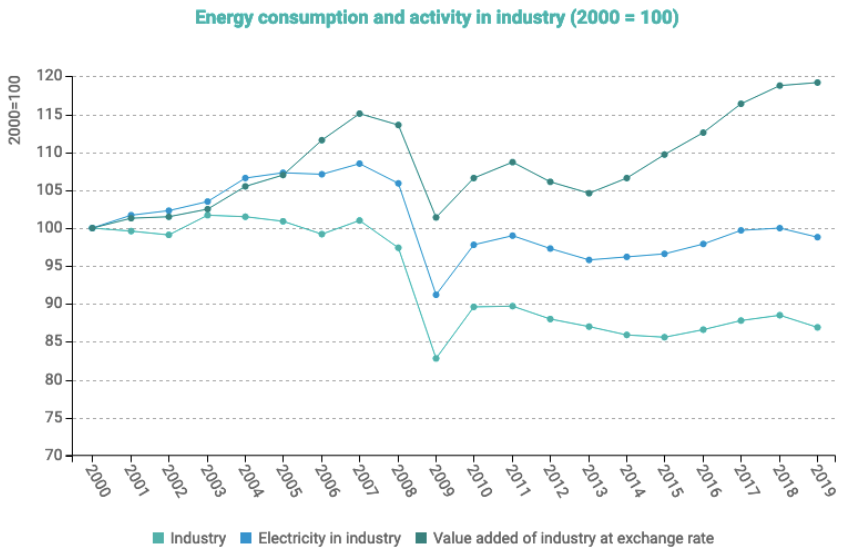
Figure 3-1 Final energy consumption by sector, EU 27, 2019



Source: Final Report of EEFIG WG on Financing Practises (based on Eurostat 2019 data)

Although there was growth in industrial activity from 2003 to 2007 and after 2013, energy consumption in the sector decreased, as shown in the next figure. However, it rose between 2015 and 2018, following a strong growth in industry activity. It decreased again in 2019 due to a slowdown in industrial growth. Importantly, in 2019, industry energy consumption is around 13% lower than in 2000. There has hence been an important decoupling of industrial value generation and energy consumption. This is illustrated in figure 3-2 below.

Figure 3-2: Decoupling of energy consumption and value added in industry

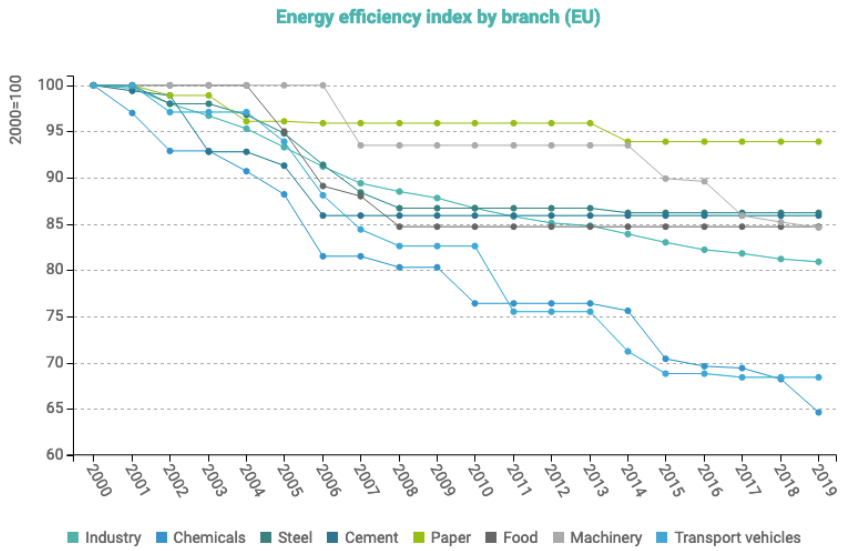


Source: Odyssee Mure https://www.odyssee-mure.eu/publications/efficiency-by-sector/industry/energy-consumption-trends-eu.html

Energy efficiency in EU industry improved by 1.1%/year on average since 2000, as measured with the energy efficiency index. However, the energy efficiency improvement rate has slowed down since 2007 (0.8%/year compared to 1.6%/year between 2000 and 2007). This is because of a slower progress in some branches and even no more energy efficiency improvement for others because of the 2008 recession.

The energy efficiency index by industrial sub-sector is shown in figure 3-3 below.

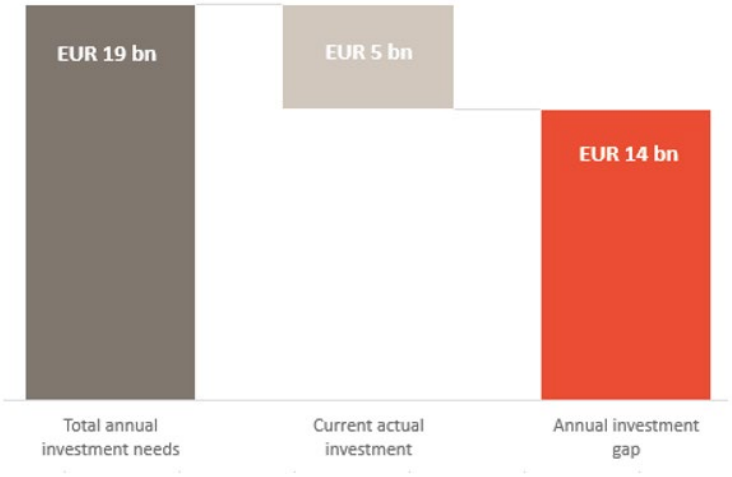
Figure 3-3: Energy efficiency index on sector level



Source: https://www.odyssee-mure.eu/publications/efficiency-by-sector/industry/european-efficiency-trends.html

In order to reach the 2030 and 2050 climate ambitions there is a need for significant investments in improving the energy performance of industry. The next figure 3-4 shows the investment gap as assessed by the EEFIG WG on Financing Practices in their final report (2021).

Figure 3-4 Investment gap for industrial energy efficiency



Source: Final Report of EEFIG WG on Financing Practises (2021)

In summary, the industry sector is important for the total energy consumption and GHG emissions in EU-27, there has been an important decoupling of industrial value generation and energy consumption over the last 20 years, but annual energy efficiency improvements have slowed down and there is a significant investment gap

This frame the key challenge of the working group in relation to improving the energy performance of the EU's industrial sector.

3.2 Obstacles to achieving the cost-effective potential for energy efficiency improvements in industry

While there has been progress in improving energy efficiency in energy-intensive industries, a considerable potential for further improvements remains. A number of obstacles to accelerated energy efficiency investments in industry have been known and discussed for many years but become all the more important as the industrial sector plays a bigger role in implementing the European Green Deal.

In **energy intensive industries** (EIIs) key obstacles to increased energy efficiency investments include:

- CEO and CFO buy-in to energy efficiency financing is key to success. Energy efficiency competes with a lot of other investment priorities including new product development and accessing new markets.

- Industry has traditionally been reluctant to invest in energy efficiency measures with medium payback period (4-10 years) unless the company deems the measures to be of strategic importance to the company's objectives.

- With growing climate ambitions EII are increasingly ready to make long term investments in green transition including energy efficiency, but they need a combination of stable long-term policy frameworks, markets for new low carbon products, access infrastructure for renewable energy (electricity, hydrogen and biogas), grants supporting technology innovation, and a levelled playing field for products exposed to international competition.

- Major energy savings necessitates rehabilitation of core manufacturing processes and utility structures requiring incorporation in corporate long-term investment planning.

- EE measures are not fully understood, are often not seen as strategic decisions, and therefore seldom reach board decisions. Most energy audit reports rest at the technical level and seldom go to senior management. It is noted that provisions of the recast of EED are aiming to address this issue.

- While multiple benefits of EE investments (e.g. impact on capacity, quality, market etc.) could underpin investment decisions, there is a need for a deeper understanding of the financial value of these benefits and for communication of documented examples of how they can improve the overall economics of energy efficiency investments to companies.

- The policy framework does not adequately provide long-term signals to industry to prioritise investments in energy efficiency. The EU ETS has historically not been a major driver for energy efficiency investments although this is expected to change, given changes to ETS in its new phase. Furthermore, the EED has weak impact as long as it does not require recommendations from mandatory audits to be implemented.

- Companies across all segments tend to use their own funds for industrial energy efficiency, limiting the size, scope and depth of impact that these measures can achieve. In this context, intermediaries (e.g. energy audit companies, ESCOs) are not focussed on core processes and not entrepreneurial enough to encourage industry to take necessary action.

- The financial community has insufficient technical capacity to underwrite EE investments in industry outside of general corporate lending.

- Importantly, focus in EII has recently shifted from energy efficiency to broader sustainability and decarbonisation issues and energy efficiency investments increasingly have to be assessed in this context.

For **industrial SMEs** and non-energy intensive industries, the main barriers are:

- Typically, small-sized and non-energy-intensive industrial SMEs do not have enough capacity to work with energy efficiency improvements and are thus in need of a more supportive approach, e.g. assistance from external experts. Energy audit programmes are effective but should be complemented with networks where an experienced engineer supports the companies within the network.

- SMEs are typically more vulnerable to market shifts and more reliant on key contracts and customers than large organisations.

- The need to maintain profitability and competitiveness with limited resources can make it more difficult for SMEs to pay attention to energy efficiency and other environmental and business improvement initiatives despite those initiatives having the potential to improve the SMEs competitiveness.

- A focus on day-to-day cash flow and limitations in accessing capital creates challenges in justifying noncore business investments. This is specially the case for SMEs.

- Small companies are less likely than larger ones to monitor performance, for example, and tend to have a more informal structure with less rigorously defined roles.

- Energy efficiency is not considered as a strategic priority at Executive Board level and there is no link to Key Points in the Corporate Investment Cycle. The presentation at executive board level of energy efficiency investments results from implementation of EnMS, and those identified by energy managers.

- Credit risk is the key risk category for banks and investors and often representing an unsurmountable hurdle for SMEs.

- SME energy efficiency projects tend to be smaller (often less than 100k€) and the due diligence costs quickly outweigh the investment returns unless mechanisms for standardisation and project aggregation are well established in de-risking projects, FIs or national support schemes.

- Investors require protection from the end-client contract (change in control, occupancy, etc.).

- Many contract types (e.g. EnPC) transfer ownership of equipment to the end-client, increasing their balance sheet debt.

- Opportunities need to be located in the right country, at the right time, with the right technology, matching the risk appetite – financing is not only a struggle for the project developers.

- Investors require protection from the end-client contract (change in control, occupancy, etc.)

- Energy efficiency among SMEs has not been extensively researched nor given sufficient focus by policymakers.

- SMEs are often reluctant to use ESCOs.

- Despite the requirement in Article 8 of the Energy Efficiency Directive for Members States to implement support schemes that encourage SMEs to undertake energy audits and implement the recommended energy saving measures, most SMEs surveyed in all pilot regions have not had an energy audit in the last 5 years**.**

- Despite the low proportion of SMEs undertaking energy audits, most SMEs surveyed have still implemented some kind of Energy Conservation Measure, most commonly upgrading the LED lights.

- Few SMEs have undertaken any kind of staff awareness programme relating to energy efficiency.

- SMEs identify lack of finance or return on investment as key barriers to implementing energy efficiency measures. Additional barriers are lack of awareness, doubts around actual saving potential and the lack of technical human resources. Energy efficiency appears as low priority for SMEs compared to other business needs and activities. They are more likely to take action on issues that are important to their existing customers; enable them to attract new customers or enable them to score more highly on public sector tenders.

Furthermore, there is a lack of tailored resources to address the energy efficiency opportunities in SMEs:

- SMEs are heterogeneous, they have limited management time and attention for energy efficiency investments. There is a lack of specific energy efficiency financial instruments by Financial Institutions and other relevant entities working in conjunction with private distribution partners and certified energy auditors. To be effective, the development of investment pipelines needs to be supported by the project development assistance facilities, light-touch energy audits where appropriate and justified.

- Lack of approved Lists of Eligible Materials and Equipment (LEME) which include equipment, appliances and/or materials which can be expected to achieve a minimum energy saving (>20% in EBRD case) when compared to market norms to be designed in conjunction with a related open List of Eligible Suppliers and Installers (LESI).

- For large non-energy intensive companies, there is a clear need to improve the priority and visibility of energy efficiency with key decision makers.

- For mid-cap companies and SMEs, the keys to drive energy efficiency investments in small and mid-sized companies are more related with the awareness and existence of public incentives, co-finance, soft-loans, tailored finance products and technical assistance for energy efficiency projects (including tax breaks), key decision makers' confidence in overall economic outlook, energy efficiency resources and the company's debt capacity.

- In SMEs and non-energy intensive industries, EE is often more complex and diverse compared to energy intensive sectors, where EE often can be large individua investment projects. A diverse mix of projects to improve EE is a barrier in itself.

- SMEs have large saving potentials in space heating. As the pay-back-time of EE measures in space heating (heating system renovation and building envelope measures) typically are relatively long[17] and space heating is not seen as a core-business investment, the willingness for SMEs to invest in EE technologies is low.

3.3 Drivers

What does it actually take to encourage companies to invest in energy efficiency? It is important to know what are the drivers that will make a difference, especially during this difficult period. Understandably, again the drivers are different for energy-intensive industries and industrial SMEs.

For **energy-intensive industries**, the identified drivers are:

- Customers for both BtB (business-to-business) and BtC (business-to-consumer) are rapidly adopting the green agenda and increasingly ask for low-carbon products and reporting of suppliers' carbon footprint.

- Investor pressure, applied directly by institutional investors or as part of organised initiatives such as CDP (Carbon Disclosure Project) and green bonds.

- The overall green transition is an opportunity for rejuvenation of European industry and renewed competitiveness.

- Overall, the EU policy framework is fundamental because of a more ambitious EU ETS starting in 2021, more ambitious EE objectives for 2030 and 2050 in order to meet Paris climate objectives. However, deep decarbonisation in EII will require development of sector-specific low-carbon roadmaps.

- Funding for innovative technologies is available through the new EU Innovation Fund and Horizon Europe.

[17] The EEFIG De-risking Energy Efficiency Platform, https://deep.eefig.eu/

- National initiatives such as voluntary agreements play an important role in promoting energy efficiency investments.

- Market conditions play a key role in the level of competitiveness. If the industry is trading on a global scale, there is increased pressure to reduce operating costs and this can often be achieved through investments in energy-efficient technologies.

- Implementing EnMS, energy management systems, to develop a company-wide approach to effective energy management can provide a positive impact on corporate culture towards energy efficiency improvements.

- Public funding and grants can support with EE Project-Development-Assistance (PDA) and quality assurance (QA) costs in order to catalyse mass production of mature, standardised projects that can trigger the interest of private investors.

- Recovery and Resilience Plans following the impact of the COVID-19 pandemic can play positive role to ensure energy efficiency is given sufficient priority, according to the Energy Efficiency First principle that the European Commission endorsed.

- Public recognition of the company's commitment to ESG criteria (Environmental, Social and Governance).

For **industrial SMEs**, the identified drivers are:

- SMEs in the B2B market are increasingly being met with requirements from their large corporate clients adopting scope 3 emission reduction targets (e.g. under the Science Based Targets initiative SBTi) to report emission data and mitigation plans.

- Public recognition of the company's commitment to ESG criteria (Environmental, Social and Governance).

- Strengthening competitiveness and highlighting the positive impacts for the business are important

- Staff behaviour is relevant for increasing energy efficiency

- The stronger the national policy framework, the more success is possible

- Strong communication on importance of climate change mitigation

- Participation in energy efficiency networks (EENs)

- Availability of financial subsidies

- When combining energy efficient technology implementation with successful energy management practices and enhanced knowledge of the SME energy end-using processes

- Standardised client agreement such as available in most de-risking projects

- Standardised risk assessment protocol.

4 Best practices for increasing energy efficiency investments in industry - Existing knowledge and initiatives

Identification and dissemination of best practise examples are a key tool enable broader replication and scale up of initiatives to scale up financing of industrial energy efficiency that have proved to be effective in one country or sector. Below we present an updated overview of best practise examples for increasing energy efficiency investments in industry. These are grouped based on whether they are mainly nationally led initiatives, Financial Institutions led initiatives or EU sponsored initiatives.

4.1 National best practise

Energy Management Systems and energy audits as key tools to achieve industrial energy efficiency – also in SMEs

The Energy Efficiency Directive (EED) mandates large companies to undertake regular mandatory energy audits (or implement certified Energy Management Systems), however, there is no requirement to implement the measures identified under the energy audits.

Implementing Energy Management Systems (EMS) ensures a clear management commitment to improve energy efficiency, it ensures budgets and resources for energy management, and it creates a framework for mainstreaming of energy management from the individual employee to the corporate management. Energy audits bring in external specialist expertise to identify energy savings opportunities across diverse areas of the company's operations, including process optimization, utility tune-up, heat recovery, operator performance and maintenance routines.

Italy[18] has adopted an innovative model where energy consuming companies including energy intensive SMEs regardless of size, not only have to undergo energy audit, but also have to implement the identified efficiency measures within a reasonable time, or in alternative, adopt a management system in compliance with ISO 50001 standards. An SME is energy intensive in this context if it uses more than 2,4 GWh/year and the ratio of energy cost to turnover is bigger or equal to 3%. This has led to a significant number of Italian SMEs undergoing energy audits, planning energy efficiency projects and implementing energy efficiency investments leading to significant energy savings.

Energy Efficiency Obligation schemes and White Certificates as a tool to promote energy efficiency in industry

The EED includes provisions for each Member State shall set up Energy Efficiency Obligation schemes (EEOs) to ensures that energy

[18] Background to Italy is available here - https://www.dariodisanto.com/why-some-invest-in-energy-efficiency-and-some-dont/ and https://www.ien.eu/article/energy-efficiency-audits-in-italy/

distributors/utilities and/or retail energy sales companies achieve a cumulative end-use energy savings target. The schemes include EE-projects implemented in the industry in most Member States. Some of the first EEOs (UK, Italy, France, Denmark) have generated consistent results over many years, as demonstrated by the ENSPOL project[19].

Italy[20] introduced a white certificate scheme (WCS) in 2005 which has since developed over the years. In the first phase, most of the projects were related to buildings with deemed savings as energy savings assessment method. Then the industrial sector contribution rose until it covered 80% of the savings in 2014, mostly assessed through metered savings procedures. In the last three years the buildings sector share has recovered due to regulatory decision and to modification of the assessment of additionality for many industrial projects categories. The Italian WCS been operating for 15 years, has ambitious targets, covers all sectors and energy efficiency solutions, and has many flexibility options in place (e.g. non-obliged parties, tradable market, bankability, etc.). With more than 26 million tons of oil equivalent (toe) of energy savings cumulated by the end of 2017 the Italian WCS has contributed significantly to the national energy efficiency targets.[21]

Poland introduced an Energy Efficiency Obligation (EEO) in 2012 to deliver its energy efficiency targets under Article 7 of the Energy Efficiency Directive. The Polish EEO includes White Certificate trading as a key element. A recent independent review of the Polish EEO[22] noted several areas of concern: projects supported do not have to be additional to market activity that would have happened anyway even in the absence of the EEO; the measurement and verification regime appears to rely on self-declared energy savings by companies obtaining white certificates; there is no official specification of lifetimes; and there is a lack of independent evidence-based evaluations of the EEO.

