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EEFIG

ENERGY EFFICIENCY
FINANCIAL INSTITUTIONS GROUP

The evolution of financing practices for energy efficiency in buildings, SME's and in industry

Final report

UN environment programme | finance initiative

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Unit B.2 — Energy Efficiency

Contact: Carlos Sánchez Rivero

E-mail: carlos.sanchez-rivero@ec.europa.eu

European Commission
B-1049 Brussels

REPORT ON THE EVOLUTION OF FINANCING PRACTICES FOR ENERGY EFFICIENCY IN BUILDINGS, SME'S AND IN INDUSTRY

FINAL REPORT

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EEFIG's work is the consensus group effort of over 500 members whose current professional experience falls into one of the following stakeholder groups:

- Public and private financial institutions (banks, investors, insurers etc.);
- Industry representatives and industry associations;
- Banking associations and investor groups;
- Energy efficiency industry experts;
- Energy efficiency services representatives;
- SME associations and expert representatives;
- Civil society experts representing diverse energy efficiency stakeholder groups;
- International Energy Agency (IEA);
- European Commission; and
- UNEP FI.

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- Project Team
  Peter Sweatman (lead) and Lucas Bossard (co-lead), with support from

Rasmus Axen l'Anglois-Nordgren, Dinne Smederup Hansen, Carsten Glenting, Amalie Kafling Nørrelund and Steven Fawkes

- Chapter 1
  Bettina Dorendorf (chapter lead), with support from David Mazaira, and Ivan Gerginov

- Chapter 2
  Jessica Stromback (chapter lead) and Divia Hobson (chapter lead), with support from Steven Fawkes, Alex Betts, Boleslaw Meluch, Conor McCarthy, Daniel Magallon, Daniel Pergeman, Elisabeth Minjauw, Franco Hauri, Paul Kerney, Remon Zakaria, Sean Farrell, Shane McCullough, and Tatiana Bosteels

- Chapter 3
  Nicolas Graveline (chapter lead), with support from Angelo Peppeti, Bettina Dorendorf, Daniel Magallon, Daniel Pergeman, Elisa Yoshitake, Filippo Gasparin, Giorgio de Bin, Mark Scicluna Bartoli, Sebastian Carneiro, Sumeet Manchanda, and Winfried Braumann

- Chapter 4
  Juan Alario (chapter lead), with support from David Mazaira, Ivan Gerginov, Mark Scicluna Bartoli, and Tatiana Bosteels

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Abbreviations

BASE	Basel Agency for Sustainable Energy
BIM	Building Management System
CDP	Cassa Depositi e Prestiti
CEE	Certificat D'Economie D'energie
CEF	Carbon & Energy Fund
CF4EE	Crowdfunding for Energy Efficiency
CR	Cross-cutting recommendations
DEEP	De-risk Energy Efficiency Platform
DG Energy	Directorate-General for Energy
DSO	Distribution System Operators
DSP	Deemed savings projects
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECB	European Central Bank
EE	Energy Efficiency
EED	Energy Efficiency Directive
EEF	Energy Efficiency First
EEEF	European Energy Efficiency Fund
EEFIG	Energy Efficiency Financial Institution Group
EEMI	Energy Efficiency Mortgage Initiative
EEN	Energy Efficiency Networks
EFSI	European Fund for Strategic Investment
EIB	European Investment Bank
ELENA	European Local ENergy Assistance
EnEV	Energy Saving Ordinance
EnMS	Energy Management System
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Contracts
ESA	Energy Service Agreement
ESC	Energy service contracts
ESCO	Energy service company
ESG	Environmental, social and governance
ESI	Energy Savings Insurance
ESIF	European Structural and Investment Funds
EUCF	European City Facility
GRESB	Global Real Estate Sustainability Benchmark
HaaS	heat-as-a-service
HLEG	High-Level Expert Group
ICP	Internal Carbon Price
IEA	International Energy Agency
IETF	Industrial Energy Transformation Fund
JESSICA	Joint European Support for Sustainable Investment in City Areas
LaaS	Lighting as a Service
LABEEF	Latvian Baltic Energy Efficiency Facility
MRV	Measurement, Reporting & Verification
MEETS	Metered Energy Efficiency Transaction Structure
MESA	Managed Energy Services Agreement
MPP	Monitoring plans projects
NFRD	Non-Financial Disclosure Directive
OBR	On-Bill Repayment
OECD	Organisation for Economic Co-operation and Development
OSS	One-Stop Shops
PACE	Property Assessed Clean Energy
PDA	Project development assistance
PF4EE	Private Finance for Energy Efficiency
PPP	Public-private partnership
R2E2	Renewable Resources and Energy Efficiency Fund
RoGBC	Romania Green Building Council
RW	Renovation Wave
SFDR	Sustainable Finance Disclosure Regulation
SFSBI	Smart Finance for Smart Buildings Initiative
SIE	Sustainable Infrastructure Europe
SME	Small and medium-sized enterprise
SRI	Socially Responsible Investing
TA	Technical Assistance
UNEP-FI	United Nations Environment Programme Finance Initiative

Summary for Policymakers

Summary for Policymakers

"The market rarely delivers energy efficiency improvements spontaneously, [if] there is no market push. Consumers are not providing a pull towards energy efficiency, usually because they are ignorant of (or indifferent to) the range on the market or the implications of their purchase." *B. Broadman*[1]

Over the 6 years since the EEFIG's landmark 2015 report, the political and societal landscape has shifted significantly. This shift towards sustainability is supported and promoted by a dynamic and dense regulatory agenda led by the European Union and its institutions, which is expected to also have a strong impact on energy efficiency investments.

Energy efficiency investments in the EU have been in the range of EUR 60 billion per year from 2016-2019[2]. They grew from 2014 to 2016 but have remained stable since then, despite increasing policy support over this period. EEFIG notes that comprehensive and systematic tracking of energy efficiency investment data remains a challenge, adding to market uncertainty, with some indicators showing that the real investment volume is larger than reported[3]. Yet, aggregate energy efficiency investments must more than double to achieve the EU's new climate and energy targets, and this is increasingly urgent to deliver anticipated progress by 2030. Many EEFIG members believe that insufficient policy intensity and enforcement at Member State level bears much of the responsibility for limited progress in lifting overall investment levels.