This underlines the value of the EU-funded ENSPOL project targeting the effective and proper implementation of Article 7 of the Energy Efficiency Directive in all Member States.

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[19] https://enspol.eu/

[20] https://www.eceee.org/library/conference_proceedings/eceee_Industrial_Summer_Study/2018/1-policies-and-programmes-to-drive-transformation/white-certificates-as-a-tool-to-promote-energy-efficiency-in-industry/2018/1-017-18_Di_Santo.pdf/

[21] https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2019/3-policy-and-governance/white-certificates-in-italy-will-it-overcome-the-huge-challenges-it-has-been-facing-in-the-last-three-years/

[22] https://www.eceee.org/library/conference_proceedings/eceee_Industrial_Summer_Study/2020/1-policies-and-programmes-to-drive-transformation/evaluating-the-polish-white-certificate-scheme/

Voluntary Agreements

Many Member States have Voluntary Agreement (VA) schemes for energy intensive industries or other parts of the industrial sector[23]. A VA scheme is a mechanism based on contracts between the government and the industry on an individual enterprise or sector level.

The basic mechanism behind a successful scheme is that the authority offers participation in a VA-scheme aiming at improving energy efficiency for large industries and that participation is linked to both obligations and incentives. Obligations for the participating companies may include requirements to carry out energy audit, set improvement target, establish energy management system (ISO50001), install identified energy saving projects with payback less than a certain number of years, and to monitor and report on energy consumption and progress in energy efficiency. At the same time the authority offers incentives (benefits) to the participating industries such as access to tools and guidelines, training and information activities, grants for technical assistance, access to investment financing at attractive rates, tax benefits if saving targets are met, and sometimes investment grant to reduce the payback time for longer term investments.

By now comprehensive experience has been gained across a wide range of countries on implementing VA schemes. Energy management systems like ISO50001 and systematic working procedures are important cornerstones in all Voluntary Agreement schemes. Competence development schemes (for consultants and industry experts) and templates/guidelines are important tools to assist companies with knowledge and information on best practices. VA-schemes with strict requirements (saving targets and verification) deliver much more energy savings than schemes with few requirements. Furthermore, VA-schemes with strict requirements must apply incentives to be attractive for the companies, for example grants for technical assistance or tax benefits.

Carefully designed Voluntary Agreement have proved to be effective policy tools for engaging industrial companies and sectors in energy management and energy efficiency investments. Voluntary Agreement Schemes are generally evaluated to be cost-efficient policy measures where the benefits for industries and society are higher than the costs of operating the schemes.

Energy Efficiency Networks

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[23] A good initial source is from the recent eceee industrial efficiency conference:
https://www.eceee.org/library/conference_proceedings/eceee_Industrial_Summer_Study/2020/1-policies-and-programmes-to-drive-transformation/voluntary-energy-efficiency-agreements-in-europe-and-the-united-states-insights-and-best-practices/
https://www.eceee.org/library/conference_proceedings/eceee_Industrial_Summer_Study/2018/1-policies-and-programmes-to-drive-transformation/history-and-prospect-of-voluntary-agreements-on-industrial-energy-efficiency-in-europe/

Energy Efficiency Networks include the setting of energy saving goals on company level as well as on network level. To strengthen the collective dynamic for implementing EE measures, site visits and monitoring are regularly organised. Even organisations that already have an Energy Management System (EMS) or the willingness to implement one can still profit from the benefits of network participation. In Europe, EENs have been implemented in seven Member States and Switzerland and the concept has created interest abroad where China, the US and Canada are experimenting with similar approaches.[24]

Climate Ready SMEs – Science-Based Targets and scope 3 emissions in the manufacturing supply chain

Large enterprises are increasingly attempting to assess scope 3 emissions and have committed themselves to Science-Based Targets. This has significant impacts on the enterprises in their supply chains. SMEs, depending on deliveries to larger enterprises as customers, are therefore being met with requirements for reporting of scope 1 and 2 emissions and developing mitigation strategies.

In Denmark, the Federation of Danish Industries with funding from the Industry Foundation has been running a 2-year project[25] during 2020-21 which established a concept for cost efficient development of climate accounts for SMEs and assisted 50 pilot SMEs in the manufacturing sector in developing their climate accounts and mitigation strategies, including energy efficiency, renewable energy and green procurement. The developed concept and methodology align with Science-Based Targets[26]. To communicate and disseminate the results and developed methodology, 20 best practise cases were developed, 4 webinars and a series of regional roundtables for experience sharing were held and a large conference in January 2022 concluded the project. The project will now continue in a second phase with focus on standardization of tools and web-based capacity building to allow scale up to a much larger group of enterprises.

4.2 FI driven best practice initiatives

[24] Rohde, Clemens; Neusel, Lisa; Durand, Antoine; Barckhausen, Anton; Jensterle, Miha (2020): "Energy efficiency networks: latest developments in Germany and in the world". In: Proceedings of the 2020 eceee Industrial Efficiency conference (online) Durand, Antoine; Pascal Damian (2019): "Energy Efficiency Networks: Overview of the implementation over the world and lessons learned". In: Proceedings of the 2019 Summer Study on Energy Efficiency in Industry, Portland 2019 https://www.eceee.org/library/conference_proceedings/eceee_Industrial_Summer_Study/2018/1-policies-and-programmes-to-drive-transformation/energy-efficiency-networks-lessons-learned-from-germany/

[25] https://www.danskindustri.dk/klimaklarsmv

[26] https://sciencebasedtargets.org/

EIB

EIB have aligned all financing activities with the principles and goals of the Paris Agreement, a commitment that builds a pathway towards low greenhouse gas emissions and climate-resilient development. The November 2019 EIB Energy Lending Policy[27] informs EIB's stakeholders on what types of energy projects are consistent with the Bank's objectives, how energy projects will be assessed and prioritised by the Bank and how the Bank supports EU energy policy.

A wide variety of loans, equity and guarantee products combined with advisory services are offered to both large companies and SMEs supporting this ambition.

EIB manages the European Local ENergy Assistance (ELENA) facility[28], which provides grants and technical advice to the public and private sectors to help energy efficiency projects. ELENA supports the preparation of projects that improve energy efficiency and renewable energy use in buildings, including energy efficiency in residential and non-residential buildings, building-integrated renewables (such as solar panels), public lighting, district heating (including combined heat and power plants and biomass boilers), and smart grids.

Jointly with the European Commission, the European Investment Bank participates in the Private Finance for Energy Efficiency (PF4EE) initiative[29]. The instrument aims to increase the availability of debt financing for eligible energy efficiency investments and to make energy efficiency lending a more sustainable activity within European financial institutions. In collaboration with pilot banks in Europe, PF4EE offers preferential loans for private economic entities who want to invest in energy saving projects.

To facilitate energy efficiency lending under PF4EE, partner banks and their clients can draw on dedicated online tools. These can be used to assess whether their energy savings project meets the main program criteria, support financial intermediaries in marketing dedicated energy efficiency financing offers, and raise awareness and facilitate on-lending, allowing to estimate a preliminary value of potential energy savings.

EIB also support Member States through JASPERS, funding projects and programmes supported by the EU structural and Cohesion funds and the Just Transition Fund.

EBRD

EBRD have a number of funding programmes targeting the corporate sector on their countries of operation including the EU neighborhood countries on Western Balkan (Albania, Bosnia-Herzegovina, Montenegro, North Macedonia, Serbia), Ukraine and Turkey.

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[27] https://www.eib.org/en/publications/eib-energy-lending-policy

[28] https://www.eib.org/en/products/advising/elena/index.htm

[29] https://pf4ee.eib.org/

The EBRD High Impact Programme for the Corporate Sector is an innovative financing instrument that promotes a transformative shift in the corporate sector. This is achieved by supporting the uptake of high climate impact technologies as well as incorporating climate change targets and climate governance principles into strategic decision-making. Working with the Clean Technology Fund and the Green Climate Fund, the EBRD can offer High Impact loans, where the interest rate of the loan is coupled with the climate outcome of the investment. In practice, a discount on the interest rate will be realised upon achieving pre-agreed, covenanted milestones in specific climate impact areas of high relevance for the specific sector and its value chain. The discount structure applies to the donor-funded tranche of the loan and reflects technology installation (CAPEX) and corporate climate governance improvements.

The EBRD flagship Green Economy Financing Facilities[30] ("GEFFs") for the financial sector, combine technical support and finance to accelerate the uptake of best performing technologies among small businesses and homeowners. In partnership with local financial institutions, GEFFs provide training and online tools to help originate investment needs and identify best performing solutions. Better-informed investment decisions contribute to enhanced sector performance and help strengthen the local supply of green technologies and related services. GEFFs support making financial flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development that is compatible with the climate change mitigation and adaptation objectives of global agreements on climate change. The GEFF programme operates through a network of more than 150 local financial institutions across 28 countries and has delivered more than EUR 5 billion to around 250,000 eligible investments undertaken by industrial, SME, residential and municipal clients that are collectively estimated to avoid more than 9 million tonnes of CO2 each year[31].

The EBRD FINTECC[32] programme established by the EBRD to promote climate technology transfer across the private sector in a number of its countries of operation, provides technical assistance and incentive grants to introduce innovative climate technologies with low market penetration and to foster transition to more sustainable business models, in the context of an EBRD direct investment in the company. The programme is active in the commercial and industrial sectors and targets private SMEs and mid-cap companies.

The EBRD Circular Economy Regional Initiative ("CERI") is a blended concessional finance programme to address specific barriers to transitioning to circular economy in the Western Balkans and Turkey. CERI provides performance-based financing support to private sector companies implementing innovative resource efficient technologies and adopting

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30 https://ebrdgeff.com/

31 Figures correspond to finance provided by the EBRD and its co-financing partners where applicable.

32 https://fintecc.ebrd.com/index.html

circular business processes and business models. The aim is to catalyse transition to a circular economy by (i) improving management of raw materials during the full lifecycle of products and diverting waste from landfills and the marine environment, (ii) reducing/avoiding GHG emissions, (iii) eliminating, preventing and improving management of harmful chemicals in material streams and (iv) supporting companies to develop circular business strategies and roadmaps.

Private FIs and Paris alignment of corporate lending portfolios
Private FIs are increasingly aligning their portfolios with ambitious climate targets. This has both led to sector-based initiatives such as the UNEP FI led Net-Zero Asset Owner Alliance and Net-Zero Banking Alliance and to individual action by leading FIs.

An example is the approach developed by Natixis (FR) to climate alignment of their corporate lending portfolio based on a Green Weighting Factor (GWF), an in-house mechanism that links capital allocation to the degree of sustainability to facilitate long term alignment with the Paris agreement. The GWF has been developed during the last 4 years and has now been fully integrated in IT systems and internal credit process as a mandatory & systematic step ahead of credit decisions. The tool is a help in individual lending decision and also helps measuring the analytical portfolio risk and assessing climate risk. It is used for product development and for client engagement, where all clients now have both a credit rating and an environmental rating.

4.3 EU supported best practice initiatives in EII

Many energy-intensive industries in Europe work through the EU funded public private partnership SPIRE (Sustainable Process Industry through Resource and Energy Efficiency) where there is a good inventory of best-practice examples[33]. These include:

- ADREM (https://www.spire2030.eu/ADREM)

  Full Title: Adaptable Reactors for Resource- and Energy-Efficient Methane Valorisation

  Aim: In ADREM, leading industries and university groups in process intensification, catalytic reactor engineering and process control teamed up to address the domain of resource- and energy-efficient reactors for valorisation of variable methane feedstocks to higher hydrocarbons and liquid fuels

[33] https://www.spire2030.eu/projects/our-spire-projects

Concept: In order to converge to the optimal design, the project utilised the unique integral, four-domain process intensification (PI) methodology, pioneered by the consortium.

- BAMB (https://www.bamb2020.eu/)

  Full Title: Buildings as Material Banks: Integrating Materials Passports with Reversible Building Design to Optimise Circular Industrial Value Chains

  Aim: The aims of BAMB (Buildings as Material Banks) are the prevention of construction and demolition waste, the reduction of virgin resource consumption and the development towards a circular economy.

  Concept: The BAMB-project implements the principles of the waste hierarchy: the prevention of waste, its reuse and recycling. Key is to improve the value of materials used in buildings for recovery.

- CIRMET (https://www.spire2030.eu/cirmet)

  Full Title: Innovative and efficient solution, based on modular, versatile, smart process units for energy and resource flexibility in highly energy intensive processes

  Aim: The project aims at designing, developing and validating an innovative solution, the CIRMET solution, so as to make energy and resources more flexible.

  Concept: The CIRMET solution addresses the main challenge of the European industry, that is, the issue of reaching efficiency by means of flexible resources and energy.

- CORALIS (https://www.coralis-h2020.eu/)

  Full Title: Creation Of new value chain Relations through novel Approaches facilitating Long-term Industrial Symbiosis

  Aim: The main objective of CORALIS is to create pathways for the decarbonisation of resource and energy intensive sector value chains through the implementation of viable industrial symbiosis.

  Concept: Industrial symbiosis (IS) has gain great attention in the last years due to its high potential for energy and resources savings.

4.4 EU supported best practices for increasing energy efficiency investments in SMEs

Key sources of such best practice examples for SMEs include the energy efficiency financing projects financed through H2020 and Intelligent Energy Europe (IEE) as well as national policy and financing initiatives from the

individual Member States. The H2020 and IEE projects within energy efficiency financing are broadly categorised in:

- Policy Support
- De-risking of EE investments to increase confidence of investors;
- Innovative financing mechanisms;
- Capacity Building and Awareness Creation.

Many of these also includes activities on capacity building and awareness creation. In addition, national best practises include initiatives such as voluntary agreements and experience exchange through energy efficiency networks.

A list of identified best practise for increased financing of industrial energy efficiency is presented below.

Policy Support

- LEAP4SME [www.leap4sme.eu] aims to support policy makers in establishing effective policies for SMEs to undergo energy audits and implement cost-effective, recommended energy-saving measures. The project activities (September 2020-August 2023) include: a thorough analysis of the national and local support to SMEs in the partner Energy Agencies countries to better understand barriers and trigger points to unlock the potential of energy efficiency measures through energy audit recommendations; a strong engagement plan to mobilise private stakeholders, informing them of existing opportunities and involving them in the policy related actions; a continuous dialogue with policy makers, business associations and experts to properly take into account the role of incentives, sustainable finance, energy management systems and non-energy benefits.

De-risking Initiatives

- TrustEE [https://www.trust-ee.eu/] – Former Horizon 2020 project that has gone commercial. Their goal is to secure profitable financing solutions for technology suppliers and project developers, with a focus on SMEs.
- eQuad [https://www.eu.jouleassets.com/about-equad] - Developed within the SEAF project, eQuad helps European energy efficiency project managers (ESCOs, engineering firms, and construction companies) access appropriate project finance while lowering upfront due diligence costs for investors.

- Investor Confidence Project [https://europe.eeperformance.org/] - unlocks access to financing for the building, industry, district energy and street lighting markets by standardizing how energy efficiency projects are developed, documented and measured.

- ESI Europe [https://www.esi-europe.org/] – Driving Investment in Energy Efficiency - The innovative ESI model allows the reduction of your energy consumption, while improving performance and increasing the environmental sustainability of your operations. By using the elements of the ESI model, the investment in new energy efficient equipment results in savings, which are ensured and insured.

- Quest [https://questproject.eu/] – its main goal is to promote investments in Sustainability and Energy Efficiency by identifying and empirically risk-grading factors that influence energetic performance of buildings, making it more profitable to invest in sustainable buildings. QUEST will develop a reliable quality management methodology for investors to evaluate their investments in efficient and sustainable buildings.

- LAUNCH [https://www.launch2020.eu] – enables large scale aggregation of sustainable energy assets (SEA) for financiers and supports contractors in growing their project pipeline. The final objective of the project is to accelerate the acceptance of SEAs as tradable securities. LAUNCH's mission is to develop the framework of best-in-class, standardized tools that will launch Sustainable Energy Assets as tradable securities, and to deploy this framework in cooperation with projects and investors.

- DEESME [https://www.deesme.eu] will enable SMEs to manage the energy transition by taking profit of multiple benefits from energy management and audit approaches and provide national authorities with guidelines and recommendations to empower their schemes under article 8 of the Energy Efficiency Directive, using the multiple benefits' approach. The project will identify and share best practices from national schemes, EU projects and other initiatives with national authorities and support them in developing more effective schemes dealing with energy audits and energy management systems. It will finally assist SMEs to develop and test the technical DEESME solutions by organizing information and training initiatives, realizing energy audits and implementing energy management systems starting from international standard and adding the multiple benefits energy efficiency approach.

Innovative Financing Mechanisms

- EaaS project [https://energy-base.org/projects/efficiency-as-a-service-eaas-in-europe/] - Innovative Financing for Servitisation and Capitalisation of Energy Efficiency Solutions for SMEs Efficient Equipment as a Service - Barriers such as lack of liquidity, financial capacity or the capacity to find competitive financing prevent SMEs from investing in energy-efficient solutions. The EU-funded eEaaS project aims to overcome these barriers by developing new business models and a financial structure to help SMEs adopt energy-efficient equipment-as-a-service. The project will mainstream the energy-efficient servitisation financial model to make it easier for SMEs to access smart, high energy-efficient technologies and standardise a financing structure. The project will play a role in the promotion of SME competitiveness and the transition to a circular economy.

- ESI Europe - Driving Investment in Energy Efficiency through Energy Savings Insurance in Europe [https://www.esi-europe.org/horizon-2020/] - The ESI model targets small and medium-sized enterprises (SMEs) and creates the conditions for them to upgrade specific old inefficient technologies to new EE technologies. The ESI model presents a proven and unique market-based approach that makes use of distribution channels and products that are already available on the market.

- EFFORCE [https://efforce.io/] – The first blockchain-based energy-saving platform. EFFORCE is the first platform that allows contributors to benefit from the energy savings generated by energy efficiency projects worldwide

- ESCO in a Box [https://www.energyproltd.com/esco-in-a-box] - aims to demonstrate that a community-based organisation can deliver energy efficiency services to SMEs when equipped with the right toolkit: standardised project development processes, vetted technology partners and contractors, guaranteed savings and suitable finance.

- Triple A [https://aaa-h2020.eu] - is seeking to identify which investments can be considered as Triple-A investments, fostering sustainable growth, while also having an extremely strong capacity to meet their commitments. The overall aim of the Triple-A project is to assist financial institutions and project developers increase their deployment of capital in energy efficiency, making investments more transparent, predictable and attractive.

- White Certificates
  The White Certificate scheme is now the Energy Efficiency Obligation under the Energy Efficiency Directive. Some Member States such as Italy have given a high priority to using it for the industrial sector. Recent analysis shows that 62% of all savings in industry in Italy were due to White Certificates.[34]

- Under the EED, large companies are to undertake regular mandatory audits, although there is no requirement to implement the measures. Italy is the one MS that requires the recommendations of mandatory audits to be implemented. This is also a requirement for energy-intensive SMEs.[35]

Capacity Building and Awareness Creation

- INVEEST [https://inveest.org/] – Capacity building project that, inter alia, provides capacity building for bankers in France. It will be expanding into other countries.

- EEFIG Underwriting Toolkit [https://valueandrisk.eefig.eu/] – value and risk appraisal for energy efficiency – a tool to assist financial institutions to scale up the deployment of capital into energy efficiency

- INNOVEAS [https://innoveas.eu] - INNOVEAS project is an initiative promoted by 10 partners from 6 EU countries, to build and deliver a capacity building programme, aiming at addressing the major non-technical barriers that most often hamper the adoption the energy auditing practice, in particular among those actors, such as Small and Medium Enterprises where such audits are not required by law. The ultimate goal is to consolidate a structured, permanent and expandable offer to help develop continuous self-sustainable services to raise awareness and build capacity in the field of energy auditing and related energy saving measures in SMEs, especially in the sectors of Food, construction and chemistry.

[34] https://www.eceee.org/library/conference_proceedings/eceee_Industrial_Summer_Study/2018/1-policies-and-programmes-to-drive-transformation/white-certificates-as-a-tool-to-promote-energy-efficiency-in-industry/ and https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2019/3-policy-and-governance/white-certificates-in-italy-will-it-overcome-the-huge-challenges-it-has-been-facing-in-the-last-three-years/

[35] Background to Italy is available here - https://www.dariodisanto.com/why-some-invest-in-energy-efficiency-and-some-dont/ and https://www.ien.eu/article/energy-efficiency-audits-in-italy/

- E2DRIVER [https://e2driver.eu] – project that is developing a training platform that will boost the collective intelligence of the automotive industry on energy efficiency. The platform will provide access to training material, online lessons, guidelines, and energy and financial tools. These will enable auto companies to thoroughly assess the energy consumption of transport use and propose measures to minimise their negative impact on the environment.

- SMEmPower Efficiency [https://smempower.com] aims to undergo energy audits and implement their proposals. A holistic methodology has been chosen to address different barriers based on three dimensions, i.e. Individual, Organizational and Institutional. The first concerns the design and delivery of an integrated Education & Training (E&T) programme targeting energy related SME staff, of 5 ECTS/EQF 6. At least 720 experts will be trained. The E&T programme will focus on financial and technical data required to prove that specific measures are cost-effective, while the trainees will apply their acquired knowledge to at least 160 pilot installations as practical action. This is connected with the second dimension targeting SME decision makers. In-house short trainings for decision makers of grouped SMEs according to their specificities will be delivered, during the practical action in pilots, by both partners and trainees. Such short trainings will be delivered to operational personnel as well, a total of at least 800 SME persons. Finally, the third dimension relates to targeted workshops where both SME decision makers and stakeholders from entities able to finance energy projects will come together and interact based on the real data provided from pilots, aiming to bridge the gap between energy audits and actual financing of measures. In addition, four long lasting training tools will be developed.

- FIRECE [https://www.interreg-central.eu/Content.Node/FIRECE.html] aims at improving the capacities of the public sector and related entities to plan territorially based low-carbon strategies in the frame of Regional Energy plans, supporting the low-carbon energy transition of traditional industrial sector to meet the regional energy saving targets defined according to EU and national legislation. The objective is to achieve supporting Regional Authorities, Energy Agencies and Regional Financial Agencies to elaborate and implement innovative financial instruments (IFIs) particularly addressed to provide Energy savings investments and project plans elaborated by SMEs. In parallel, an assessment procedure will check the quality of the investments and projects elaborated by SMEs to optimize resources and reach the targets. FIRECE project links to the specific objective because it will support public sector to plan and manage instruments able to achieve saving targets. The implementation of Innovative financial instruments and the assessment of the projects submitted by SMEs for energy savings will contribute to achieve the indicators contained in the Regional Energy Plans. Finally, FIRECE contributes to the achievements of the energy saving targets planned at worldwide and EU level.

- SPEEDIER [https://speedierproject.eu] is a highly innovative one-stop-shop solution that applies an integrated approach to energy management, providing information, advice, capacity building, energy auditing, financing, implementation of energy efficiency solutions and monitoring of impacts. SPEEDIER delivers a self-financing outsourced energy management service with much benefit to SMEs, enabling them to implement energy conservation measures and also obtain access to the energy services market. The service will be available via energy consultants, auditors and experts and will facilitate the uptake of energy audits, and the subsequent implementation of energy efficiency measures in SMEs.

4.5 The potential for replicating best practise

As noted in this section, there are many policies and projects to promote financing energy efficiency in industry. They cover both energy-intensive industries and SMEs.

Successful approaches that have been integrated in the EC policy framework include both market-based instruments such as the EU ETS and Energy Efficiency Obligation schemes, and administrative approaches such as requirements for Energy Audits and implementation of EMS. These have been implemented successfully across the EU and have been a major driver for the decoupling of industrial growth and energy consumption. There are however still variations in the depth of the implementation across the MS and therefore room for additional gains through consistent implementation.

Successful approaches that have been applied across a number of countries in EU and abroad include Voluntary Agreement Schemes for energy intensive industry and Energy Efficiency Networks for SMS. These are spread mainly through peer-to-peer information exchange between energy agencies based on results achieved, national evaluations and cross-country studies. Even higher uptake of these successful approaches may however require EC encouragement for replication at MS level through formal endorsement or even vesting in EC regulation.

As outlined above many nationally implemented best practice approaches and innovative pilot schemes receiving EU funding (typically through H2020) exist. These generally concern capacity building for stakeholders, project development assistance (PDA), aggregation mechanisms, and de-risking to improve the long-term framework conditions for energy efficiency financing. Similar approaches for scaling energy efficiency in buildings have been extensively tested by IEE and H2020 and emerging experience shows that capacity building and PDA are often successful on a national level but that aggregation and de-risking across country boundaries is challenging and typically require longer time horizon than allowed by the standard 3-years implementation time required under H2020 for stand-alone projects.

Recent calls for support by Horizon 2020, now Horizon Europe, have strengthened requirement for up-front identification of strategies for scale-up and replication of the results of individual projects. This is positive and CINEA should be encouraged to expand this further. Further to this, specific

thematic calls for cross border replication of successful best practises that have been implemented nationally or in a limited number of jurisdictions could be considered.

In relation to capacity building for energy efficiency in industry, the foundation is built on awareness creation of all stakeholders from enterprise owners over other staff categories within the company and to intermediaries such as energy service companies, audit companies and engineering companies. Furthermore, there is need for awareness creation and capacity building in financial institutions. For that, EEFIG as a whole is well placed with its Investor Underwriting Toolkit and DEEP database. At the third WG meeting, the representative from the French INVEEST project noted the results with capacity building for bankers was most encouraging and there was considerable interest by the WG members about the mechanics of the project which could easily be adapted for use in other countries.

Furthermore, it should be noted that the Sustainable Energy Investment Forums and the Smart Cities Marketplace platforms are important venues to promote individual best practice cases and encourage replication. Finally, it may be considered whether a curated list of best practice examples from buildings and industry should be included in the EEFIG website.

5 Conclusions and recommendations

5.1 General

The industrial sector plays a fundamental role in Europe's economy. Industrial products and services represent more than 20% of the EU's total value added. Directly industry provides 35 million jobs and many more indirectly, both within the EU and globally. The industrial sector includes many world-leading large industries but importantly, 99% of all European firms are SMEs. The European Commission considers SMEs the "economic and social backbone" of the EU.[36] While in energy terms, the large companies are so important but collectively SMEs cannot be forgotten.

Industry is on a path of climate neutrality, as part of the policy framework of the European Union, led by the European Green Deal. Becoming more energy efficient is a key starting point. Becoming more energy efficient and climate neutral may come at a cost. But it is more complicated than simply handing over money to companies. There is a need to understand the technical and decision-making dynamics as well as the priorities that companies must apply to stay competitive.

EEFIG's industry working group is playing a valuable role in bringing stakeholders together in a series of thematic meetings. It builds on the 2015 EEFIG report that set the tone for positioning the financing of energy efficiency in all sectors, including industry. The working group has identified obstacles and drivers, as documented above, but it has searched for solutions to accelerate investments in energy efficiency as part of the roadmap to carbon neutrality.

The main conclusions and recommendations from the work of the Working Group are provided below.

5.2 Conclusions

The conclusions for energy-intensive industries, SMEs, financial institutions and role and importance of non-energy benefits are the following.

Energy-intensive industries

- Energy intensive industries are increasingly looking at "deep decarbonisation" and make major changes in their production and their carbon footprint, primarily through a combination of improved energy

[36] 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, A new Industrial Strategy for Europe, 10.3.2020, COM (2020) 102 final

efficiency, renewable energy, electrification, new products, circular business models, and any other means to decarbonise.

- Industries are willing to decarbonise but seek partnerships with the EC and national governments on stable long-term policy frameworks, markets for new low carbon products (e.g. green cement, renewable and recyclable bio-based products, circular products), support for measures to improve their energy performance, access to infrastructure for renewable energy (electricity, green hydrogen and bio-energy), grants and concessional finance supporting technology innovation, support schemes for on-site renewable energy production and a level playing field for internationally-traded products.

- Focusing on innovation is key, to develop both for new, less carbon-intensive, renewable and circular products and less carbon- and energy-intensive processes.

- Partnerships and mutual commitments between governments and industries can create a framework for deep decarbonisation combined with long term competitiveness that facilitates access to long term commercial financing for green transition.

- Large companies are also increasingly adapting to sustainability related reporting requirements from customers, investors, banks and other stakeholders, and they are well aware that these will be further strengthened with the implementation of the EU Taxonomy for sustainable economic activities.

- Implementing energy management systems (EnMS) to develop a company-wide approach to effective energy management have proven to have a positive impact on corporate culture towards energy efficiency improvements.

- Furthermore, voluntary agreement schemes on energy efficiency in energy intensive industries have been successful across a number of countries.

- The EU Taxonomy Regulation entered into force on 12 July 2020 and the rise of ESG criteria in the decision making of investments have jolted industries to find solutions to minimise their environmental impact, including energy consumption.

- Intermediaries (e.g. ESCOs) can provide important support when capital, capacity and expertise is limiting investments in complex EE technologies.

- Covid-19 has delayed the implementation of energy efficiency in the industry due to the market's economic uncertainty and the manufacturers' prioritisation to reduce their costs.

SMEs

- SMEs generally understand that there is a need to improve their competitiveness through efficiency improvements but they face many factors that lead to inertia. Typically, small-sized and non-energy-intensive industrial SMEs do not have enough capacity and capital to work with energy efficiency improvements and are thus in need of a more supportive approach from intermediaries such as external experts.

- SMEs play a key role in the supply chain of energy-intensive companies. SMEs in the B2B market are therefore increasingly being met with requirements from their large corporate clients adopting scope 3 emission reduction targets to report emission data and develop mitigation plans. In parallel some energy-intensive companies are setting up partnerships with the SMEs involved in their value chain, helping these to decarbonise.

- SMEs lack of capacity to build a business case on any possible energy efficiency measure that they can take to financial institutions and funding sources (e.g. national or regional funds, energy efficiency networks). This is where an intermediary (e.g. ESCOs, qualified auditors, CMVP) can provide important support.

- SMEs in Europe are diverse geographically, in size, sector and ownership. These factors strongly affect decision making when it comes to decide on the implementation of an EE intervention and on its relevance among other priorities. For example, the majority of SMEs are located in the countryside, whereas the most advanced energy efficient companies are located in the cities, where the absorption and application and expertise of new technologies are higher.

- Frequent changes in policy implementation discourage the implementation of energy efficiency interventions in the industry sector and has a disproportionate effect on SMEs.

- Even in SMEs, implementing energy management systems and undertaking energy audits have proven to have a positive impact on corporate culture towards energy efficiency improvements and have led to greater investments in energy efficiency measures. New International Standards are being published to support SMEs (e.g. ISO 50005:202 and ISO 50009:2021).

- Standardisation is important for SMEs in establishing a firm relationship between an asset owner, an intermediary (e.g. ESCO) and the financial community as seen in de-risking programmes. Also very relevant is the standardisation of the energy audit approach for SME sector and size and the development of standardised carbon saving metrics for SMEs (at least for medium enterprises).[37]

[37] Adapted from LEAP4SME H2020 project, Energy audits market overview and main barriers to SMEs, July 2021, p 40.

- Furthermore, peer-to-peer information exchange through structured knowledge sharing networks (such as Energy Efficiency Networks) has been a successful approach for SMEs in several countries.

- The market is increasing the pressure on SMEs to monitor and reduce GHG emissions, through their role in the B2B supply chain where they are increasingly met by requirement for reporting of scope 3 emissions under the Science Based Targets Initiative.

- In the case that an SME has relatively low energy demands, resulting in low energy expenses, they often do not consider investing in energy efficiency measures.

- Usually, SMEs focus on expanding their market, size and product competitiveness, leaving behind other factors, such as the energy efficiency upgrades.

- In efforts to support industrial symbiosis, there is a necessary collaboration between SMEs and large industries to reduce waste (circular economy) and emissions.

- The concerns have been exacerbated in the current Covid-19 crisis, with SMEs reluctant to take on any more debt.

- The uncertainty of future energy trends, also proven by the recent rises in natural gas and petroleum, have motivated SMEs to reduce their energy consumption to avoid profit losses.

The role of Financial Institutions

- Since industry needs a steady flow of financing to meet its long-term energy and climate obligations, financial institutions (both private and public) are central to the energy and climate strategy.

- FIs have played key roles in de-risking programmes by actively supporting and accepting the standardisation of design and implementation processes in their underwriting actions.

- EEFIG's DEEP database clearly shows that energy efficiency is the cheapest source of clean fuel for industry and that many energy efficiency projects in industry have payback times below 4 years.

- FIs provide an important signal to industry when they actively participate in climate and clean energy financing initiatives. With the EC sustainable finance strategy and the implementation of the action plan on financing sustainable growth, Financial Institutions will increasingly look to the EU Taxonomy in their engagement with corporate clients.

- Market-leading banks have a plethora of green products, such as Green Loans, but this does not apply to smaller, regional banks that SMEs usually do business with.

- In contrast to renewable energy financing, industrial energy efficiency does not allow for large scale asset backed financing but tend to be embedded in corporate balance sheet-based lending programs and therefore a corporate risk rather than a project risk. In particular energy efficiency upgrades in SMEs are usually small-scale investments for financial institutions.

- Furthermore, more awareness among FIs is needed of the long-term benefits of the EE investments and measures. This is likely to follow from the implementation of the EE 1st principle in FIs.

The role and importance of multiple benefits

- Improved energy efficiency is an important policy tool to address not only energy consumption and climate impacts, but also non-energy problems (e.g. water usage, local air pollution, better resource management). However, until recently, these links were poorly understood. This has changed in recent years and there have been important steps to analyse and even quantify the non-energy benefits of energy efficiency investments. Hence, improving the business case of energy efficiency solutions to be implemented at company level. In the recent years, issues related to the water-energy nexus have been looked into in a more systematic way.

- Understanding the non-energy benefits to improved energy efficiency can be persuasive in increasing efficiency investments by industry. The focus is on the decision-making process for individual firms, projects and investment decisions rather than the level of policy (international, national, regional or local).[38]

- By analysing and quantifying where possible the non-energy benefits, there is increased awareness within the corporate structure that energy efficiency can be promoted while contributing to the advancement of business sustainability. The analysis can be seen as a diagnostic tool, ending with the review of the business logic through the prism of energy efficiency measures for improving innovation and improvement.[39]

[38] Adapted from MBenefits H2020 project, *Literature Review – methodology and preliminary findings*, June 2018, p. 5.

[39] Adapted from DEESME H2020 project, Multiple benefits approach of energy audit, June 2021, p. 10.

5.3 Policy recommendations

From the start, the members of the Working Group wanted to have an impact to support policymaking in the EU, knowing how important the industrial sector is in contributing to reducing energy demand and GHG emissions in the European Green Deal. While the focus must be on the long term to ensure Europe becomes carbon neutral by 2050, this next decade needs to see an acceleration of investments in energy efficiency. This is important for climate and energy goals. It is also important for Europe as it works its way out of the aftermath of the Covid-19 pandemic. Much of the economy suffered and industry must play an important role in the recovery. Taking the next steps to carbon neutrality through improved energy efficiency is an important path forward.

From the work of the EEFIG Working Group on further improving energy efficiency in industry there are a number of recommendations to the key stakeholders. There are important messages to the industrial sector, to Member States, to EU institutions and to the financial community.

Recommendations to Industry:

- Implement Energy Management Systems, conduct energy audits, and implement recommendations of such audits:
  - Monitor and manage their energy consumption using mandatory or voluntary Energy Management Systems such as ISO 50001 standards, energy monitoring systems, mandatory energy efficiency targets, energy audits.
  - Review, implement and monitor the actions identified in the audits (whether mandatory or not).
- Engage with EC and Member States on stable long-term frameworks for ambitious climate commitments:
  - Engage through sector organisations with EC and Member States to develop 2030 and 2050 strategies for carbon neutrality at sector and enterprise level.
  - Engage through sector organisations with EC and Member States authorities on stable framework conditions, markets for new low carbon and bio-based products, support for measures to improve their energy performance, and access to infrastructure that can enable electrification.
  - Seek partnerships with their supply chain on deep decarbonisation of products and processes.
- Be open to innovation and use available EU funding vehicles for low-carbon technology and business model development and roll-out:

- Use the EU ETS and EU funding opportunities with grants supporting technology innovation (Horizon Europe, Innovation Fund, etc.) as a strategic tool for the carbon-neutral energy transition.

- Test innovative business models (such as Servitisation) that incentivises the implementation of energy efficiency.

Recommendations to Member States:

- Engage with industry on the long-term framework for decarbonisation:

  - Review policy options for developing long term stability for green transition of industry.

  - Engage with the industry and their sector organisations to develop 2030 and 2050 strategies for carbon neutrality at sector and enterprise level with technical support from research institutes.