One of the long-standing and important European legislative instruments in setting the energy performance standards for new and existing buildings is the 2002 Energy Performance of Buildings Directive (EPBD) which was amended in 2018 (2018/844/EU) to accelerate the renovation of the existing building stock. EPBD introduced Member States' responsibilities in supporting the mobilisation of investments for building renovation and the obligation to prepare long term buildings renovation strategies.

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[1] Boardman, B. (2004). New directions for household energy efficiency: evidence from the UK. Energy Policy, Vol. 32, Issue 17, p.1.

[2] EIB (2021). Investment report 2020/2021. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/32177fdd-643f-11eb-aeb5-01aa75ed71a1/language-en

[3] The latest results of the German industrial energy efficiency index for instance, based on the input of 880 participating companies, show that 40% of the participating companies accelerated their energy efficiency investments or even increased the volume in 1st half of 2020, despite the pandemic.
See: Energieeffizienz-Index Winter 2020/21 | Institut für Energieeffizienz in der Produktion | Universität Stuttgart (uni-stuttgart.de)

In 2012, the Energy Efficiency Directive was added to provide additional multi-sectoral measures, to boost EPBD and ensure that Europe's 2020, 20% energy efficient improvement target (vs 2005) was met. Importantly, EED contains a set of binding measures[4] on energy suppliers, public authorities, and other stakeholders.

In 2018, the EU adopted the Clean Planet for All communication, which provides a long-term strategic vision for a climate-neutral economy, with net-zero EU emissions by 2050. At the same time, the EU launched a comprehensive review of the relevant legislative framework to ensure delivering the 2030 targets, now being implemented through the "Fit for 55" package.

In 2019, the EU launched its Green Deal to transform the EU into a modern, resource-efficient and competitive economy, with net-zero emissions of greenhouse gases by 2050, economic growth decoupled from resource use and no person and no place left behind. The Green Deal creates the framework not only for energy and climate related legislation, but also for a range of sustainability and sustainable finance related legislation (inter alia EU Taxonomy, Circular Economy, and non-financial reporting directives).

In October 2020, a Renovation Wave strategy was published to unite regulation, funding and technical assistance concepts that are usually addressed separately. This prior legislative separation has been blamed for the limited effectiveness and efficiency of some policies to date. The Renovation Wave strategy also identifies the EUR275 billion of additional investment in building renovation necessary per year[5].

On July 14th 2021, a set of proposals were launched to make the EU's climate, energy, transport and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030 versus 1990 levels. This establishes a fully renewed policy framework to drive energy and resource efficiency across the EU economy. Finally, a strong boost for energy efficiency investments will also come from the EU Recovery and Resilience Facility that was approved by the EU council on October 9th 2020[6]. Member State recovery and resilience plans include a minimum of 30% of climate-relevant expenditure and they contain a buildings renovation flagship priority. The EU Taxonomy, new disclosure regulations[7] and pressure by investors and financiers on large, listed companies

[4] European Commission (2021). The 2012 Energy Efficiency Directive. Retrieved from: https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive_en
[5] European Commission (2020). Questions and Answers on the Renovation Wave: https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_1836
[6] European Commission (2020). Questions and answers: Commission presents next steps for EUR672.5 billion Recovery and Resilience Facility in 2021 Annual Sustainable Growth Strategy. Retrieved from: https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_1659
[7] See European Commission COM (2018) 97 final, Action Plan: Financing Sustainable Growth (link)

are other strong drivers for investments in energy efficiency, inter alia, and preventing non-Paris aligned investments that will harm the EU's Green Deal.

In this very recently accelerated policy context, this report and EEFIG member surveys confirm that the majority of EEFIG's 2015 recommendations remain relevant today and how many can still be incorporated into revisions of key elements of the fit-for-55 package. EEFIG notes continued progress observed in the creation of one-stop-shops, notably with the support from the EIB's ELENA facility.

Strong progress has been made in three key EEFIG identified areas: enabling public accounting treatment of energy performance contracts (with the Eurostat guidance note published in 2017[8]), the delivery of DEEP - Europe's largest energy efficiency project database (now with 24,000 projects) and developing standards for credit approvals within for financial institutions' energy efficiency investment processes. Nevertheless, EEFIG members have high hopes that the fit-for-55 package will address additional policy support required to increase investments in buildings, industry and SMEs, with new 2030 targets, regulations, fiscal tools, public and private finance blending, renovation loans, technical assistance lines and carbon pricing are among relevant areas for continued improvement.

This summary for policymakers contains a synopsis of the main 2021 EEFIG recommendations for immediate consideration by policymakers and financial institutions together in the current policy review cycle.

EEFIG members look to the revisions of the Energy Efficiency Directive and the Energy Performance of Buildings Directive to support ambitious energy efficiency targets by sector, and aligned with the science on climate change, and to continue to raise the cost of inaction to spur upgrades. EEFIG welcomes detailed guidelines for the application of the energy efficiency first principle by segment and to support Member States prioritise energy efficiency investments. Financial institutions should also start to apply the energy efficiency first principle, as a necessary alignment emerges of bank capital, disclosure and mortgage regulations with the EU Green Deal. Energy efficiency investments will grow at increased rates if promoted by new policies and regulations and as European financial institutions more closely align their balance sheets and operations with the targets of the Paris Agreement.

The speed of the transposition of these new Directives is key as the policy cycle needs to accelerate to meet 2030 targets. The adequate and rapid increase in technical and project development assistance in all buildings segments and SMEs will support the creation of energy efficiency projects pipeline and demand for energy efficiency financing.