  - Develop partnerships with business and sector associations on decarbonisation, such as voluntary agreements, to ensure they work towards meeting the long-term climate and energy objectives.

- Provide targeted support:

  - Develop support programmes to facilitate the uptake of cost-effective measures identified in mandatory audits and energy-intensive industrial SMEs.

  - Use public grants and funds to support project development, quality assurance, de-risking and insurance costs of multiple EE investments, in order to trigger private sector investments, instead of limiting the public funds to fewer wholly funded projects.

- Embed EE 1st principles in public procurement decisions

  - Support development of markets for green products including through green public procurement.

Recommendation to EU institutions:

- Continue to ensure that the 'Energy Efficiency First' principle is integrated into relevant climate and energy policies as an element in the broader decarbonization policy framework:

  - Monitor and revise relevant policies to ensure their continued effectiveness to accelerate investments in energy efficiency.

- Extend and support non-financial corporate sustainability reporting, that currently applies to large companies, to small and medium-sized enterprises that emit significant amounts of GHGs, on a voluntary basis.

- Keep contributing to R&D investment in energy efficiency technologies in industry sectors where solutions for deep decarbonisation are not yet commercially available:
  - Facilitate the use of EU financial schemes to ensure energy-intensive industries have effective access to them.
  - Increase research investments into energy efficiency technologies and techniques in industry as well as facilitating the market uptake of cost-effective energy efficiency solutions among large and small companies.

- Keep contributing to develop innovative business models facilitating the market uptake of energy efficiency measures and renewables within SMEs in the industry and services sectors:
  - Promote the growth of energy efficiency networks, build sectoral toolkits and benchmarking tools, help standardise energy efficiency solutions and increase the knowledge sharing capabilities of industrial companies and SMEs.
  - Keep contributing to develop innovative business models facilitating the market uptake of energy efficiency measures and renewables within the industry and services sectors[40].
  - Provide incentives to SMEs to implement energy efficiency measures, including by facilitating financing of EE projects by energy service companies (ESCOs) and EE special purpose vehicles.
  - Support SMEs in dealing with forthcoming product passports, which will include many sustainable indicators (incl. GHG emissions).

- Support the development of sector specific industrial roadmaps for climate neutrality:
  - Support the development of sector specific industrial roadmaps for climate neutrality at European level as well as to encourage their adoption and implementation at local level by mobilising relevant stakeholders.

[40] In this regard, funding opportunities such as the LIFE-2021-CET-VALUECHAIN - aiming at climate proofing the whole value chain through innovative business models - represent an interesting opportunity for EU companies and relevant stakeholders.

Recommendations to Financial institutions:

- Embed EE 1st principles in lending policies:
  - Give priority to energy efficiency investments - in industry as well as buildings - in support of the strategy for sustainable finance and the Energy Efficiency First principle.
  - Take a proactive approach with the client base in industry that facilitates access to long term commercial financing for the carbon-neutral energy transition.
- Integrate EE in risk assessment and product development
  - Systematically evaluate the benefits of EE projects in their risk assessments of industrial clients and provide their clients dedicated energy efficiency finance lines.
  - Develop green financial instruments to support long-term investments in carbon-neutral energy transition of European industry.
- Use available de-risking tools to support EE financing market development
  - Use EEFIG tools like the underwriting's toolkit[41] and DEEP database[42] and participate in de-risking projects to show commitment to improved energy efficiency and to show that EE investments can be sound financial investments.
  - Facilitate the financing of energy service companies and EE special purpose vehicles, with asset finance preferred over ESCO corporate finance.

[41] https://ec.europa.eu/eefig/going-activities_en#ecl-inpage-106

[42] https://deep.eefig.eu/

Appendix A PowerPoint presentation

European Commission

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EEFIG Working Group on Further improvements of energy efficiency in industry

Main results, conclusions and recommendations

1 March 2022

European Commission

UN environment programme | finance initiative

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Objective of the Working Group

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Objective and members of the WG

The objectives of the WG was to:

- **Identify and assess the main obstacles and drivers** for improving energy efficiency industry (based on the already extensive literature on barriers to industrial efficiency and the real-world experience of WG members);
- **Identify best practices**, their key features and possible obstacles they have to face, assessing the potential to replicate them under which circumstances; and
- **Formulate both general and specific recommendations** on what tools and policy instruments are likely to be most effective for increasing energy efficiency investments in industry.

The members of the WG were various stakeholders concerned about improving energy efficiency in industry:

- The financial community
- Industry representatives
- Technology and service suppliers
- Academics
- Policy analysts.

There were 40 regular participants at the 6 WG meetings during 2020-2021, showing the strong interest in the topic.

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Summary of results and conclusions

European Commission

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Energy-intensive industries

- Energy intensive industries (EII) are increasingly looking at “deep decarbonization”
- They make major changes in their production and their carbon footprint, primarily through a combination of improved energy efficiency, renewable energy, electrification, new products, circular business models, and any other means to decarbonise.
- Industries are willing to go that way but seek partnerships with the EC and national governments on stable long-term policy frameworks, markets for new low carbon products, access infrastructure for renewable energy (electricity, hydrogen and biogas), grants supporting technology innovation, and a levelled playing field for products with international.

Small and Medium-sized Enterprises

- SMEs generally understand that there is a need to improve their competitiveness through energy efficiency improvements, but they face many factors that lead to inertia.
- But SMEs do not have enough capacity and capital to work with energy efficiency improvements and are thus in need of a more supportive approach from intermediaries such as external experts.
- And they lack capacity to build a business case on possible energy efficiency measure that they can take to financial institutions and funding sources.
- Concerns about financing have been exacerbated in the current Covid-19 crisis, with SMEs reluctant to take on any more debt. The uncertainty of future energy trends, also proven by the recent rises in natural gas and petroleum, have motivated SMEs to reduce their energy consumption to avoid profit losses.

Financial Institutions

- Industry needs a steady flow of financing to meet its long-term energy and climate obligations, financial institutions (both private and public) are central to the energy and climate strategy.
- FIs provide an important signal to industry when they actively participate in climate and clean energy financing initiatives.
- With the EU sustainable finance strategy and the implementation of the action plan on financing sustainable growth, Financial Institutions will increasingly look to the EU Taxonomy in their engagement with corporate clients.
- In contrast to renewable energy financing, industrial energy efficiency does not allow for large scale asset backed financing but tend to be embedded in corporate balance sheet-based lending programs and therefore a corporate risk rather than a project risk.

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Summary of recommendations

European Commission

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Recommendations for industry

Industry should implement Energy Management Systems (EMS), audits and identified projects, engage with governments on stable long-term frameworks for ambitious climate commitments, and use available EU funding vehicles for low-carbon technology development and roll-out:

- Monitor and manage their energy consumption using Energy Management Systems (such as ISO 50001 standards), conduct energy audits, and implement recommendations of such audits.
- Engage with EC and Member States authorities on stable framework conditions, markets for new low carbon and bio-based products, support for measures to improve their energy performance, and access to infrastructure that can enable electrification through sector organisations.
- Use the EU ETS and EU funding opportunities with grants supporting technology innovation (Horizon Europe, Innovation Fund, etc.) as a strategic tool for the carbon-neutral energy transition.

Recommendations for member states

Member States should engage with industry on the long-term framework for decarbonization, provide targeted support, and embed EE 1st in public procurement decisions:

- Develop partnerships with business and sector associations on decarbonization, such as voluntary agreements, to ensure they work towards meeting the long-term climate and energy objectives.
- Develop support programmes to facilitate the uptake of cost-effective measures identified in mandatory audits and energy-intensive industrial SMEs.
- Support development of markets for green products including through green public procurement.

Recommendations for EU institutions

EU institutions should continue to embed EE 1st principles into climate and energy policies, support R&D in innovative technologies for EII, support dedicated business models for SMEs, and support development of industry sector roadmaps for climate neutrality:

- Continue to ensure that the 'Energy Efficiency First' principle is integrated into relevant climate and energy policies as an element in the broader decarbonization policy framework.
- Keep contributing to R&D investment in energy efficiency technologies in industry sectors where solutions for deep decarbonization are not yet commercially available
- Keep contributing to develop innovative business models facilitating the market uptake of energy efficiency measures and renewables within SMEs in the industry and services sectors.
- Support the development of sector specific industrial roadmaps for climate neutrality at European level as well as to encourage their adoption and implementation at local level by mobilizing relevant stakeholders.

Recommendations for Financial Institutions

Financial institutions should embed EE 1st principles in lending policies, integrate EE in risk assessment and product development, and use available de-risking tools to support EE financing market development:

- Give priority to energy efficiency investments - in industry as well as buildings - in support of the strategy for sustainable finance and the Energy Efficiency First principle.
- Systematically evaluate the benefits of EE projects in their risk assessments of industrial clients and provide their clients dedicated energy efficiency finance lines.
- Use EEFIG tools like the underwriting's toolkit and DEEP database and participate in de-risking projects to show commitment to improved energy efficiency and to show that EE investments can be sound financial investments.

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Thank you!

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Appendix B Composition of the working group

Name	Organisation	TYPE
Alessandra Cassisi	CIVIESCO	Finance ESCO
Alessandro Federici	ENEA	Policy
Alex Rathmell	EnergyPro	Consortium
Alessandro Fiorini	ENEA	Policy
Alexandra Tudoroiu-Lakavice	COGEN Europe	Industry Association
Amandine Gal	Econoler	Finance/Consulting
Anastasios Vasilopoulos	Engineering Solutions	Industry
Andreas Guertler	EiiF	Industry Association
Angelo Giordano	CiviESCo	Finance ESCO
Antoine Durand	Frauenhofer	Consortium
Angels Orduña	SPIRE	ETS Industry
Carlos Sanchez-Rivero	ENER	EC
Carsten Glenting	Viegand Maagøe	Consortium
Chara Karakosta	NTUA	Consortium
Christophe Rynikiewicz	BASE	NGO
Coco Downey	DG ENER	EC
Dario Di Santo	FIRE	NGO Industry Assn
Diana Wang	University of Stuttgart	Research
Dinne Smederup Hansen	COWI	Consortium
Dusan Jakovljevic	EEIP	Consortium
Enrico Biele	EnR IWG	Policy
Erwin Cornelis	Tractabel, Engie, then Independent	Policy
Ettore Piantoni	Comat Servizi Energetici S.p.A.	Policy
Filippo Gasparin	CINEA	EC
Filippos Dimtrios Mexis	Triple-A	Finance
Fredrik Backman	Swedish Energy Agency	Policy
Gabriele Pesce	Euroheat & Power	Industry Assn
Hannes MacNulty	Independent	Consultant
Isidoro Tapia	EIB	Finance
Jamil Dawood	DEA	Policy
Jan Ciampor	ENER	EC
Jean Theo Ghenda	Eurofer (European Steel Association)	ETS Industry
Johannes Laubach	MACS Energy & Water	Consulting
Kai Schinck	DENEFF	Industry association
Karl Schaumlechner	voestalpine Stahl GmbH	ETS Industry
Klaas Vos	FrieslandCampina	ETS Industry
Lisa Okken	DENEFF	Industry Association

Livio Di Chicchis	FIRE	NGO Industry Assn
Luis Lopez Brunner	EiiF	Industry Association
Madis Laaniste	DG ENER	EC
Malgosia Rybak	Cepi	ETS Industry
Marco Baresi	Turboden	ETS Industry
Marco Manchisi	Tera Srl	Industry
Marija Sculac Domac	Croatian Chamber of Economy / Eurochambres	Finance/Association
Michael Pachlatko	Joule Assets	Finance
Michele Stano	CIVIESCO	Finance ESCO
Mukund Bhagwat	Copper Alliance	Industry Association
Nevenka Hrovatin	University of Ljubljana	Research
Nicola Rega	CEFIC	ETS Industry
Nikola Catovic	MACS Energy & Water	Consulting
Nils Borg	ECEEE	NGO
Oronzo Dailoiso	EASME/CINEA	EC
Paolo Bertoldi	JRC	EC
Paolo Ingrassia	CIVIESCO	Fiinance ESCO
Patrik Thollander	Linköping University	Research
Peter Handley	DG GROW	EC
Peter Maagøe Petersen	Viegand Maagøe	Consortium
Raimon Argemí	COGEN Europe	Industry Association
Rod Janssen	EEIP	Consortium
Rüdiger Lohse	DENEFF EDLHUB	Industry Association
Sébastien Delpont	Greenflex	Finance
Shane McCullough	Strategic Banking Corporation of Ireland	Finance
Sergio Bottiglioni	Ricerca e Progetto	Consulting
Simon Minett	COGEN Europe	Industry Association
Stefan Buettner	University of Stuttgart	Research
Stefania, Racolta-Cruceru	EBRD	Finance
Suzanne Leamy	Senior Business Analyst	Finance
Thomas Bjorkman	SEA	Policy
Thomas Uhd	Cementir (Aalborg Portland)	ETS Industry
Ugo Simeoni	European Turbine Network	ETS Industry
Virginia Zhelyazkova	Postbank/Eurobank Bulgaria	Finance
Winfried Braumann	REENAG	Finance
Zoya Vasileva	Mattig Group – Switzerland	Consulting

Appendix C Data on which the analysis is based

DG ENERGY

Launch and facilitate the implementation of a new EEFIG Working Group on "Further improvements of energy efficiency in industry"

BACKGROUND PAPER
FOR EEFIG WORKING GROUP ON INDUSTRY
1ST MEETING, JULY 15, 2020


CONTENTS

1 Introduction

This report is prepared in the context of the assignment "Launch and facilitate the implementation of a new EEFIG Working Group" on "Further improvements of energy efficiency in industry" (EC request for service N° ENER/C3/FV2018-556/08/FWC2018-464/10). The inception report is designed to serve as the basis for the work of the working group. It sets out the background, develops the goals, objectives and challenges for the working group.

The report follows the kick-off meeting with the European Commission on January 9, 2020, that discussed all of the aspects of the work and got the initial agreement of the Commission to move forward with the next steps.

Background and purpose of the WG

Objectives of the WG and why a WG is needed

A working group on Industry is being set up under the Energy Efficiency Financial Institutions Group (EEFIG)[1], similar to other working groups on a range of topics. This working group would assess the industrial practices dealing with energy efficiency, will identify and assess the main obstacles and drivers for improving energy efficiency in industry, will identify best practices and will provide recommendations to DG ENERGY on what tools and policy instruments are likely to be most effective for increasing the energy efficiency investments in industry.

The key objectives of the WG are:

- Identify and assess the main obstacles and drivers for improving energy efficiency industry (based on the already extensive literature on barriers to industrial efficiency and the real-world experience of WG members);
- Identify best practices, their key features and possible obstacles they have to face, assessing the potential to replicate them under which circumstances;

[1] http://www.eefig.com/index.php

- Formulate both general and specific recommendations on what tools and policy instruments are likely to be most effective for increasing energy efficiency investments in industry.

Since EEFIG was created seven years ago, the priority for energy efficiency in the EU has significantly increased. Once seen as simply one of the elements of energy policy, since the creation of the Energy Union energy efficiency is now considered first. That means, *inter alia*, addressing energy demand before finalising the clean energy supply that is needed. Improving energy efficiency is necessary in all end-use sectors.

In recent years, the European Union adopted the Clean Energy Package[2] that revised the Energy Efficiency Directive[3]. That led to more ambitious long-term targets for energy savings.

In 2019, the European Commission presented the European Green Deal[4]. It sets the ambition of making the EU climate neutral by 2050. The Green Deal provides a roadmap with actions to boost the efficient use of resources by moving to a clean, circular economy; and restore biodiversity and cut pollution.

Furthermore, the Green Deal outlines the additional investments needed to achieve climate neutrality by 2050 and EU financing tools available and explains how to ensure a just and inclusive transition.

In January 2020, the Commission presented its European Green Deal investment Plan[5]. The European Green Deal Investment Plan will mobilise EU funding and create an enabling framework to facilitate and stimulate the public and private investments needed for the transition to a climate-neutral, green, competitive and inclusive economy. The plan is to mobilise at least €1 trillion of sustainable investments over the next decade.

In March 2020, the Commission presented, in the context of the European Green Deal, its proposal for the EU Climate Law[6] that proposes a legally binding target of net zero greenhouse gas emissions by 2050.

In March 2020, the Commission also published its industrial strategy[7]. There will be "comprehensive measures to modernise and decarbonise energy-intensive industries, support sustainable and smart mobility industries, to promote energy

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[2] https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en
[3] https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive_en
[4] COM (2019)640 final
[5] https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_24
[6] Proposal for a Regulation establishing the framework for achieving climate neutrality and amending Regulation 2018/1999 (European Climate Law), COM (2020) 80 final.
[7] https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en

efficiency, strengthen current carbon leakage tools and secure a sufficient and constant supply of low-carbon energy at competitive prices." The strategy includes a dedicated strategy for small and medium-sized enterprises (SMEs) aims to reduce red tape and help Europe's numerous SMEs to do business across the single market and beyond, access financing and help lead the way on the digital and green transitions.

What this means for the industrial sector is that the level of energy efficiency improvements needs to scale up. Furthermore, to ramp up those improvements, significantly more funding is needed from both the public and private sectors. This means that EEFIG needs to build on its previous activities.

In its 2015 report[8], EEFIG identified many of the barriers to the long-term financing for energy efficiency and proposed policy recommendations and market solutions to them. The purpose of the group is to get the financial institutions and other relevant stakeholders to help find ways to overcome the investment blockage. There is financing available, but banks have poor capacity and interest to finance energy efficiency, and consumers (in this case industry or businesses or institutions) are reluctant to decide to undertake such measures. While there are some investments, for sure, they are not at a scale that will have a real impact that is needed to meet our long-term objectives. The working group must look into these issues.

In the autumn of 2019, EEFIG surveyed its members and there are some important insights. According to the EEFIG survey, energy efficiency investment returns is, perhaps unsurprisingly, the #1 demand driver across all corporate segments irrespective of size, quickly followed by a clear business case & baseline and awareness at key decision makers level, human capacity and leadership.

The financial institutions surveyed provided the following insights:

- Financial Institutions tend to underestimate the importance of business interruption risks and the existence of subsidies to drive demand for energy efficiency in companies;

- Financial Institutions see the general economic outlook and effective enforcement of existing regulations as much less important drivers of energy efficiency than do the users;

- Finance users see key decision makers' confidence in energy efficiency resources, awareness at key decision maker level & leadership and human capacity and the price and volatility of energy as stronger drivers than the financial institutions do.