[8] Recording of EPCs in Govt Accounts (Guidelines, Sept 2019): Retrieved: https://ec.europa.eu/eurostat/documents/1015035/7959867/Eurostat-Guidance-Note-Recording-Energy-Perform-Contracts-Gov-Accounts.pdf/

This summary for policy makers contains EEFIG's priority cross-cutting recommendations, those for buildings, industry and SMEs, and specifically for financiers and financial instruments. The following table contains just EEFIG's summary cross-cutting recommendations:

Ensure an adequate and rapid implementation of the policies proposed by the EU Commission in recent years related to energy efficiency. EEFIG 2015 recommendations are only partially implemented, and therefore act as a useful tool to monitor progress made.
Develop large energy efficiency programmes by segment to facilitate the growth of energy performance contracting and ECSOs, notably for public and commercial buildings and energy-intensive SMEs.
Ensure that the European Semester evaluates the energy efficiency investment levels and activities, at Member State level, in order to provide feedback into the next policy cycle and the effectiveness of national policies. This is particularly important in the next few years, as many new policies will be put in place to achieve the long term objective of net-zero emissions.
The EU Commission should promote that public procurement rules include the energy efficiency first principle and incentivise the use of low carbon technologies, including energy efficiency. All projects financed by EU funds should be procured applying these rules.
Facilitate the development of new low-carbon heat networks and the modernisation of existing ones, in order that they are Paris aligned.
Improve the use of EU funds (ERDF, LIFE, H2020, etc) in energy efficiency. This funding should only be used to support energy efficiency investments that deliver a significant contribution according to the EU Taxonomy. Grants should only be used when it can be demonstrated that other alternatives are not feasible, such as a public-backed financial instrument. Reporting requirements for small energy efficiency investments can be streamlined.
The development of large-scale financial instruments can be encouraged, in collaboration with distribution partners to reach millions of corporate and buildings related customers in order to mobilise larger amounts of investment with the grants available.
Improve annual reporting on energy efficiency investments in each Member State by sector across the EU, in particular for existing buildings and industry. Systematic reporting to central databases like DEEP should be mandatory for public funded projects.

Buildings

Energy efficiency investments in buildings are significantly below the levels required to deliver the EU's increased climate ambition and identified in the Renovation Wave. An additional EUR 275 billion per year in renovation investments over the period 2021-2030 was identified in the Renovation Wave Strategy in order to reach EU energy and climate objectives in 2030.[9]

In order to accelerate the pace of energy efficiency investments in buildings, increases of capital allocated to energy efficiency are required but this will only deliver new investments if policy measures increase demand and address the

[9] European Commission (2020) Renovation Wave Strategy. See: https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_1836

key barriers[10]. The buildings market transformation requires an integrated and systemic approach to regulatory reforms that include:

- enforcing energy efficiency standards in buildings to bolster existing policies;
- transposing best practice policies quickly across Member States;
- dedicating specific incentives and requirements to buildings types;
- educating building owners and financial intermediaries;
- providing long-term finance to enable deep Paris-aligned retrofits.

Inter alia, on the financial side, this includes: new mechanisms to de-risk renovation investments, a faster deal flow from concept to bankable projects, and new capacity within financial institutions to identify, evaluate and implement energy efficiency transactions. A variety of new business models, innovations and tailored tools are required in each buildings segment. The main issue is improving the energy efficiency of existing buildings, as new buildings will be built with nearly zero energy needs from 2021.

EEFIG's 2021 recommended actions include improving building certification and establishing minimum energy performance standards for existing buildings, developing the institutional capacity to implement national long-term building renovation strategies at scale, and increasing the availability of technical and project development assistance in all buildings segments. This means ensure that there are sufficient trained and qualified people in the public and private supply chains to funded and blended financed deep renovations and SME energy savings projects.

Few countries have mandatory minimum energy performance standards for existing buildings and often energy efficiency and renovation standards are not very demanding or not checked. Minimum energy performance standards have the potential to significantly scale up investment in energy efficiency in buildings, but public grant funding will be needed to support renovations to improve their economics so that no one is left behind, and improve the public acceptability of the regulatory reform. Public support can also be deployed through blended loan schemes that engage private lenders, alongside strategic grants addressing energy poverty, access and inequity. Customer demand and engagement is critical to allow financial institutions to improve and position finance packages.

The public sector needs to and can play a genuinely exemplary role in improving the energy efficiency of its buildings. Large programmes aiming at improving the energy efficiency in public buildings have been announced, but often only a few buildings then are renovated. These programmes, if implemented at the scale and depth needed, have the potential to significantly increase the investment in

[10] Zangheri, P., Armani, R., Kakoulaki, G., Bavetta, M., Martirano, G., Pignatelli, F. and Baranzelli, C., Building energy renovation for decarbonisation and Covid-19 recovery, EUR 30433 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-24766-1, doi:10.2760/08629, JRC122143.

energy efficiency in the public sector. They would also contribute to developing the ESCO market that can also play a significant role in commercial buildings.

Clean and efficient buildings solutions are often more capital intensive but have lower operating costs. Procurement rules should therefore include operating costs in the calculation of public benefit and thus promote low carbon solutions on a level playing field.

Technical assistance and project development assistance is critical in driving demand. There are many initiatives in the EU offering energy efficiency advice (ELENA, EUCF, EIB advisory hub and the H2020 PDA) and a greater level of segmentation and signposting should be implemented to support project developers and homeowners in this area.

These 2021 recommendations and others prioritised by the EEFIG for buildings are summarised here:

Promote Member States adopt minimum energy performance standards for existing buildings. These standards should be more demanding over time to align with EU climate and energy targets.
Public grants, green mortgages, tailored renovation loans and new blended finance facilities combined with technical assistance can help building owners deliver these standards.
EU should scale-up its funding for technical and project development assistance, including its delivery via one-stop shops and other retail-facing platforms and organisations, to support building owners and local authorities improve the energy efficiency of their buildings. These funds should also be used to incentivise Member States to put in place similar technical assistance facilities, but financed with their national funds and by promotional banks.
Ensure Member States implement plans to significantly improve the energy efficiency of all public buildings, including social housing, aligned with targets within new legislation. The EU Commission should step-up its monitoring of their implementation, as many plans remain unfulfilled.
Support Member States to increase the amount of grants available for building renovations, and in the provision of fiscal incentives. These grants should be focused on low-income homes, small and medium-sized enterprises with difficult access to finance, on blended finance for deep renovations and to facilitate the market entry of clean and energy efficient technologies in their early penetration phase.
Support Member States in improving the quality and transparency of Energy Performance Certificates. It remains low in many countries.