The 2015 final report provided important recommendations on industrial energy efficiency to policy makers:

[8] http://www.eefig.com/index.php/the-eefig-report

- The policy framework should positively support strong corporate energy efficiency investment choices at key points in their investment cycle
- Public resources and facilitation should be engaged to establish dynamic and effective systems for sharing information and technical experience
- Ensure EU and national policies and resources are working effectively together to drive R&D and optimal energy efficiency outcomes
- Support the clarification of the regulatory, fiscal and accounting treatment and standardisation of Energy Performance Contracts
- Energy efficiency opportunity identification and investible project pipelines should be supported with Project Development Assistance facilities for SMEs.

Since the 2015 recommendations there has been progress in the EE investment process as well as in energy management systems (EnMS):

- More has been done on improving the EE investment process
- Progress has been made on an industry roadmap for fiscal – accelerated depreciation allowance processes
- Industry EE and best practices has been developed
- Industry benchmarks and technology maps has been further developed
- High profile campaigns on benefits are conducted
- There is increasing interest to see how working groups can examine how green bonds can be used to accelerate the uptake of EE in buildings and industry
- There is interest for working groups to provide practical suggestions to improve EEFIG tools, website and outreach.

What EEFIG has done so far that relates to industry

It is useful to review some of actions of EEFIG that have had an impact for the industry sector.

› DEEP[9] is an open source database for energy efficiency investments performance monitoring and benchmarking.

- The objective is to up-scale energy efficiency investments in Europe through the improved understanding of the real risks and benefits of

[9] https://deep.eefig.eu/

energy efficiency investments based on market evidence and track record.

- The database includes 10,000+ energy efficiency projects in buildings and industry from 25 data providers.
- New data and improved functionality is added regularly.

› Underwriting Toolkit

› The EEFIG Underwriting Toolkit[10] is a guide which aims to assist financial institutions to scale up their deployment of capital into energy efficiency. It has several purposes:

- to help originators, analysts and risk departments within financial institutions better understand the nature of energy efficiency investments and therefore better evaluate both their value and the risks.
- to provide a common framework for underwriting energy efficiency investments that will allow training and capacity building around standardised processes and understanding.
- to help developers and owners seeking to attract external capital for energy efficiency projects to develop projects in a way that better addresses the needs of financial institutions.
- to foster a common language between project developers, project owners and financial institutions.

In October 2017, EEFIG had a special half-day workshop dedicated to industrial energy efficiency.

› For the meeting itself, there were two guiding themes, addressed by two panels, one consisting of demand-side stakeholders, and one of intermediaries and the financing industry.

› Theme 1: "Recent trends in Financing Industrial Energy Efficiency, Challenges encountered and Solutions to Them"

- What will be the impact of further efforts to "de-risk" investments? Is there room for further standardization of the investment process?
- How can the "perceived" risk be brought down to the "real risk?
- How do we encourage industry to consider energy efficiency investments as strategic decisions for improving their overall competitiveness?

[10] http://www.eefig.com/index.php/underwriting-toolkit

- Theme 2: "Moving Forward – How to Further Improve the Industrial Energy Efficiency, and Make It More Accessible to SMEs"

  - What more can be done to ensure economic energy efficiency measures are implemented?

  - How do we motivate more private investment activity for financing industrial energy efficiency? Is there the possibility of bundling projects to reduce transaction costs and make them more interesting to financial institutions?

  - Have the mandatory audits under the Energy Efficiency Directive led to significant investments? If not, why? If yes, how?

  - Can policy changes at EU or national levels encourage more investment in industrial energy efficiency measures?

Following the meeting, Chairman's Conclusions were disseminated. These will be made available to WG members.

The meeting highlighted that:

- **Short-term horizons continue to dominate the majority of industrial energy efficiency investments** and a significant opportunity remains in Europe to cost-effectively save energy in industry. There remained a good number of "easy wins" and low cost, high return investment opportunities in the non-core, periphery processes in industrial sites (lighting systems, boilers, electric motors, compressors and the like). Nevertheless, with 85% of industrial energy use coming from core-processes, it is clear that Europe's energy efficiency targets will not be met with non-core "low hanging fruit" alone, and experts lamented the infrequency with which energy audits dealt deeply with core processes as well as the lack of process related knowledge among many of the energy auditors themselves.

- **Energy audits are a helpful first step for most of industry, yet while they do make some opportunities visible too many cost-effective opportunities are not implemented**. Adoption of ISO 50001 was a significant advance as it requires structure, targets, measurement, and continual progress. Many audits are carried out by auditors without sufficient detailed knowledge of the specific industrial process in question, there is inadequate standardisation of the actual audit methodology and, while there is a mandatory audit requirement for large industrial firms, there is no requirement to actually implement the recommendations, in most member states.

- **Industrial energy efficiency projects are too often not seen as strategic**, but as a distraction to the "real company business" except in the core industrial processes of energy intensive industries. Lack of progress boils down to a "bandwidth issue" – plant managers will only

dedicate scarce and valuable internal technical resources to non-strategic matters if: 1) They become strategic (ie company culture dictates energy savings targets and requires their timely delivery); 2) Energy efficiency projects deliver other things of strategic value (eg. Quality or productivity improvements); 3) They form a key part of individuals' personal performance evaluation; or 4) They are a matter of regulatory compliance (e.g. Safety procedures).

- **Most industrial energy efficiency projects are funded internally and often loose out in competition with other investments**. Internal fund allocation does not work like an efficient capital market, as internal investment funds tend to be allocated as risk-equity whose purpose is to deliver strategic business growth, and not cost reduction. Firms that have set-aside fund allocations to focus just on internal energy efficiency investments find that this can unlock pipelines of energy efficiency projects which otherwise would just not get seen if having to compete directly for internal funds with core-strategic investments. In addition, this can enable access to green bond markets and other low cost and additional sources of external energy efficiency finance.

- **European industry already leads the world in its energy efficiency but can do much more**. Making European industry more competitive and less carbon and energy intensive through increased energy efficiency investments makes economic, social and environmental good-sense, and is perfectly aligned with EU energy policy. Participants felt that there was a strong case for further EEFIG work on industry and that these conclusions can be developed in the third EEFIG cycle.

These conclusions from October 2017 are generally all still true. However, in countries with ambitious national climate plans and partnerships between government and industry (e.g. Sweden and Denmark), broader decarbonisation of industry (of which energy efficiency is an important component) is becoming a strategic agenda for corporate managements.

Next steps

All of this means there is a great urgency to see results in all end-use sectors, including industry. Care has to be given because it is not necessarily the way forward for the group and for the sector as a whole, hence, suggestions for further improvements of energy efficiency is to be comprehensive, deliberate and realistic.

The inception report is structured as follows:

› **Chapter 2 Existing knowledge and context** presents an overview of up-to-date knowledge on the topic and the main challenges to be addressed;

- **Chapter 3 The problem to be addressed by the WG,** provides a description of the key issues and challenges related to WG topic. Based on this, the role and possible contribution of the WG in the context of the topic is detailed;

2 Existing Knowledge and Context

The present chapter gives an overview of up-to-date knowledge on the topic and the main challenges to be addressed. Over the next months the Working Group will be addressing various aspects of energy efficiency within energy-intensive industries and industrial SMEs. This chapter provides a review of the existing knowledge and the context for the sectors.

Some of the challenges which will have to be taken into account in the work are:

- **The highly specific nature of many industrial energy efficiency projects**
  While many industrial facilities present opportunities for 'off the shelf' energy-saving interventions such as motor upgrades, in many cases the greatest opportunities for energy savings lie in the industrial processes themselves, for example improving heat recovery. Identifying and developing investable projects therefore requires highly specialized, process-specific knowledge, and implementation may disrupt business-critical processes. Furthermore, the energy efficiency component of integrated investment projects e.g. large plant refurbishments may be difficult to separate and may therefore pass unnoticed.

- **The need to go beyond short-payback projects**
  Industrial companies often subject EE investment decisions to a narrow, rigid appraisal process, frequently limited to a simple payback threshold (e.g. a 1½ year payback cut off) based solely on energy cost savings. As a result, the EE activity of industry is often a function of limited available funds for competing local investment needs and high internal cost of capital rather than longer term decarbonisation goals. While this is gradually changing with some companies developing ambitious long-term climate strategies, there is a need to better account for non-energy benefits to improve the attractiveness of larger investments, to re-think corporate investment appraisal methods, and to facilitate access to external sources of finance to ensure efficiency investment is limited to low hanging fruits.

- **The need to better measure energy productivity**
  While industrial companies monitor the productivity and profitability of their processes, in many cases energy is only one of a number of inputs. As such the energy productivity / specific energy consumption (the amount of production output per unit of energy) of a facility or company can be difficult to measure in a dynamic world with frequent changes in sales and product mix. In turn this makes it challenging to benchmark and compare industries, and to hold them to account for year-on-year performance improvements.

- **SMEs offer significant energy efficiency potential but also specific challenges**
  SMEs are a diverse population, covering a wide range of business activities and energy end-uses. Any SME is likely to experience most of the barriers to energy efficiency adoption that are common to all organisations, plus a number of barriers unique to or more pronounced among SMEs (limited

inhouse technical capacity, part time energy manager often also responsible for safety and environment, relatively higher transaction costs compared to project size). Therefore, specific policy instruments are needed to realize the energy efficiency potential of SMEs.

2.1 Energy-intensive industries

In this section, an overview of the industrial sector in EU is presented in terms of its contribution to the EU economy (Gross value added), its contribution to total energy consumption (Energy consumption) and its contribution to the climate challenge (GHG emissions). Special emphasis is on the energy intensive industry whereas SMEs are covered in detail under section 2.2.

Further, at the end of the section, current policy measures and schemes to stimulate energy efficiency are described along with a discussion on which barriers that exist towards improving energy efficiency in energy-intensive industries.

The 2015 EEFIG report defined energy-intensive industries as: EEFIG defines "Energy Intensive" as covering companies which use significant quantities of energy as part of their primary economic activities including the following industries (both ETS and non-ETS): Aerospace, Automotive, Cement, Chemical, Food & Drink, Glass, Metals, Pharmaceuticals, Pulp & Paper, Refining and Shipping."

2.1.1 Overview of the industrial sector in EU28

Gross value added

Overall, the industrial sector (large industries and SMEs) contributes with 19% of the total gross value added in 2017 in EU28, see Table 2-1 below.

Table 2-1 Overview of industrial sectors by gross value added

Sector	Gross value added (2017)	Sector contribution to total gross value added (2017)	Sector contribution to industry gross value added (2017)
	Million EUR	%	%
Total - all NACE activities	13,771,472	100%	-
Industry (except construction)	2,650,370	19%	**100%**
Mining and quarrying	58,189	0%	**2%**
Manufacturing	2,213,903	16%	**84%**
Electricity, gas, steam and air conditioning supply[11]	241,511	2%	9%

[11] *Electricity, gas, steam and air conditioning supply are not manufacturing industry and should in this context not be compared to energy-intensive industries*

Water supply; sewerage, waste management and remediation activities[12]	136,767	1%	5%

*Source: Eurostat; Table: National accounts aggregates by industry (up to NACE A*64) [nama_10_a64]*

Within the industrial sector, the manufacturing industry is by far the largest contributor with 16% of total gross value added (84% of the value added from the industrial sector).

The top five sub-sectors within the industry based on share of gross value added are:

1. Manufacture of food products; beverages and tobacco products (10%)
2. Manufacture of motor vehicles, trailers and semi-trailers (9%)
3. Electricity, gas, steam and air conditioning supply (9%)
4. Manufacture of machinery and equipment not elsewhere classified (9%)
5. Manufacture of fabricated metal products, except machinery and equipment (7%)

Of these sectors, the food and beverage industry are typical SMEs while the other sectors typically are energy intensive industries.

The gross value-added for all the manufacturing sub-sector are presented in Appendix A.

Energy Consumption in EU28

In terms of energy consumption, the industrial sector consumes 25% of the final energy consumption in EU28, see Table 2-2 below.

Table 2-2 Energy consumption by industrial sector in EU28

Final consumption by sector (energy use)	Share of total energy consumption (%)	Share of energy consumption within the industry (%)
Final consumption - energy use	100%	-
Final consumption - industry sector - energy use	25%	100%
Iron and steel - energy use	3%	10%
Chemical and petrochemical - energy use	5%	20%
Non-ferrous metals - energy use	1%	4%
Non-metallic minerals - energy use	3%	14%
Transport equipment - energy use	1%	3%
Machinery - energy use	2%	7%
Mining and quarrying - energy use	0%	1%
Food, beverages and tobacco - energy use	3%	12%
Paper, pulp and printing - energy use	3%	13%
Wood and wood products - energy use	1%	3%

[12] *Water supply,; sewerage, waste management and remediation activities are not manufacturing industry and should in this context not be compared to energy-intensive industries*

Construction - energy use	1%	4%
Textile and leather - energy use	0%	2%
Industry sector - not elsewhere specified - energy use	2%	7%

Source: Eurostat; Table: Complete energy balances [nrg_bal_c]

Especially manufacturing of chemical and petrochemical products has a high energy consumption (20%) followed by manufacturing of non-metallic minerals (14%), manufacturing of paper, pulp and printing products (13%) and manufacturing of food, beverages and tobacco products (12%).

Greenhouse Gas (GHG) Emissions in EU28

In terms of Greenhouse Gas Emissions (covering emissions of CO2, N2O and CH4), the industrial sector emits approximately 60% of the total GHG emissions across both ETS and non-ETS sectors according Table 2-3 below.

Table 2-3 GHG Emissions in industrial sectors

Sector	Total GHG emission, tCO2 eq. (2018)	Share of total GHG emission (%)	Share of GHG emission from industry (%)
Total - all NACE activities	3,493,782,665	100%	-
Industry (except construction)	2,100,622,951	60%	100%
Mining and quarrying	81,201,552	2%	4%
Manufacturing	836,131,368	24%	40%
Electricity, gas, steam and air conditioning supply	1,021,327,916	29%	49%
Water supply; sewerage, waste management and remediation activities	161,962,114	5%	8%

Source: Eurostat; Table: Air emissions accounts by NACE Rev. 2 activity [env_ac_ainah_r2]

Sub-sectors with the highest GHG-emissions are:

1. Electricity, gas, steam and air conditioning supply (49%)
2. Manufacture of other non-metallic mineral products (e.g. cement, ceramics, glass etc.) (9%)
3. Manufacture of basic metals (8%)
4. Water supply; sewerage, waste management and remediation activities (8%)
5. Manufacture of chemicals and chemical products (7%)
6. Manufacture of coke and refined petroleum products (7%)

Referring to footnote 11 and 12 above, power and heat generation as well as water supply should in this context not be considered as energy intensive industries (manufacturing).

The GHG-emissions from all the manufacturing sub-sectors are presented in Appendix A.

2.1.2 Role of EU ETS

In energy intensive industry, the EU emissions trading system (EU ETS) is a key tool for reducing greenhouse gas emissions cost-efficiently in the EU and covers about 45% of the EU's greenhouse gas emissions outlined above.

The EU ETS operates in all EU countries as well as Iceland, Liechtenstein and Norway. The ETS limits emissions from heavy energy-intensive industries and power stations as well as airlines operating between the included countries. In 2020, emissions from these sectors will be 21% lower than in 2005[13].

The ETS works through a cap set on the total amount of greenhouse gases that can be emitted by the sectors covered by the system. The cap is EU-wide and gradually reduced over time resulting in a reduction of total emissions.

Companies receive or buy emission allowances within the cap which can be traded as needed e.g. if a company reduce their emissions, it can either keep the spare allowance to cover future emissions or sell them, as they now need fewer allowances. The flexibility of the trading system further ensures that emissions are reduced where it is most cost effective.

The ETS covers emissions of CO_2, N_2O and PFCs

- CO_2 from:
  - power and heat generation
  - energy-intensive industry sectors including oil refineries, steel works and production of iron, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals
  - commercial aviation
- N_2O from production of nitric, adipic and glyoxylic acids and glyoxal
- PFCs from aluminium production

Free allowances are allocated in some sectors but will gradually be reduced towards 2030.

2.1.3 Energy taxes and subsidy schemes

Taxes on energy and subsidy schemes are used throughout the EU Member States to encourage a certain behaviour, to regulate the competitiveness of industry, to support the industry to focus on energy efficiency etc.

In 2016 the EU Member States collected a total of EUR 280 bn in energy taxes (4,7% of total tax revenue). The energy intensive industry was given a total subsidy in energy by EUR 18 bn[14].

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[13] https://ec.europa.eu/clima/policies/ets_en

[14] *European Commission, 9.01.2019, "REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS: Energy prices and costs in Europe"*

Depending on the industrial sector the energy costs have different impact on the total production cost. In EU the energy costs for businesses are on average 0-3% of the production costs[15]. However, for the energy intensive industrial sectors like cement, lime and plaster, pulp and paper, clay building materials, iron and steel chemicals etc. 3-20% of the production costs are energy costs.

Figure 2-1 Industrial electricity prices in 2017[16]

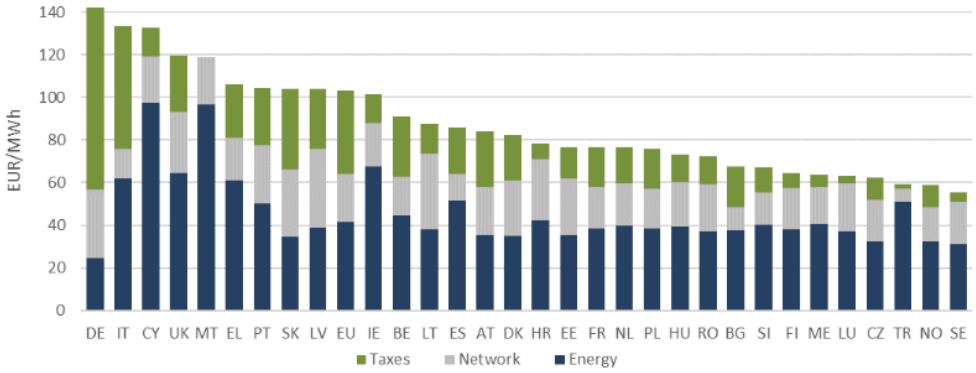
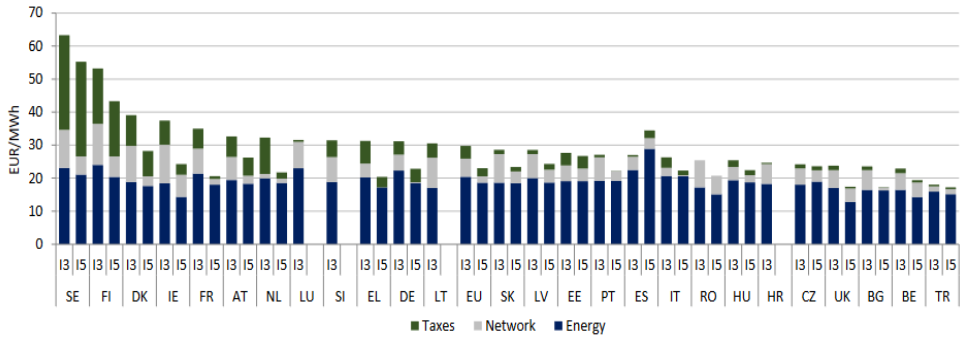


Figure 2-2 Medium and large industrial gas prices in 2017[17]



The subsidy given to the industry must be in accordance with the EU Commissions rules on state aid, e.g. it is not possible to exempt the industry completely from energy taxes.