Industry & SMEs

Like buildings, Europe's annual investments in energy efficiency in industry have remained fairly constant since 2018, at around EUR 5 billion per annum. EEFIG sees an investment gap in the order of EUR 14 billion per annum[11,12] to reach the current European climate and energy goals. This industry investment gap is

[11] Holmes, I., Jess, T., Genard, Q. (2017). Efficiency first scorecard: is the EU's energy union on track? and IEA (2019). Energy efficiency in 2019.;

[12] This value should be taken with reservation because the inflationary to estimate this value (target - actual investment) comes from different sources and the data collection could have different assumptions.

twenty times smaller than the one identified for EU buildings, and given concentrated industrial energy use, and it being responsible for 25% of EU greenhouse gas emissions, and that the availability of finance is not problematic, EEFIG is confident rapid progress can be achieved.

For industry and SMEs, the 2021 EEFIG recommendations to scale up demand for energy efficiency investments include:

- Increased public technical and project development assistance;
- Facilitate financial innovations, such as ESCO-driven performance-based payment contracts;
- Implement industrial process certification and mandatory energy management systems (ISO 50001);
- Improve the use of EU funds (ERDF, LIFE, H2020, etc) and link them with national industrial strategies;
- Increase the use of targeted fiscal (or grant) instruments (e.g. Accelerated depreciation schedules for energy efficiency equipment);
- Establish sector-specific Energy Saving Schemes (reinforced Energy Suppliers Obligation Scheme under EED, Large Non-Energy Intensive Companies, EU ETS);
- Ensure national regulatory frameworks support and promote corporate energy efficiency investment programmes;
- Improve sector-specific information flows (e.g. Energy efficiency networks);
- Promote voluntary sectoral and network energy savings targets for companies not subject to mandatory measures propagated through Energy Efficiency Networks;
- Increase corporate institutional capacity to implement energy savings plans;
- Introduce project rating systems (by industrial sector);

Large corporations have the financial capacity to implement energy efficiency investments and they will do it if they are incentivised. The situation is different for SMEs, which have a more limited capacity to finance energy efficiency investments, as well as a lower capacity to identify and implement them. ESCOs can support the development of energy efficiency investment in industry, and SMEs, by providing advice and finance. Information flows in industry can also be improved to facilitate financing of energy efficiency investments[13], as well as to further align the accounting treatment of EnPC for the private sector in line with Eurostat guidance note of September 2017 to ensure maximum uptake[14].

The integration of ESG criteria by companies will support them to put in place an action plan to reduce GHG emissions. This action plan should include many investments in energy efficiency. Pressure by investors and financers arising from increased transparency in non-financial reporting aligned with EU Taxonomy will also push them to reduce their GHG emission and energy

[13] EREK has some interesting info available https://www.resourceefficient.eu/en. And some sectorial numbers for some sectors.
[14] https://ec.europa.eu/easme/en/news/new-financing-models-energy-efficiency-smes and http://www.energyefficiencynetwork.eu/

footprints. SMEs will also face similar drivers as for large companies, but with a certain delay and once the ESG criteria for SMEs are developed.

Corporate energy efficiency investments are often very profitable. However, they are not developed mainly because site-level internal pay back periods that are too short are used or because these investments have a lower priority in relation to those relating to improved production capacity. Regulatory frameworks that incentivise industries to develop energy efficiency must be put in place[15]. Provision of technical assistance through sector approaches and EENs was also considered very important, especially to reach SMEs.

These 2021 recommendations and others prioritised by the EEFIG for industry and SMEs are summarised here:

Industrial companies must monitor and manage their energy consumption using mandatory Energy Management Systems, ISO 50001 standards, energy monitoring systems, mandatory energy efficiency targets (sector and entity level), energy audits (mandatory and including reporting on product carbon footprints). Subsidies should be used only to support SMEs and those outside EU ETS .
The standardisation of industry-specific packages of energy efficiency solutions (promoted by the funders of such industries, based upon successful implementation) will provide a strong base to structure finance around the energy savings expected and to design dedicated project financing instruments. Public technical and project development support is recommended.
Grow 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.
Increase research investments into energy efficiency investments in Industry.
Extend 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.
Financial institutions must systematically implement energy efficiency first and evaluate the benefits of energy efficiency projects in their risk assessments of industrial clients and provide their clients dedicated energy efficiency finance lines.
Facilitate the financing of energy service companies and energy efficiency special purpose vehicles, with asset finance preferred over ESCO corporate finance. Funding the EnPCs or the direct cashflows from savings is less complex than the assessment of the management teams of ESCOs and their corporate structures.

Finance and Financial Instruments

There is a far greater supply of finance, and investment funds, looking to invest in sustainable projects, including energy efficiency, than there are projects to be financed.

Significant financial barriers to the development of energy efficiency investments exist, and financial institutions can contribute to lowering them. The main barriers, identified in 2015, that remain critical are: high investment costs (as energy efficiency solutions are more capital intensive than less efficient solutions and often have longer pay-backs); high transaction costs - as energy efficiency investments are generally smaller than competing projects; some energy

[15] The EU taxonomy will help here. Also, the QUEST project is ongoing – see: https://cordis.europa.eu/project/id/846739

efficiency projects have poorly known risk characteristics, and some market segments have a difficult access to finance (low incomes households and SMEs). In addition, the limited availability of reliable information and real energy efficiency performance data is a growing issue for financial institutions.

The expansion of public engagement and regulatory frameworks is sure to drive the engagement of more financial institutions to support the parallel development of new and tailored energy efficiency financial products. New financial instruments supporting energy efficiency, and improvements to existing ones, should focus on reducing the cost of finance and increasing their tenors to match the life of the assets to be financed, levered by public grants.

Energy efficiency investments are usually smaller than those relating to energy supply, and often they are complex to assess. Developing finance lines and funds to finance energy efficiency requires the capacity to identify and evaluate these investments, internally or by sourcing the expertise. The financial intermediary needs to confirm that the investment to be financed improves energy efficiency, and is aligned with the EU Taxonomy, as well as measuring the energy efficiency gains. The capacity of lenders and investors to carry out (or alternatively outsource) these technical tasks is a bottleneck.

The transaction costs of developing an energy efficiency product and individual projects are high, for financial institutions and buildings owners or companies. Technical evaluation, project execution and results monitoring can be significant costs for relatively small investment outlays. This makes entry into this business unattractive for many financial institutions. The provision of technical assistance to Banks and Financial Intermediaries has been successful in triggering increased project development, and this report contains case studies of these.

Standardisation of processes can facilitate project aggregation and reduce the transaction costs of energy efficiency finance and EEFIG published an underwriting tool to help address this. Standardisation is also necessary to develop securitisation for energy efficiency projects and for mortgage lenders to upgrade their collateral portfolio’s energy performance.

EEFIG’s 2021 key recommendations for financial institutions are here:

Develop de-risking tools such as guarantees from Governments: (i) to mitigate credit risks related to financing energy efficiency especially for low-income households or to small and medium-sized enterprises or other companies with weak credit ratings; (ii) to reduce risks with innovative technologies or technologies in the early market penetration phase; and (iii) to adequately cover long term risks related to long tenor products.
Promote the development of scalable innovative financial instruments to finance energy efficiency investments, including on-bill repayments, on-tax financing, green mortgages and renovation loans. This development will likely imply changes in legislation or regulations providing a positive feedback loop.
Standardise investment assessment processes, contract terms and investment structures to support better aggregation of projects. This is very relevant for home renovation, small commercial and small and medium-sized enterprises.

Develop more specialised financial instruments for individual segments of the market and in conjunction with those market operators (energy service companies, heat networks, mortgage lenders, start-ups, etc).
Retail lenders should engage on energy performance for all registered mortgage lenders and implement mortgage portfolio standards that deliver improved portfolio collateral energy performance in line with national Paris-aligned decarbonisation pathways.
Blend grants with loans in single delivered packages with easy to apply processes (for both at once) for households and SMEs with lower access to finance. Technical assistance to develop and market new financial instruments can be considered on a case by case basis.
Develop a secondary market for energy efficiency. This will become necessary when the energy efficiency market has achieved a certain scale

Reading guide

Reading guide

Objective of this report and contents

This report is an update of the EEFIG Report 2015, and provides a deep dive into the current status and necessary actions to scale up energy efficiency investments in buildings, SMEs and industry in Europe.

Following an introduction in Chapter 1, which provides a summary of the current context for energy efficiency investments in Europe, Chapters 2 and 3 discuss the drivers, barriers, instruments and main success factors of investments in buildings, and industry and SMEs, respectively. Chapter 4 provides a set of consolidated conclusions and recommendations.

Chapter 1 also provides an overview of the High-level Expert Group (HLEG) on sustainable finance's recommendations on energy efficiency which helped frame the thinking of the Technical Expert Group on Sustainable Finance and EU Taxonomy.

Overall common themes

Driving demand for energy efficiency remains the most imminent challenge to rapidly increasing energy efficiency investments in line with Europe's 2030 targets – and this is mainly addressed by new and enhanced policy measures that will create demand growth and new markets for energy savings.

Facilitating the right financial offer is the responsibility of financial institutions (and other financial market participants such as funds). Chapters 2 and 3 include a review of the most successful instruments in each asset class and where and how public support can be best included.

Providing the right financial incentives to reduce the high up-front capital investments associated with energy efficiency investments can be supported by public budgets and state-backed financial institutions, through blending loans and grants or by providing guarantees, first-loss facilities and through providing greater refinancing liquidity to Paris-aligned renovation loans and other EU Taxonomy aligned energy efficiency investments.

Reducing transaction costs through further standardisation of investment processes should be a focus for market actors, as well as implementing and marketing best practice financing approaches for energy efficiency investments.

1 Rationale for scaling up Energy Efficiency Investments in Europe

1 Rationale for scaling up Energy Efficiency Investments in Europe

Over the 6 years since the EEFIG's landmark 2015 report, the political and societal landscape has shifted significantly. A considerably increased focus and ambition to combat climate change has materialized and is confirmed in the initial agreement on 21st April 2021 on a European Climate Law targeting climate neutrality by 2050. Energy Efficiency is a key area to contribute to this objective, as stated in the last IEA's World Energy Outlook, Energy Efficiency is one of the core areas to act in over the next decade to still consider possible limiting global warming to 1.5 °C[16].

For most financial institutions and companies, sustainability and ESG-related topics and investments now sit on top of their political and business agendas. This shift towards sustainability is supported and promoted by a dynamic and dense regulatory agenda led by the European Union and its institutions, which is expected to also have a strong impact on energy efficiency investments. The most recent regulatory package submitted on 14 July 2021 under the name "Fit for 55" will update the Energy Efficiency Directive and the Energy Performance of Buildings Directive, inter alia. It will also raise the level of ambition for energy efficiency investments and introduce new requirements.

Much of the EU's 2018 Action Plan on Sustainable Finance[17] emerged from the recommendations of the High-level Expert Group (HLEG) on Sustainable Finance that was mandated by the EC in 2016, and worked in contact with EEFIG, to develop a vision on how to build a sustainable finance strategy for the EU. The creation of the EU taxonomy on environmentally sustainable economic activities was one of the key HLEG recommendations that is now being implemented based on a Regulation[18] and associated Delegated Acts. The EU taxonomy's sectoral technical screening criteria sit at its heart and are setting a new ambitious benchmark for energy efficiency investments and ecologically sustainable activities.