In some EU Member States subsidy schemes are used as an important instrument for the energy intensive industry to implement energy efficiency projects or set goals for energy reductions. Especially schemes like the voluntary agreement schemes (see below) have used the mechanism of reducing the energy tax in return of an energy efficiency agreement.

[15] *Ibid.*

[16] *Ibid.*

[17] *Ibid.*

2.1.4 Other policy measures and support mechanisms

Several other policy and support mechanisms towards the industry exist in the EU Member States. Besides the EU ETS mechanism two mechanisms are based on the EU EE-directive (DIRECTIVE 2012/27/EU)[18]:

- In accordance with Article 7 of the EE-directive each Member State shall set up an energy efficiency obligation scheme.

  The scheme shall ensure that energy distributors/utilities and/or retail energy sales companies achieve a cumulative end-use energy savings target by 31 December 2020. The target was at least equivalent to achieving new savings each year from 2014 to 2020 of 1.5 % of the annual energy sales to final customers of all energy distributors or all retail energy sales companies by volume, averaged over the most recent three-year period prior to 2013. This obligation scheme includes energy efficiency projects implemented in industry in most or all member states.

  The amended EED 2018/2002 includes a new energy savings obligation period 2021–2030 and extension of the obligation beyond 2030 with no end date, but subject to review by 2027 and every 10 years thereafter. The energy savings obligation (2021–2030) requires cumulative end-use energy savings equivalent to new annual savings of at least 0.8% of final energy consumption (except for Cyprus and Malta, which have to achieve new savings of 0.24% of final energy consumption).

- In accordance with Article 8 of the EE-directive each Member State have to ensure that large enterprises (i.e. enterprises that are not SMEs) are subject to an energy audit carried out in an independent and cost-effective manner by qualified and/or accredited experts or implemented and supervised by independent authorities under national legislation least every four years from the date of the previous energy audit.

  The first energy audit had to be carried out before December 2015. This mandatory energy audit can be replaced by an energy or environmental management system certified by an independent body according to the relevant European or International Standards, e.g. ISO 50001 or ISO 14000

- A number of EU Member States have or have had a voluntary agreement scheme for energy intensive industries or other parts of the industrial sector[19]. See Appendix B for an overview of current and past agreement schemes.

  A voluntary agreement scheme is defined as a mechanism based on contracts between the government and industry or on negotiated targets with commitments and time schedules. This means that the industry and

[18] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:315:0001:0056:en:PDF

[19] *Cornelis, E., History and prospect of voluntary agreements on industrial energy efficiency in Europe, Elsevier, 2019 (0301-4215)*

the government negotiate and agree on targets, time schedule, actions to be taken, rewards and penalties for the industries. The agreements are voluntary meaning that the industry does not by law have to sign an agreement. However, the benefit for the industry are most likely enough to make the sign an agreement.

The first VA Schemes was introduced in the 1990s. The different VA Schemes typically last 5 to 10 years or even longer. Most of them have been revised several times. The VA schemes cover different sectors like the industry (ETS and/or non-ETS), service sector, energy sector and agriculture. Different kind of commitment determining methods are used, like energy audits and benchmarking.

Evaluation of some of the long-term VA Schemes in the EU Member States shows that a VA Scheme will result in a yearly improvement in the energy efficiency by 0,5 % to 2 %. Further, it is estimated that approximately half of the achieved energy savings can be considered as additional.

Networking amongst specific branches are established or have been established in some EU Member States (e.g. The Netherlands' network in the paper mill industry).

2.1.5 Financing opportunities and schemes[20]

As lack of capital often is considered as a key-barrier towards increasing energy efficiency in the industrial sector, financing schemes and ways of de-risking investments are often seen as important initiatives to stimulate greater investments in this area.

Most energy efficiency investments in industry are still financed through normal balance sheet financing and competes directly for limited funds with investments in core technologies. This creates a dual challenge of being seen as less important than investments in the core business and having to meet investment criteria favouring short pay-back times (typically no more than 3 years).

At the same time an increasing number of financial institutions (driven both by stakeholder expectations, market positioning, and concern about future brown discounts and related reserve requirements) are moving towards greening of their lending portfolio and investors such as pensions funds are increasingly monitoring the climate policies (and other ESG aspects) of their portfolio investments[21]. It can therefore be expected that EU based lenders and investors

[20] Section 2.2.4 describes financing opportunities and schemes available at Member State level for SME. Some of these may be relevant for energy intensive industry, but mostly energy efficiency investments are financed through normal balance sheet financing in competition with other investments.
[21] As dealt with in more details in related EEFIG3 studies *Input on energy efficiency to the emerging EU sustainable finance taxonomy and tagging energy efficiency loans* and *"Monitoring and communication of the evolution of financing practices for energy efficiency in buildings and in industry*

will increasingly engage with large GHG emitters in their portfolios and lenders will increasingly offer targeted green products on favourable terms. Ultimately some lenders and investors may choose to limit additional or divest existing activities with large GHG emitters if they see no results from active engagements.

When loan finance for energy efficiency investments is available from existing corporate banking partners, this will at the point of departure be balance sheet financing and therefore the implementing enterprise both has the full risk of the investments and a reduction in loan funds available for other purposes.

Therefore, arrangements like ESCO (Energy Service Companies) and EPC (Energy Performance Contracting) have been considered as important steps towards increasing energy efficiency in the industrial sector, i.e. schemes where third-party carries all investments or schemes that guarantee the outcome of the investments.

However, the success of ESCO – even though certain impact has been seen in public and commercial buildings – has been low in the industrial sector.

As for EPC, the concept in combination with provision of grants for energy efficiency investments in the energy efficiency obligation scheme (under the EE-directive described above), has had significant impact in the industrial sector in several EU-countries. But challenges remain; many cost-effective opportunities are not implemented, energy audits quality varies between countries, many audits are carried out by auditors without sufficient detailed knowledge of the specific industrial process in question, and there is no requirement to actually implement the recommendations, in most member states.

2.1.6 Identified barriers to greater investments in EE

Even though increasing interests into energy efficiency are seen across all industrial sectors, many of the well know barriers towards increasing energy efficiency still exists.

For energy-intensive industries specially the following barriers are important:

- Significant improvements necessitate significant investments and the companies are short of capital for such projects – even though many energy intensive industries have energy costs of a magnitude where energy efficiency investments are to be considered as a long-term strategic focus area.

- Even though many financing opportunities are available for EE-investments, these all influence on the companies' balance sheets and therefore EE-investments still are competing with many other investment projects (automation, it-solutions, new products, expansion projects etc.).

- Large improvement projects often require significant changes of production equipment and the planning horizon to do this is complicated. Either production stops will be very costly and has to be accounted for in the

business case, or the time window to implement the changes (by example a production stop of 2 weeks every 2 years) will be very short and occupied by many other projects necessary from safety perspectives, maintenance etc.

- As grant schemes are available in some EU-countries, such an incentive is not broadly applied. Grants firstly makes investments more attractive for the industries, secondly is seen by industries as a tool to cover some of the risks in EE-investments.

A newer barrier or competitor towards increasing energy efficiency is, paradoxically, the increasing focus in the broader green transition (CO2-savings) in large industries. Even though energy consumption often is an important element in the CO2-balance, many energy-intensive industries can achieve significant CO2-reductions by developing new products, changing the composition of raw materials or develop new business concepts, etc. without saving energy.

Also increasing use of renewable energy will a competitor in planning of investments to reduce energy consumption and as such, the focus on green transition in itself can be seen as a barrier towards greater investments in energy efficiency unless the Energy Efficiency First principle is respected.

2.2 Industrial SMEs and non-energy intensive industries

This section will provide an overview of industrial SMEs and non-energy intensive industries in EU, including an overview of the sub-sector and its importance to EU economy, energy consumption and GHG emissions, policy measures and support mechanisms, financing opportunities, specific barriers to greater investments in EE, and the role of ESCOs.

According to the EU Commission's definition[22]:

- The category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.
- Within the SME category, a small enterprise is defined as an enterprise which employs fewer than 50 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 10 million.
- Within the SME category, a microenterprise is defined as an enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million.

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

Eurostat provides statistics on the EU economy. Industrial SMEs and non-energy-intensive industries are mostly represented in the manufacturing sector (Eurostat (NACE Rev.2, section C)),[23] assuming following categorisation:

- SMEs: enterprises of the manufacturing sector with up to 249 employees
- Non energy intensive enterprises: enterprises within the manufacturing sectors and with more than 250 employeesFor both categories, typical energy-intensive sub-sectors[24] are excluded.

Accordingly, an overview of industrial SMEs and non-energy-intensive industries is presented in Figure 2-3.[25]

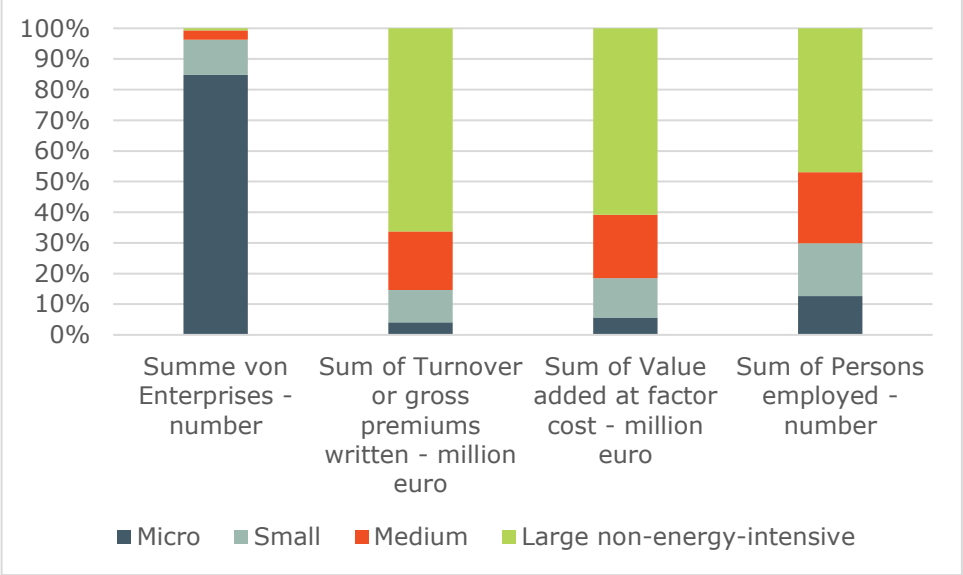


Figure 2-3:Overview of the EU-28 manufacturing sector in year 2017

Source: Eurostat; Table: Industry by employment size class (NACE Rev. 2, Section C without energy-intensive sub-sectors) [sbs_sc_ind_r2]

Nearly 1,500,000 non-energy-intensive enterprises were operating in EU28 in 2017. The overwhelming majority (99%) of these enterprises employ less than 250 employees and 96% less than 50 employees. On the other hand, non-energy-intensive industries (enterprises with more than 250 employees) contribute 66% of the turnover, 61% of the value added and 47% of the jobs.

[23] The other sectors are: mining and quarrying (section B), Electricity, gas, steam and air conditioning supply (section D) and Water supply; sewerage, waste management and remediation activities (section E). Section A is dedicated to Agriculture, forestry and fishing

[24] They are: C17 - paper and paper products, C19 - coke and refined petroleum products, C20 - chemicals and chemical products, C21 - basic pharmaceutical products and pharmaceutical preparations, C22 - rubber and plastic products C23 - other non-metallic mineral products, C24 - basic metals, C25 - Manufacture of fabricated metal products, except machinery and equipment

[25] more details are provided in Appendix C

2.2.1 Overview of sub-sector and its importance to EU economy

According to Table 2-4, three sub-sectors contributed to 55% of the value added from the non-energy-intensive manufacturing sector in 2017.[26] The figures are almost similar for enterprises employing between 10 and 49 persons (43%) and those with 50 to 249 employees (49%), even if the weight varies for different sub-sectors.

Table 2-4: Value added (in Mio. EUR) of EU-28 manufacturing enterprises in various non-energy intensive sub-sectors according to number of employees (2017).

NACE_R2	Micro	Small	Medium	Large non-energy-intensive	Total
C10 - Manufacture of food products	-	29,160	47,061	108,000	184,221
C28 - Manufacture of machinery and equipment n.e.c.	7,937	28,810	55,785	132,216	224,748
C29 - Manufacture of motor vehicles, trailers and semi-trailers	1,525	4,862	14,013	197,421	217,821
Other	55,069	84,755	121,032	261,346	522,202
Total	64,531	147,587	237,892	698,983	1,148,992

Source: Eurostat; Table: Industry by employment size class (NACE Rev. 2, Section C without energy-intensive sub-sectors) [sbs_sc_ind_r2]

The dominating sub-sectors in terms of share of gross added value within the SMEs are:

1. Manufacture of food products (20% for enterprises with 10 to 49 employees, as well as for those with 50 to 249 employees)
2. Manufacture of machinery and equipment n.e.c. (20% for enterprises with 10 to 49 employees and 23% for those with 50 to 249 employees)

Regarding non-energy-intensive industries, around 2/3 of the value added is generated by three sub-sectors:

[26] Table including statistics of all non-energy-intensive manufacturing companies is provided in Appendix D

1. Manufacture of food products (15%)
2. Manufacture of machinery and equipment n.e.c. (19%)
3. Manufacture of motor vehicles, trailers and semi-trailers (28%)

2.2.2 GHG emissions, energy consumption summary

No statistics on GHG emissions and energy consumption, which cover specifically industrial SMEs and non-energy intensive industries in the EU, could be found. However, it is widely recognized that industrial SMEs and non-energy-intensive industries have a larger energy efficiency improvement potential than enterprises of the energy-intensive sector.[27] It is assumed that industrial SMEs might have an energy-efficiency potential higher than 25%.[28] This is among others due to the fact that energy-intensive firms have higher energy costs and consequently a higher incentive to improve the energy efficiency compared to SMEs.

2.2.3 Policy measures and support mechanisms

Different instruments fostering energy efficiency address industrial SMEs and non-energy intensive industries at EU and Member State level. The main two mechanisms are based on the EU Energy Efficiency Directive[29].

- In accordance with Article 7 of the EE-directive each Member State shall set up an energy efficiency obligation scheme.

  This scheme has been mentioned in 2.1.4. In principle, energy distributors or all retail energy sales companies can look for energy efficiency opportunities in industrial SMEs and non-energy intensive industries. This is widely the case in countries which have implemented white certificate schemes.

  As alternative to an energy efficiency obligation schemes, Article 7 § 2.b. allows the accounting of "energy savings resulting from individual actions newly implemented since 31 December 2008 that continue to have an impact in 2020 and that can be measured and verified, towards the amount of energy savings referred to in paragraph 1".

[27] Thollander, Patrik & Cornelis, Erwin & Kimura, Osamu & Morales, Inés & Jiménez, Rogelio & Backlund, Sandra & Karlsson, Magnus. (2014). The design and structure of effective energy end-use policies and programs towards industrial SMEs.

[28] Thollander, Patrik & Rohdin, Patrik & Karlsson, Magnus & Rosenqvist, Jakob. (2012). A standardized energy audit tool for improved energy efficiency in industrial SMEs. This figure seems reasonable, since (e.g. in Germany) around 40% of the energy for SMEs is consumed by space heating.

[29] https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive_en

- In accordance with Article 8 of the EE-directive, non-energy-intensive industries are also subject to mandatory energy audit as long as they are non-SMEs (see 2.1.4.).

  Regarding SMEs, they are addressed in Article 8, especially in §2, which mentions that Member States shall:

  - Develop programmes to encourage SMEs to undergo energy audits and the subsequent implementation of the recommendations from these audits.

  - Bring to the attention of SMEs concrete examples of how energy management systems could help their businesses. The Commission shall assist Member States by supporting the exchange of best practices in this domain. This is done within actions such as the H2020 program targeting Energy Audits for SMEs.[30]

- Even if most of the voluntary agreement schemes in the EU were addressing energy intensive industries, some of them also include SMEs and non-energy-intensive industries.[31]

- Energy Efficiency Networks: is a recognized and effective instrument to foster the implementation of energy efficiency measures and trigger investments in energy efficient technologies both non-energy intensive and energy-intensive industries.

  Energy Efficiency Networks include the setting of energy saving goals at company level as well as at network level. To strengthen the collective dynamic for implementing EE measures, site visits and monitoring are regularly organized. Even organizations that already have an Energy Management System (EMS) or the willingness to implement one can still profit from the benefits of network participation.[32] In Germany, the German Government and 22 industrial associations and organisations (currently 22) committed to support the creation of 500 new EENs. Half of the EEN participating companies have less than 250 employees.

2.2.4 Financing opportunities and schemes

At Member State level, there is a pallet of financing opportunities. A short overview is presented in Table 2-5 and Figure 2-4.

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[30] e.g. INDUCE in the food and beverage industries (see: www.induce2020.eu) or E2DRIVER in the automotive sector (see www.e2driver.eu)

[31] see Appendix B for an overview of current and past agreement schemes

[32] EENs have been implemented in 7 Member States and in Switzerland. Similar concepts are also widely implemented in China, US and Canada, see overview in the world: Durand 2019 (http://publica.fraunhofer.de/dokumente/N-562131.html)

Table 2-5: Financing options for SME energy efficiency (IEA 2015[33])

Financial Option	Context
Preferential loans	SMEs may lack the assets (collateral) necessary to secure a traditional commercial loan. And financiers may lack the familiarity and confidence with the small projects they are asked to underwrite. To address this, governments and stakeholders such as development banks can extend special credit lines to local financial institutions, which on-lend the funds to their clients.
Energy savings insurance	SMEs and local banks often lack both the technical capacity to assess the potential of more capital-intensive energy efficiency investments and the confidence that they will pay back. Solutions to address these barriers are under way. One promising approach is energy savings insurance, which pays out if the projected value of energy savings is not met. Analysis shows that the instrument can absorb up to 80% of this underperformance risk (Global Innovation Lab for Climate Finance, 2015).
Grants	Grants may offer capital for projects that SMEs could not otherwise finance. However, SMEs may be deterred by the administrative costs of applying for a grant or if the chance of winning a grant is low. Streamlining application processes or providing additional information and guidance can help address this.
Equipment leasing	In leasing arrangements, the financier owns the energy efficiency equipment and the customer obtains the right to use it. The SME needs no capital to participate, and may gain an immediate reward from reduced energy costs.
ESCO funding model with Shared savings	An energy services company (ESCO) designs, constructs, operates and finances energy efficiency equipment. The customer pays for energy savings through an agreed rate ($ per avoided unit of energy), or pays a fee for a guaranteed level of service. However, ESCOs function best with large projects; and they typically prefer larger companies that are less likely to fail during the funding period.
Utility on-bill financing	An energy retailer or third-party financier provides initial capital for energy efficiency projects. This is repaid through a debt repayment charge on energy bills. This can provide an efficient mechanism for SMEs to obtain energy efficiency funding.
White certificate schemes	Like emissions trading systems, these are market-based systems wherein energy utilities earn certificates for their efficiency improvement. The advantage to SMEs is that they may acquire such certificates by implementing an energy efficiency project, which in turn reduces the cost of the project. Administration costs can be reduced when equipment or service providers manage the administration of certificates.
Tax incentives	These provide a financial incentive to undertake an energy efficiency project.