References to the EU taxonomy criteria are evident in many political and regulatory files and instruments (such as EU Green Bond Standard, InvestEU, Next Generation EU, Green Bonds, the Recovery and Resilience Facility, the EU Sustainable Finance Strategy, and the EcoLabel for retail financial products). A successful application of the EU Taxonomy not only depends on the availability

[16] IEA World Energy Outlook 2021
[17] EU Action Plan: Financing Sustainable Growth
[18] Regulation 2020/852, in force since 12 July 2020

of data (for instance to document a Do-No-Significant-Harm assessment), but also a Europe-wide transposition of standards that the EU taxonomy refers to (such as near-zero energy buildings - nZEBs).

Energy Efficiency Investments in Buildings

In the EU, 40% of energy consumption is in buildings[19] and there is significant potential for energy savings. Two thirds of this consumption are for residential buildings[20]. The finance sector struggles to increase its energy efficiency investments due to low demand, complex replication and low standardization of projects. In addition, of the relatively low number of renovations, many are self-funded by buildings owners, and therefore often just focus on the elements with very quick energy paybacks, equipment renewal or immediate value enhancements.

Energy efficiency investments in buildings need to more than triple to over EUR275 billion per year to deliver the EU's increased climate ambition for 2030. These investments can only be achieved by a significant mobilization of private capital and a transformation of the market regulatory framework addressing existing barriers to renovation. Based upon individual expert assessments of members of the working group, many believe that there are insufficient policy intensity and enforcement at the Member States level currently to implement the ambitious renovation targets described in the EU's Renovation Wave.

There are several drivers for energy efficiency investments in the market, such as public incentive programs, piloting of one-stop-shop financing models, regulations and reporting requirements. Since 2015, financial institutions have made significant efforts to develop and deploy a variety of viable financing instruments, credit lines and dedicated funds being the most prominent. The future drivers of demand in the market are expected to be mandated building energy performance, minimum standards for local governments, coupled with incentive programs, deployment of de-risking and bundling models. A detailed list of financial instruments which can be used to finance energy efficiency is included in Appendix D.

Despite these drivers and development, the energy efficiency market remains small in relation to its potential size, fragmented and challenging to scale.

Energy Efficiency Investments in Industry and SMEs

EU's industry and SMEs account for about 25% of the continent's CO2 emissions. Different studies estimate that EU will need approximately EUR 19 billion of annual investments (vs the current EUR5 billion) to reach the targets in the Paris Agreement. More than 99% of industry is comprised of SMEs, and in some EU27 countries they collectively up to 70% of the energy used in the sector[21].

The EU has made progress with several important policy developments targeting the sector since 2015, e.g. the revised Energy Efficiency Directive and the

[19] Eurostat, Energy balances 2019 edition, final energy consumption in year 2017.
[20] Odyssee-Mure Energy Efficiency Trends in Buildings
[21] IEA (2015): Policy Pathway-Accelerating Energy Efficiency in Small and Medium-Sized Enterprises 2015; OECD/IEA: Paris, France.

updated Energy Efficiency Labelling Directive. However, market barriers still exist, such as a lack of project development capacity among SMEs, lack of national institutional action and aid programs for industry. These are exacerbated in times of low energy prices and fuel prices.

To create growth and jobs, the EU industry must be at the forefront of the clean energy transition. Among assorted policies, the Commission is supporting industry-led initiatives to promote EU global leadership in clean energy and low-carbon solutions. These initiatives should aim to strengthen industrial linkages in the entire value chain and integrate non-economic actors such as social partners and consumers organisations. The Commission will also discuss with relevant stakeholders the need to set up a "clean energy industrial forum" that could bring together different strands (energy-transport-manufacturing-digital, etc.) and collectively discuss how to optimize the benefits of the clean energy transition for the EU industry, and how to promote our global competitiveness and international collaboration.

The main uncertainty identified through SR7's work is the question of how EU Member States will implement the mandatory measures required by the revised Energy Efficiency Directive 2021.

Past experience indicates several market drivers which have the potential to propel energy efficiency investments in the sector. These include CO2 market pricing mechanisms, standardization and disclosure regulations, financial instruments to different company sizes, and financial incentives promoting efficiency embedded and aligned with post-Covid market recovery support programs and mechanisms.

1.1 Energy efficiency investments are central to achieving the European Union 2050 target and Paris climate goals

Improving energy efficiency plays a crucial role in achieving European and international energy and climate goals. In consequence of the Paris Agreement[22], the European Union set a target to become carbon neutral by 2050[23], which requires strong action for decarbonisation[24]. In December 2020, the European Council agreed to increase its target to reduce GHG emissions in Europe by at least 55% by 2030, compared to 1990, and launched the European Green Deal to frame this vision.

[22] Paris Agreement to the United Nations Framework Convention on Climate Change, Dec. 12, 2015, T.I.A.S. No. 16-1104
[23] Long-term low greenhouse gas emission development strategy of the EU and its Member States (LT-LEDS), March 2020.
[24] During the writing of this report Germany's Federal Constitutional Court has ruled that the Federal Climate Change Act does not provide for sufficient measures to reduce greenhouse gas emissions from 2031. In addition, a court in Hague ordered Royal Dutch Shell to drastically deepen planned greenhouse gas emission cuts, by 45% by 2030.

In 2019, the Energy Efficiency First Principle was introduced[25], and is now described in article 3 of the EC's proposed recast Energy Efficiency Directive (2021) and will be implemented through the Governance Regulation[26] of the European Energy Union as a fundamental guiding principle for policy making, planning and investments in the energy sector.

This requires energy efficiency investments to be considered first in decisions about energy system development. This means that where efficiency (demand-side) investments are shown to be economically viable, they should be prioritized in buildings, industry or transport, ahead of (supply-side) investments into new power generation, grids or pipelines and fuel supplies. The adoption of the Energy Efficiency First Principle coms while there is poor evidence of wide implementation and energy efficiency is still easily neglected notwithstanding its high potential impact. Following greater definition in article 3 of the recast Energy Efficiency Directive, and broad reference across the Fit for 55 package, the Commission is expected to present sector specific guidance to Member States on how to operationalise the Energy Efficiency First principle and help trigger implementation of the approach.