[33] IEA. (2015). Accelerating Energy Efficiency in Small and Medium-sized Enterprises. Powering SMEs to catalyze economic growth.

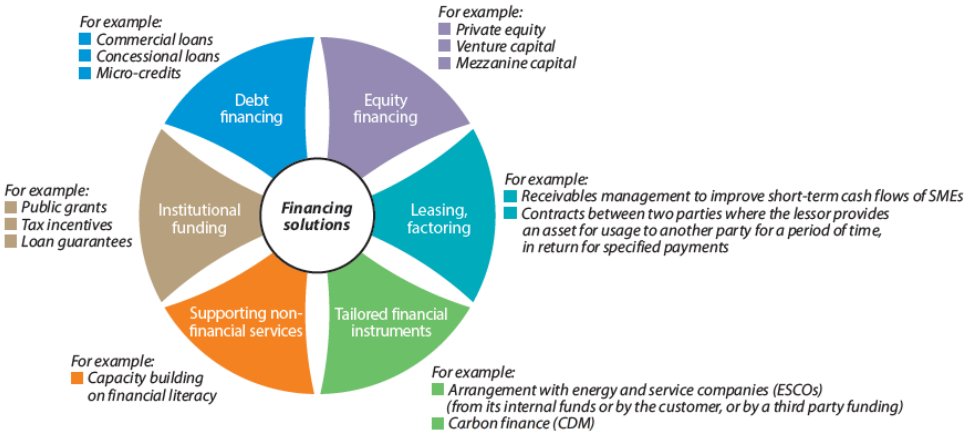

Figure 2-4: The spectrum of financing solutions for SMEs (IEA 2015, based on Mueller and Tuncer (2013))

2.2.5 Identified barriers to greater investments in EE

Since large energy efficiency potentials can be tapped but are not realized, barriers have been analysed by researchers and diverse institutions.[34] For industrial SMEs and non-energy intensive industries, the main barriers are:

- Typically, small-sized and non-energy-intensive industrial SMEs do not have enough capacity to work with energy efficiency improvements and are thus in need of a more supportive approach, e.g. assistance from external experts. Energy audit programmes are effective but should be complemented with networks where an experienced engineer supports the companies within the network.

- SMEs are typically more vulnerable to market shifts and more reliant on key contracts and customers than large organisations.

- The need to maintain profitability and competitiveness with limited resources can make it more difficult for SMEs to pay attention to energy efficiency and other environmental and business improvement initiatives.

- A focus on day-to-day cash flow and limitations in accessing capital creates challenges in justifying noncore business investments. This is specially the case for SMEs.

- Small companies are less likely than larger ones to monitor performance, for example, and tend to have a more informal structure with less rigorously defined roles

- Energy efficiency is not considered as a strategic priority at Executive Board level and there is no link to Key Points in the Corporate Investment Cycle. The presentation at executive board level of energy efficiency investments

[34] see Buettner 2018, IEA 2014, IEA 2015, EEFIG 2015

results from implementation of EnMS, and those identified by energy managers.

- There is a lack of tailored resources to address the energy efficiency opportunities in SMEs:
  - SMEs are heterogeneous, they have limited management time and attention for energy efficiency investments. There is a lack of specific energy efficiency financial instruments by Financial Institutions and other relevant entities working in conjunction with private distribution partners and certified energy auditors. To be effective, the development of investment pipelines needs to be supported by the project development assistance facilities, light-touch energy audits where appropriate and justified.
  - Lack of approved Lists of Eligible Materials and Equipment (LEME) which include equipment, appliances and/or materials which can be expected to achieve a minimum energy saving (>20% in EBRD case) when compared to market norms to be designed in conjunction with a related open List of Eligible Suppliers and Installers (LESI).
- Large Non-Energy Intensive Companies: There is a clear need to improve the priority and visibility of energy efficiency with key decision makers.
- Mid-cap Companies and SMEs: The keys to drive energy efficiency investments in small and mid-sized companies are more related with the awareness and existence of public incentives, co-finance, soft-loans, tailored finance products and technical assistance for energy efficiency projects (including tax breaks), key decision makers' confidence in overall economic outlook, energy efficiency resources and the company's debt capacity.
- In SMEs and non-energy intensive industries, EE is often more complex and diverse compared to energy intensive sectors, where EE often can be large individua investment projects. A diverse mix of projects to improve EE is a barrier in itself.
- SMEs have large saving potentials in space heating. As the pay-back-time of EE measures ranges typically between 8 and 10 years and space heating is not a core-business, the willingness for SMEs to invest in EE technologies is low.

2.2.6 Role of ESCOs

ESCOs can contribute to bridge the capacity and financial gap of SMEs. However, SMEs present specific barriers for the implementation of Energy Performance Contracting:[35]

- Investments, project sizes and profit magnitudes are usually too small to attract larger ESCOs (e.g. multinationals), with considerable overhead costs;
- High transaction costs for the procurement of the energy services relative to the savings potentials;
- Financing is difficult to obtain for smaller projects, as due diligence costs are relatively high;
- High costs of the M&V procedures needed to verify the guaranteed savings;
- Risk of bankruptcy of the SMEs.

Therefore, ESCOs should take following challenges into account to better support SMEs in the implementation of EE solutions:

- EPC models should be simplified through the creation of simple standardized technical solutions, with simple M&V procedures;
- Simple model contracts, technical and financial solutions should be developed,
- Clusters of SMEs, that offer innovative energy efficiency services, should be encouraged

A general problem with ESCO is that the model tend to address small, maintenance related improvements and not large renovation of processes in order to limit the risk for the ESCO-company, but also because of the nature of the company (blue coloured staff mainly).

[35] see http://epcplus.org/

3 The problem to be addressed by the WG

The present chapter provides a description of the key issues and challenges related to WG topic – further improvements of energy efficiency in industry. Based on this, the role and possible contribution of the WG in the context of the topic is detailed.

The survey results, described above in section 1, give an indication of the views of EEFIG membership as a whole. The EEFIG workshop on industrial energy efficiency in October 2017 also raised many issues and provided many conclusions of policy directions needed.

3.1 Energy-intensive industries

Overall it is proposed that the working group should address the following topics related to energy intensive industries:

- How can stronger incentive programmes be established for the industrial sector across EU27? – can by example grant schemes be established under the EE-directive and can it eventually be combined with certain EE-obligations for the industries?

  By example "voluntary agreement schemes" has been quite successful in a number of EU-countries imposing certain obligations for the companies but also providing access to certain economic benefits (grants, tax reduction, accelerated depreciation of investments etc.)

  How could the EU legislative framework be improved? For example how to improve the Energy Audit requirement in order to deliver more EE projects? How to revise State Aid rules (GBER Art. 38)?

- How can EE-project compete or integrate with other green transition-projects? – is it possible to use the up-coming strategic green transition-focus as a vehicle to reach a greater implementation of energy efficiency investments?

  By example, how could "EE First principle"- be promoted and implemented in practice in the policy and investment decision making of companies? Thus reducing the need for clean primary energy sources?

- Which financing and de-risking schemes can be used or eventually developed?

  Can the market for ESCO- and EPC-contracting be stimulated and increased, or should new off-balance mechanisms be investigated? – can the significant increase in funds for green investments play a role towards the energy intensive industry?

- Is knowledge on technical opportunities, financing opportunities and de-risking mechanisms present at strategic level in the industries?

  Should information campaigns and capacity building activities be implemented to increase general awareness on the significance of EE in the green transition as well as tools to support the implementation of EE-projects?

Furthermore, the WG will liaise and coordinate with the parallel WG on Multiple Benefits to assess their importance in the context of decision making and financing for industrial energy efficiency.

3.2 SMEs and Non-Energy-Intensive Industries

Regarding SMEs and non-energy intensive industries, it is suggested that the working groups should address the following topics:

- How to improve the awareness of opportunities: How to make the energy efficiency projects in SMEs more visible and attractive to asset owners?

  Is a better standardisation of the technical solutions and of the energy audit reports a way to improve the current status?

  Are some tools (incl. benchmarking tools) to be promoted?

- Are Project Development Assistance Facilities for SMEs a solution and how to develop them?

  EEFIG has identified previously[36] the need to scale-up targeted capacity building and to build energy efficiency project development capacity for SMEs – which as EEFIG notes does not necessarily have to be internal to each SME. Project Development support is a key component which can work alongside financial instruments where appropriate and should be linked to energy audits to ensure that the right technical capabilities can be applied to develop investable projects in the SME sector. EEFIG could see a need for project development assistance facilities, modelled on the successful SME energy efficiency investment programmes managed by public financial institutions such as EIB, KfW and EBRD, directed to scale-up projects, develop benchmarks, reduce transaction costs, improve energy audits and their uptake and support the project development of energy efficiency investments in SMEs across Europe.

- Is there an insufficient number of competent project developers (ESCOs)?

[36] EEFIG 2015

How should ESCOs be set up in order to address the specific challenges of SMEs? Which framework is necessary to support a real ESCOs market for SMEs?

- How to improve the EU legislative framework in order to incentives investment into EE?

  For example, how to improve the Energy Audit requirement in order to deliver more EE projects? How to revise State Aid rules (GBER Art. 38)?

- How to address the space heating demand in existing industrial buildings? Would be a regulatory approach necessary (e.g. requirements to refurbish as "stick")?

- How to support the transition from carrying out an energy audit to implementing energy efficiency measures?

- How to improve the lack of incentives and policy drivers from governments?

  For example, lists of Eligible Materials and Equipment (see 2.2.5) in combination with a subsidy scheme have demonstrated to be very successful in Germany to foster Energy Efficiency, especially for cross-cutting technologies.

- How can energy efficiency networks be supported in the EU?

  Since EENs are an efficient instrument for SMEs and non-energy-intensive industries, a favourable scheme has to be elaborated. Should it be a VA approach like in Germany or linked with fiscal advantages like in Switzerland,[37] or are there other possible schemes? The main barrier is to find and convince companies to participate in an EEN.

- How to decrease the transaction costs of EE investments?

  Could third party actors play the role of "aggregators", which bundle small projects from different companies?

3.3 Integrating business models

Financing industrial efficiency improvements

Large funds and financial institutions are able to finance large-scale industrial energy efficiency projects. Examples include the European Bank for Reconstruction and Development (EBRD), which supports industrial efficiency projects around the world through a variety of investment and guarantee models, the European Investment Bank (EIB), the European Union's own

[37] which exempt the voluntarily engaged companies from the CO_2 surcharge on fossil fuels

Cohesion Fund, and public banks. Use of these funds for industrial efficiency is generally limited to large, capital-intensive 'flagship' projects that frequently have a strategic economic significance for the host region. Large financiers have been investing in this way for several decades, and have mature processes and access to the professional engineering capacity needed to develop and execute projects. Information on these projects is readily available.

By contrast, financing activity around smaller industrial energy efficiency improvements – which in reality may still be very large in terms of capital invested – is more opaque. As with most energy efficiency retrofit activity, energy-saving measures in industrial contexts are typically deployed as internal investments by industrial firms, either as part of a maintenance programme or as a defined capital project, with any improvement in energy efficiency frequently a by-product of the core operational motivation for undertaking the project. Investment occurs within the system boundary of the industrial organisation, using either internal reserves or straightforward bank lending, and in either case the investment is unlikely to be labelled as 'energy efficiency' by any party involved. As such it is very difficult to establish a baseline of routine energy efficiency investment by Europe's industrial companies.

This situation has important implications for the type of efficiency projects implemented and the extent of the energy savings achieved. The investments being made are a function of (i) the capital, operational or maintenance needs of the industrial process, (ii) the availability of funds, (iii) the hurdle rate defined by the company for project investments. In most companies the investment decision is still unlikely to take into account the demands of climate science to reach 'net zero carbon', with the exception of those firms that have adopted internal carbon prices or similar mechanisms. The result is systemic under-investment in industrial energy efficiency in relation to the demands of the net-zero transition.

This status quo will increasingly be challenged by growing regulatory, shareholder and customer pressure to reduce and eventually eliminate emissions, all of which will bring a stronger decarbonisation signal to companies' investment appraisal processes. But in the meantime, there is a need for wider adoption of business models that are based on an understanding of industrial firms' needs and decision-making behaviour as it exists today, that can bring about efficiency improvements alongside other sources of value, without distracting attention from their core business. This section discusses the prevalent business models in use today, reviews emergent models, and suggests some key enablers that may give rise to future business model innovation.

Common business models

The most prevalent business models involved in delivery of industrial energy efficiency are in one of two categories.

(i) Routine maintenance of plant and equipment. Energy efficiency is improved when components are replaced with more efficient versions, and when plant breakdowns, leakages and snags are repaired. As such,

the supply chain involved in this process – from product suppliers through to mechanical and electrical contractors carrying out works – are responsible for energy efficiency improvements as a by-product of their core function, which is to keep the production process operational. The business models involved are straightforward purchases of equipment and services (with maintenance on core production equipment frequently conducted by specialist in-house staff.) Warranties, availability guarantees and other quality assurance elements are important attributes of these supply chains. Small, explicit energy efficiency upgrades may also take place provided they meet the company's hurdle rate (see above), which frequently limits investments to those delivering a short payback. As a result, this value chain offers limited opportunities for providers of simple retrofit solutions that can be capital-purchased and quickly implemented within scheduled maintenance windows.

(ii) Capital projects. These projects are undertaken when there is a strategic requirement, and as such they take place at infrequent intervals but offer a significant opportunity for efficiency gains. In many businesses – with the exception of highly energy-intensive sectors – energy is not a strategic driver so the project may not be implemented with a focus on efficiency, but this will be a welcome consequence in many cases as new plant offers better energy performance and modern design processes take better account of efficiency. Nevertheless, the business models of engineering contractors delivering these projects rarely use the energy cost savings as the economic 'engine' of their service. Instead, business models are generally based around conventional design and build contracting, with operations then taken in-house.

Both these categories can be further broken down according to the type of equipment being addressed. Production equipment –which is involved in manufacturing a product or industrial output – is frequently highly specialised in nature, and anything that might interfere with such a sensitive, highly optimised process is treated as a risk, leading to a presumption against all but the most compelling efficiency propositions. These must be designed by specialist process engineers, and there are limited opportunities for implementation. While for many manufacturers energy is an important and costly input, for a large number of others there are easier ways to increase profits than cutting energy use in the core production process.

Greater traction has been experienced in introducing efficiency measures to ancillary equipment, for example the supplies of electricity, heat, hot water, steam and compressed air. While equally critical to business continuity, these systems are simpler to specify and less risky to alter than production processes. They can also be the source of substantial energy savings, and for many years energy services companies (ESCOs) have developed variants of a business model that uses energy cost savings as a way for an industrial client to fund upgrades to ancillary systems.

The simplest business models for these systems involve the financing or leasing of new plant, on the basis that the cost savings achieved relative to the outgoing system will cover the repayments to be made by the industrial firm over time. Other ESCOs take the proposition further, offering savings or performance guarantees by assuming responsibility for the operation and maintenance of ancillary plant on a contracted basis. Providers of combined heat and power (CHP) plants and other energy centres may replace some or all of an industrial customer's energy supply. Some models invoke 'down-side' penalties in the event of non-availability of the ancillary service or some other shortfall against a service-level agreement, while other models will guarantee or share 'up-side' from energy savings achieved above a basic pre-agreed level. In all cases, the industrial 'host' is transferring a degree of performance risk to the contractor, and this is rendered roughly cost-neutral – or at least more economically attractive – thanks to the energy cost savings achieved. The host can also safely concentrate on its specialist production processes having outsourced the more commoditised elements of the system to an external contractor.

Such models are not limited to the industrial sector. Indeed, they have arguably enjoyed greater traction in the public sector, largely because hospitals and other public sector organisations have greater long-term certainty around their estates than many private sector companies, allowing them to enter into long-term ESCO contracts with more confidence. This highlights that while energy efficiency business models can succeed across multiple sectors, flexibility and adaptation is required for the special conditions of industrial applications. The following section considers alternatives to capital purchases, design and build contracts and ESCO arrangements from across various sectors that could inspire a new generation of industrial energy efficiency business models.

Alternative business models for industrial energy efficiency

The following non-exhaustive list summarises business models that may have a role in industrial energy efficiency, but that are not yet experiencing widespread traction.

- **At-risk development of projects ('DevCo').** In parts of the construction and renewable energy sectors, development companies identify opportunities for projects, draw up detailed designs and plans, overcome planning and regulatory hurdles and get a project to an investment-ready stage, only earning a return when investors move in. For industrial energy efficiency projects, this approach has the potential to bridge the gap between an idea or concept for an efficiency improvement and a fully developed, investable project. Standardisation and is currently little used for energy efficiency projects. But standardisation and quality assurance efforts including the Investor Confidence Project may make energy efficiency DevCos more feasible in future. Such an approach could facilitate projects of larger scale and ambition than those that emerge organically from an industrial company, and projects will inherently meet the needs of external investors which could attract new capital flows.

- **Integration of energy efficiency into services provided by outsource partners and supply chain actors.** Mechanical and electrical (M&E), maintenance, facilities and other outsource and supply chain actors have a unique ability to respond to the 'trigger points' for energy efficiency action, such as plant upgrades, scheduled maintenance and cleaning downtime. Currently many such providers are not focused on energy efficiency, but examples are emerging in the commercial sector of efficiency targets being embedded in service-level agreements with facilities contractors, driving improvements year-on-year throughout a contract. The increased focus on the net zero transition may lead more contractors to develop propositions that assist clients in their decarbonisation 'journey'.

- **Integrated design and incorporating energy efficiency into bespoke industrial plant and process upgrade projects.** As pressure on industrial companies to reduce or eliminate emissions increases, integrated design for high efficiency and low carbon performance may become a more mainstream part of project design and build. Process engineering designers who can excel in this area will begin to experience greater competitive advantage.

- **Simple, easy-to-deploy, replicable, efficiency measures.** Recognising that opportunities to integrate efficiency retrofits are limited, product vendors and service contractors may focus on 'quick wins'. Examples include motor drives and controllers, lagging and insulation and lighting replacements. These alterations will make only incremental changes to efficiency, but they can be rapidly deployed by non-specialists without major interruption to production processes. They are separate from more ambitious projects such as large plant replacement, heat recovery schemes or process control optimisation, that can only be implemented infrequently. Awareness-raising and promotion of these measures to industrial customers is an important part of the proposition.

- **Integration of energy efficiency with renewable energy Power Purchase Agreements (PPAs).** The rapid growth in corporate PPAs may drive an increase in models that allow major users to address their energy demand as well as supply. This may involve derivations of the ESCO model, in which avoided consumption (negawatts, or negawatt-hours) is contracted along with off-site-generated clean power.

- **'As a service' models.** Lighting-as-a-service, heat-as-a-service and other approaches that focus on delivery of outputs rather than energy are gaining traction in the commercial sector. ESCO models in the industrial sector (see above) provide similar services to support production processes. The specialist nature of some industrial processes may limit further uptake of these models. However, this may be offset by the availability of increasingly sophisticated and low-cost monitoring and control equipment (see below), allowing sub-processes to be reconceptualised as services and transferred to service providers.

- **Aggregation, and combining efficiency with flexibility and grid services.** Many large industrial energy users already enter demand response contracts with energy system operators, often using on-site generation to help manage demand peaks, or in some cases agreeing to pause energy-intensive processes at pre-agreed times. The increasing importance of flexibility in energy demand to maintaining stable grids should mean that barriers to entering these contracts are reduced in future, making them accessible to greater numbers of industrial energy users, and presenting opportunities for aggregators who can manage the contracts on their behalf. Many new assets and improved controls can support both demand response and energy efficiency, making it likely that more aggregators will combine both into a single service for industrial clients.

- **Local energy planning, partnerships and microgrids.** Industrial facilities, as major users of energy and related services, are a natural component of integrated energy systems such as heat networks or local energy trading schemes. Developers that work jointly with industrial users and nearby communities on integrated energy schemes may become more common, with the potential to increase overall efficiency.

Trends and drivers for new business models

A number of trends are converging that may stimulate innovation and adoption of new industrial energy efficiency business models. To highlight some of the key drivers:

- **Drivers of strategic decision-making.** Several factors may combine to boost the salience of energy in corporate decision-making, or to soften the hurdle rates for efficiency investments, such as:

    - Regulatory pressures on emissions reduction and related environmental issues;

    - Shareholder pressure, often conveyed through activist initiatives and environmental disclosure systems such as CDP;

    - Customer pressure, including efforts by business customers to reduce Scope 3 emissions, as well as consumer pressure;

    - Value creation through participation in voluntary schemes, such as Net Zero targets, Science Based Targets, or the Energy Productivity 100 (EP100).

- **Competitive pressures.** An energy-efficient process is a more profitable process, so in highly competitive energy-intensive industries there is a direct incentive to keep improving energy efficiency.

- **Digitalisation, internet of things and Industry 4.0.** A new technology-enabled industrial paradigm is emerging, in which new

manufacturing technologies, greater automation and ubiquitous monitoring will create new opportunities for efficiency gains. Software, including artificial intelligence, will be able to boost efficiency in highly complex systems.

- **Commercial and financial innovation.** Other fields of energy efficiency, such as residential retrofit, are actively developing new financial propositions based on asset value uplifts associated with decarbonisation and reduced energy costs. Disruptive models may also arise in the industrial sector or be adapted across sectors.

- **Resilience.** As the impacts of climate change are experienced more directly, the ability to continue operations in the event of supply chain disruptions, personnel being unable to get to work, or power failure, becomes increasingly critical. Many interventions that improve resilience can also boost efficiency and fundamentally, a facility that uses less energy is more likely to be able to generate its energy needs on-site, reducing dependency on energy grids.

Acceleration by the Working Group

Policymakers and regulators across Europe can take further steps to create the conditions for business model innovation in industrial energy efficiency. Helpful efforts include: improving standardisation; building capacity and awareness among a diverse range of supply chain actors; providing clear incentives for action that will begin to alter the decision-making lens applied to energy efficiency by industrial firms. This final area could be addressed in several ways, all with the intention of increasing demand for industrial energy efficiency. Regulatory certainty and clarity are essential, but action can also be accelerated through enhanced disclosure of energy productivity or other metrics along with sector and peer-group benchmarking.

This Working Group can support these efforts in several ways. It is proposed that the group:

- Develops a simple, consistent analysis of energy efficiency in industrial contexts, in particular the barriers and drivers that are unique to this segment and how these interact with the prevalent business models in use;

- Seeks and collates evidence on the business models in use today from representatives across the financial community, industrial companies themselves, and from the supply chain including ESCOs;

- Seeks evidence on the 'front line' of innovation in business models, also from representatives across these three groups, and evaluates what the contribution of each business model could be;

- Develops an action plan focused on accelerating the most promising models.

- Establishment of a close cooperation with selected industries to discuss their needs and views on solutions.

3.4 The expected contribution of the WG

The working group will not seek to add to the already extensive literature on barriers to industrial efficiency. Rather, it will summarize their conclusions and draw upon the real-world experience of its members to identify potential solutions and draw a roadmap to the deployment of these solutions. This will result in a set of actionable recommendations for the Commission, Financial Institutions and industry stakeholders. These findings will provide a source of insight for providers of energy services to industrial companies, and for advocates within industrial companies seeking to develop more ambitious, impactful projects.

The WG has to be the link between the three key groups of stakeholders:

- the broader industrial community,
- the financial community, and
- the energy and financing policymakers, particularly EU institutions.

The key objectives of the WG are:

- Identify and assess the main obstacles and drivers for improving energy efficiency industry (based on the already extensive literature on barriers to industrial efficiency and the real-world experience of WG members);
- Identify best practices, their key features and possible obstacles they have to face, assessing the potential to replicate them under which circumstances;
- Formulate both general and specific recommendations on what tools and policy instruments are likely to be most effective for increasing energy efficiency investments in industry.

The Working Group will, *inter alia*:

- Review current trends in improving energy efficiency in industry, building on the work presented in this report.
- Better understand the developments in the mandatory audits required under the EED as well as other tool such as Voluntary Agreements and Energy Efficiency Networks.
- Assess the impact of ISO 50001 to embed energy management systems into industry.

- Assess how investments and financing processes into industrial energy efficiency can be better linked to wider decarbonisation investments (e.g. for renewables) within corporate strategic needs.

- Monitor the progress made by SMEs to improve energy efficiency to better understand where there are best practice examples, whether they can be replicated and how that can be more widely disseminated.

- Provide expert recommendations to the Commission and to the financial community on what further initiatives and policies will further promote greater improvements in energy efficiency.

Appendix A Overview of the industrial sector in EU28 in 2017

Table 3-1 Overview of industrial sectors by gross value added

Sector	Gross value added (2017)	Sector contribution to total gross value added (2017)	Sector contribution to industry gross value added (2017)
	Million EUR	%	%
Total - all NACE activities	13,771,472	100%	-
Industry (except construction)	2,650,370	19%	**100%**
Mining and quarrying	58,189	0%	**2%**
Manufacturing	2,213,903	16%	**84%**
Manufacture of food products; beverages and tobacco products	273,698	2%	10%
Manufacture of textiles, wearing apparel, leather and related products	73,562	1%	3%
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	39,544	0%	1%
Manufacture of paper and paper products	49,004	0%	2%
Printing and reproduction of recorded media	33,632	0%	1%
Manufacture of coke and refined petroleum products	33,906	0%	1%
Manufacture of chemicals and chemical products	156,923	1%	6%
Manufacture of basic pharmaceutical products and pharmaceutical preparations	121,820	1%	5%
Manufacture of rubber and plastic products	100,263	1%	4%
Manufacture of other non-metallic mineral products	73,999	1%	3%
Manufacture of basic metals	73,665	1%	3%
Manufacture of fabricated metal products, except machinery and equipment	195,097	1%	7%
Manufacture of computer, electronic and optical products	149,443	1%	6%
Manufacture of electrical equipment	101,447	1%	4%
Manufacture of machinery and equipment n.e.c.	236,425	2%	9%
Manufacture of motor vehicles, trailers and semi-trailers	251,539	2%	9%
Manufacture of other transport equipment	68,069	0%	3%
Manufacture of furniture; other manufacturing	93,642	1%	4%
Repair and installation of machinery and equipment	88,226	1%	3%
Electricity, gas, steam and air conditioning supply[38]	241,511	2%	9%
Water supply; sewerage, waste management and remediation activities[39]	136,767	1%	5%

[38] *Electricity, gas, steam and air conditioning supply are not manufacturing industry and should in this context not be compared to energy-intensive industries*

[39] *Water supply,; sewerage, waste management and remediation activities are not manufacturing industry and should in this context not be compared to energy-intensive industries*

Table 3-2 GHG-emission from the industry

Sector	Total GHG emission, tCO2 eq. (2018)	Share of total GHG emission (%)	Share of GHG emission from industry (%)
Total - all NACE activities	3,493,782,665	100%	-
Industry (except construction)	2,100,622,951	60%	100%
Mining and quarrying	81,201,552	2%	4%
Manufacturing	836,131,368	24%	40%
Manufacture of food products; beverages and tobacco products	55,989,344	2%	3%
Manufacture of textiles, wearing apparel, leather and related products	8,274,343	0%	0%
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	6,411,394	0%	0%
Manufacture of paper and paper products	31,798,753	1%	2%
Printing and reproduction of recorded media	3,052,496	0%	0%
Manufacture of coke and refined petroleum products	139,586,833	4%	7%
Manufacture of chemicals and chemical products	154,559,191	4%	7%
Manufacture of basic pharmaceutical products and pharmaceutical preparations	6,381,838	0%	0%
Manufacture of rubber and plastic products	11,228,168	0%	1%
Manufacture of other non-metallic mineral products	199,067,908	6%	9%
Manufacture of basic metals	167,457,629	5%	8%
Manufacture of fabricated metal products, except machinery and equipment	14,943,476	0%	1%
Manufacture of computer, electronic and optical products	3,109,041	0%	0%
Manufacture of electrical equipment	4,385,887	0%	0%
Manufacture of machinery and equipment n.e.c.	10,078,187	0%	0%
Manufacture of motor vehicles, trailers and semi-trailers	10,430,554	0%	0%
Manufacture of other transport equipment	2,427,079	0%	0%
Manufacture of furniture; other manufacturing	4,425,762	0%	0%
Repair and installation of machinery and equipment	2,523,485	0%	0%
Electricity, gas, steam and air conditioning supply	1,021,327,916	29%	49%
Water supply; sewerage, waste management and remediation activities	161,962,114	5%	8%

Appendix B Overview of voluntary agreement schemes in EU28

Country	Voluntary Agreement	Operational period	Coverage	Structure	Concept	Approach	Commitment determine method	Energy Management System	Network
The Netherland	Long Term Agreements 1	1991-1998	Industry, services	2 levels	Negotiated	Target	Energy audits		
	Long Term Agreements 2	2000-2012	non-ETS industry, services	2 levels	Negotiated	Target	Energy audits		
	Benchmarking Covenant	2000-2012	ETS industry	2 levels	Negotiated	Target	Sector benchmarks		
	Long Term Agreements 3	2008-2020	non-ETS industry, services, transport + supply chain	2 levels	Negotiated	Target	Energy audits, Roadmaps	x	
	Long Term Agreements - ETS	2009-2020	ETS industry + supply chain	2 levels	Negotiated	Target	Energy audits	x	
Finland	Energy Audit Programme	1992-1997	Industry, services, energy sector	2 levels	Public vol.	Implemented	Energy audits		
	Energy Conservation Agreements	1997-2007	Industry, services, energy sector	2 levels	Negotiated	Implemented	Energy audits		
	Energy Efficiency Agreements	2008-2016	Industry, services, energy sector	2 levels	Negotiated	Target	Energy audits	x	
	Energy Efficiency Agreements	2017-2025	Industry, services, energy sector	2 levels	Negotiated	Target	Energy audits	x	
Germany	EWK I	1995-1999	Industry, power production	2 levels	Unilateral	Target	(Not specified)		
	EWK II	2000-2012	Industry, power production	2 levels	Negotiated	Target	(Not specified)		
	IEEN (EE Network Initiative	2014 to now	Industry						x
France	AERES 1	1995-2002	Energy intensive industry	1 level	Unilateral	Target	(Not specified)		
	AERES 2	2002-2007	Energy intensive industry	1 level	Unilateral	Target	(Not specified)		
Denmark	Agreement on Industrial Energy Efficiency	1993-1996	Energy intensive industry	1 level	Public vol.	Implemented	(Not specified)	x	
	Revised agreement	1996-2013	Energy intensive industry	1 level	Negotiated	Implemented	Energy audits	x	
	Revised agreement	2015-	Energy intensive industry	1 level	Negotiated	Implemented	Energy audits	x	
Ireland	Large Industry Energy Network	1996-	Energy intensive industry	1 level	Public vol.	Implemented	Energy audits	x	x
	Energy Agreement Programme	2006-	Energy intensive industry	1 level	Public vol.	Implemented	Energy audits	x	x

Luxembourg	Voluntary Agreements 1	1996-2000	Industry, services	1 level	Negotiated	Implemented	Energy audits		
	Voluntary Agreements 2	2000-2010	Industry, services	1 level	Negotiated	Implemented	Energy audits	x	
	Voluntary Agreements 3	2011-2016	Industry, services	1 level	Negotiated	Implemented	Energy audits	x	
	Voluntary Agreements 4	2017-2020	Industry, services	1 level	Negotiated	Implemented	Energy audits	x	x
UK	Climate Change Agreements 1	2001-2011	Industry, services, agriculture	2 levels	Negotiated	Target	(Not specified)		
	Climate Change Agreements 2	2013-2023	Industry, services, agriculture	2 levels	Negotiated	Target	(Not specified)		
Check Republic	Emission Reduction Target Agreements	2002-	Industry	1 level	Negotiated	Large: Target; SME: Implemented	Large: energy audits; SME: benchmarks	x	x
Belgium, Flanders	Benchmarking Covenant	2002-2014	ETS Industry	1 level	Negotiated	Target	Sector benchmarks		
	Auditing Covenant	2005-2014	Non-ETS Industry	1 level	Negotiated	Implemented	Energy audits		
	Energy Governance Agreements - ETS	2014-2020	ETS Industry	1 level	Negotiated	Implemented	Energy audits	x	
	Energy Governance Agreements - non-ETS	2014-2020	Non-ETS Industry	1 level	Negotiated	Implemented	Energy audits	x	
Belgium, WAL	Branch Agreements 1	2003-2012	Industry	2 levels	Negotiated	Implemented	Energy audits		
	Branch Agreements 2	2013-2020	Industry	2 levels	Negotiated	Implemented	Energy audits, Roadmaps		
Norway	Programme for Energy Intensification	2004-2014	Energy intensive industry	1 level	Negotiated	Implemented	Energy audits	x	
Sweden	Programme for Energy Intensification	2005-2013	Energy intensive industry	1 level	Negotiated	Implemented	Energy audits	x	
Latvia	Agreements on Energy Efficiency	2011-2016	Industry	1 level	Negotiated	Implemented	Energy audits		
Malta	Energy Efficiency Partnership Initiative	2016-2018	Industry	1 level	Negotiated	Implemented	Energy audits		
Slovak Republic	Energy Saving Agreement	2016-	Industry	1 level					

Appendix C Overview of the EU-28 manufacturing sector in year 2017

Enterprise	Size of the enterprise	Enterprises	Turnover or gross premiums written	Value added at factor cost	Persons employed
	persons employed	number	Million EUR	Million EUR	number
Micro	From 0 to 9	1,260,809	186,741	64,531	2,584,545
Small	From 10 to 49	172,180	485,876	147,587	3,510,700
Medium	From 50 to 249	44,251	880,070	237,892	4,724,666
Large non-energy-intensive	250 or more	10,464	3,047,866	698,983	9,590,438
All	Total	1,487,704	4,600,552	1,148,992	20,410,349
Micro	From 0 to 9	85%	4%	6%	13%
Small	From 10 to 49	12%	11%	13%	17%
Medium	From 50 to 249	3%	19%	21%	23%
Large non-energy-intensive	250 or more	1%	66%	61%	47%

Source: Eurostat; Table: Industry by employment size class (NACE Rev. 2, Section C without energy-intensive sub-sectors) [sbs_sc_ind_r2]

Appendix D Value added (in Mio. EUR) of EU-28 manufacturing enterprises in various non-energy intensive sub-sectors according to number of employees (2017)

	Micro	Small	Medium	Large non-energy-intensive	All
NACE_R2	From 0 to 9 persons employed	From 10 to 49 persons employed	From 50 to 249 persons employed	250 persons employed or more	Grand Total
C10 - Manufacture of food products	-	29,160	47,061	108,000	184,221
C11 - Manufacture of beverages	1,944	4,459	7,923	32,884	47,210
C12 - Manufacture of tobacco products	340	90	310	5,543	6,282
C13 - Manufacture of textiles	2,621	3,847	8,976	6,804	22,248
C14 - Manufacture of wearing apparel	3,070	5,426	5,263	6,989	20,747
C15 - Manufacture of leather and related products	1,573	3,878	4,181	5,464	15,096
C16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	6,350	9,690	9,588	9,200	34,828
C18 - Printing and reproduction of recorded media	6,305	5,107	8,896	6,259	26,567
C26 - Manufacture of computer, electronic and optical products	3,197	8,863	18,788	-	30,848
C27 - Manufacture of electrical equipment	2,806	8,640	18,200	66,000	95,646
C28 - Manufacture of machinery and equipment n.e.c.	7,937	28,810	55,785	132,216	224,748

C29 - Manufacture of motor vehicles, trailers and semi-trailers	1,525	4,862	14,013	197,421	217,821
C30 - Manufacture of other transport equipment	971	2,095	5,155	65,445	73,666
C31 - Manufacture of furniture	5,222	8,686	9,457	10,573	33,938
C32 - Other manufacturing	7,669	8,747	10,526	24,939	51,881
C33 - Repair and installation of machinery and equipment	13,000	15,229	13,771	21,247	63,247
Grand Total	64,531	147,587	237,892	698,983	1,148,992

Source: Eurostat; Table: Industry by employment size class (NACE Rev. 2, Section C without energy-intensive sub-sectors) [sbs_sc_ind_r2]

MJ-04-22-160-EN-N

Publications Office
of the European Union

ISBN 978-92-76-58460-5