At a global level, energy efficiency, wind and solar provide around half of emissions savings to 2030 in the Net Zero Emissions 2050 scenario, according to the last IEA Net Zero Roadmap. Energy efficiency plays a key role especially in the period up to 2030 as the necessary technology is already available and many of the interventions can be quickly scaled up. Globally, the annual investment needed[27] in energy efficiency is estimated by IRENA[28] to be USD 1 trillion, which means doubling the amount projected in current estimations and tripling the current investment levels. This gives a clear idea of the considerable market size and potential for energy efficiency investments and related services.

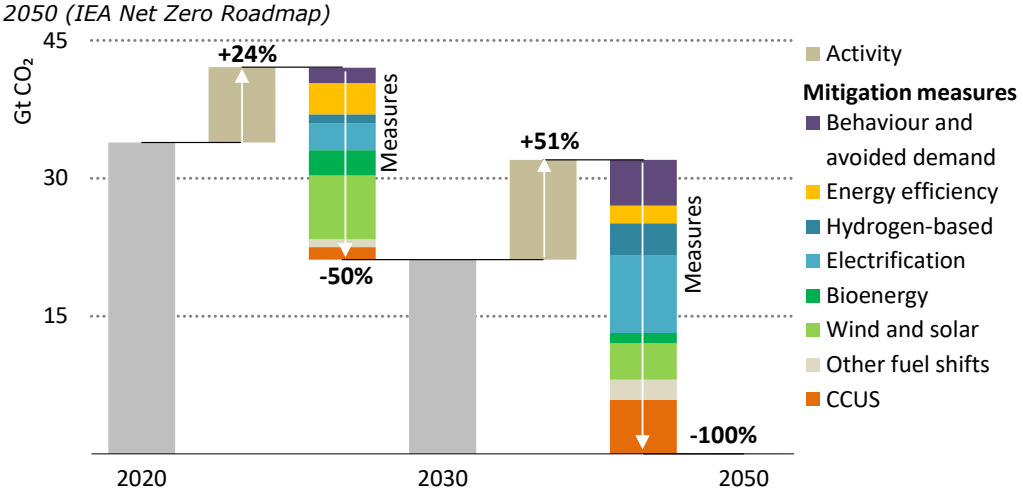
[25] *European Commission (2019). Commission recommendations: 'Energy efficiency first: accelerating towards a 2030 objective of 32.5%'. Retrieved from: https://ec.europa.eu/info/news/energy-efficiency-first-accelerating-towards-2030-objective-2019-sep-25_en*

[26] Regulation EU (2018)1999 on the Governance of the Energy Union and Climate Action), Art 18(2), Recital 64.

[27] Sources and methodologies to account for energy efficiency investments are diverse, as there is no commonly agreed definition for energy efficiency investments. For instance, the IEA defines energy efficiency investments as the differential cost compared to a baseline, however it is assumed that financial institutions and national entities report total allocation of funds to projects tagged as energy efficient. It should be also considered that different institutions have also different regional scopes they report on. As an example, IEA figures for Europe include 43 countries and not the EU-27 considered in EU related reports.

[28] IRENA (2019). Global Energy Transformation: a roadmap to 2050.

Figure 1-1 Share of EE energy efficiency projected by IEA to achieve carbon neutrality in 2050 (IEA Net Zero Roadmap)



NB: Activity = energy service demand changes from economic and population growth
Source: International Energy Agency (20121). Net Zero by 2050 A Roadmap for the Global Energy Sector[29]

1.2 How energy efficiency fits in the broader sustainability agenda

Energy efficiency measures are an integral part of the current sustainability agenda, also referred to as Environmental, Social and Governance (ESG). The ESG-agenda has lifted the attention on the added value of energy efficiency "from the boiler room to the boardroom".

The role and importance of energy efficiency - although emphatically underlined in the political agenda – often lacks visibility and attention in the public discourse on sustainability, compared with renewables, electric mobility, electricity, hydrogen and other elements relating to primary energy. Investing in energy efficiency first reduces the amount of investment required in supply-side measures later. The operationalisation of the efficiency first principle is expected to help trigger an important change in both public and private investment priorities.[30]

Efficiency first as a principle is simple: investing in energy efficiency measures first reduces demand and so less clean energy is required to achieve Europe's climate goals.

Private and public sector financial institutions are expected to provide most of the capital required for the European energy transition. In particular, private sector financial institutions are beginning to appreciate the market potential of energy efficiency, separately from renewable energy, and are now keen to

[29] International Energy Agency (20121). Net Zero by 2050 A Roadmap for the Global Energy Sector. See: https://iea.blob.core.windows.net/assets/4482cac7-edd6-4c03-b6a2-8e79792d16d9/NetZeroby2050-ARoadmapfortheGlobalEnergySector.pdf
[30] *European Commission (2019). Commission recommendations: 'Energy efficiency first: accelerating towards a 2030 objective of 32.5%'.*

increase its capital allocation in the context of their sustainable finance activities, by creating, for example, energy efficiency mortgages and specialist funds.[31]

In general, energy efficiency investments are heterogeneous and much smaller than utility-scale renewables, and they are more complex than rooftop PV. The present value of energy savings is the main way in which energy efficiency investment returns are considered, however increasingly investors are also paying greater attention to the multiple benefits of energy efficiency that can significantly enhance these energy-only returns. Energy efficiency investments deliver GHG emissions reductions, increased energy security, higher industrial productivity, property value uplift, increases in international competitiveness of countries, new jobs, a reduction in energy poverty, and improvements in resilience, health and wellbeing of end-users.[32] This has been emphasized by EEFIG in its work since 2015 and across its different working groups and is covered in this report.

1.3 Background on the EU market for Energy Efficiency

This section provides a summary of the EU market for energy efficiency, based upon a review by the working group of 250 of the most recent reports.

1.3.1 Development of EU energy efficiency investments since 2015

Energy efficiency investments in the EU have been in the range of EUR60 billion per year from 2016-2019[33]. They grew from 2014 to 2016 but have remained stable since then, despite increasing policy support over this period.

Most of these energy efficiency investments are in the buildings sector (80%), followed by transport (15%) and then the corporate/ industrial sector (5%)[34]. Interestingly, this investment volume allocation does not reflect at all the sectoral share of energy consumption or GHG emission[35], suggesting that emissions reductions currently are not a primary driver of energy efficiency investment levels.

Overall energy efficiency spending decreased in 2020 not only due to the economic downturn in the context of the global pandemic but also as part of a

[31] Energy Efficiency mortgages Initiative
[32] IEA (2015). Capturing the multiple benefits of energy efficiency.
[33] EIB (2021). Investment report 2020/2021. Retrieved from: https://op.europa.eu/en/publication-detail/-/publication/32177fdd-643f-11eb-aeb5-01aa75ed71a1/language-en
[34] IEA (2020). World Energy Investment 2020. Retrieved from:https://www.iea.org/reports/world-energy-investment-2020/energy-end-use-and-efficiency#overview-of-energy-efficiency-investment-trends
[35] European Environment Agency (2021). EEA greenhouse gas - data viewer — European Environment Agency (europa.eu)

general decrease in investments in this sector since 2015[36] according to available data.

On a positive note, the pandemic has also triggered the drive to "build back better". In the context of the Recovery and Resilience Facility (EUR 672.5bn), EU Member States have presented investment plans containing a renovate flagship, and with a 37% climate related share of green investments. As a result, recovery packages contain billions of EUR in stimulus spending with important percentages of those funds allocated to increase energy efficiency, particularly in buildings and transport. Bruegel provides a summary of the EU Member States' recovery and resilience plans and dataset focused on planned investment by countries that have submitted their plans[37].

There is a huge investment gap in energy efficiency in Europe. According to the EIB[38], European buildings and industry need EUR 281 billion energy efficiency investments per annum from 2021 to 2030 and then to increase further in subsequent decades[39]. This necessary investment in energy efficiency represents approximately three-quarters of the total investment gap to delivery Europe's climate and energy targets in 2030.[40]

To fill this gap, investments are needed from a broad range of parties including EU buildings owners, investors, banks, businesses, industries, utilities, and public sector entities and municipalities. If implemented in a cost-optimised manner, these investments can usually pay for themselves through the energy savings achieved. They become more attractive when also considering the broader positive impacts on asset value, use quality, the local economy, public budgets and society - impacts which are gradually being better substantiated through new research and studies, underpinning the need for expanding systematic data collection.

Comprehensive and systematic tracking of energy efficiency investment data remains a challenge, adding to market uncertainty, with some indicators showing that the real investment volume is larger than reported[41].

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[36] IEA (2020). World Energy Investment 2020. Retrieved from: https://www.iea.org/reports/world-energy-investment-2020/energy-end-use-and-efficiency#overview-of-energy-efficiency-investment-trends

[37] Bruegel Datasets (2021): European Union countries' recovery and resilience plans. https://www.bruegel.org/publications/datasets/european-union-countries-recovery-and-resilience-plans/

[38] EIB (2019). Energy Lending Policy: supporting the energy transformation.

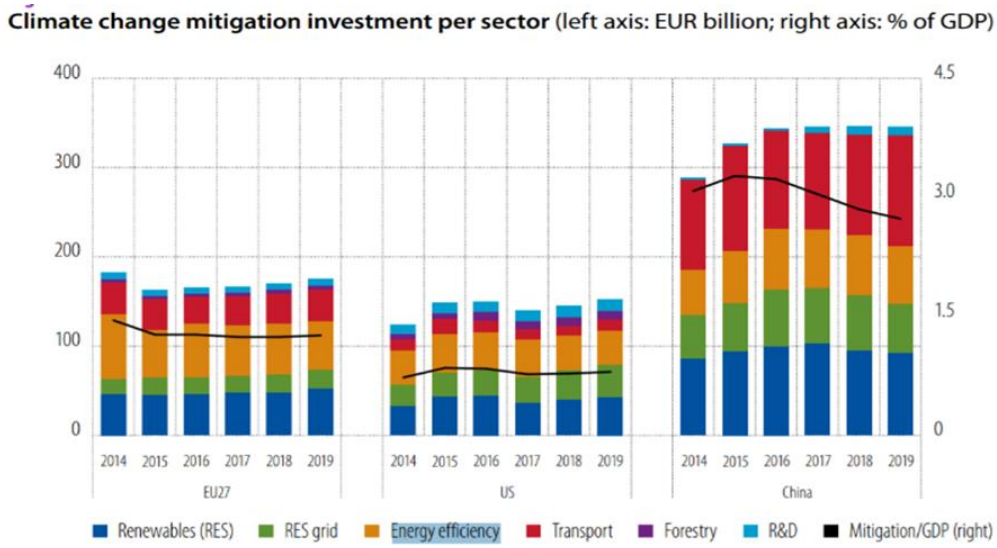
[39] EIB (2020). Energy overview. Retrieved from: https://www.eib.org/attachments/thematic/energy_overview_2020_en.pdf

[40] To be noted that the figures quoted by the IEA above are not comparable with the ones from the EIB/Commission, due mainly to different in the definition of energy efficiency investments.

[41] The latest results of the German industrial energy efficiency index for instance, based on the input of 880 participating companies, show that 40% of the participating companies accelerated their energy efficiency investments or even increased the volume in 1st half of 2020, despite the pandemic.
See: Energieeffizienz-Index Winter 2020/21 | Institut für Energieeffizienz in der Produktion | Universität Stuttgart (uni-stuttgart.de)

There is a significant time lag between regulatory changes at EU level, national transposition and implementation and translation into market activities and finally to investments, and their implementation in the market, and impacts. Increasingly, a new legislative round starts before the full implementation of the prior one, and this creates unnecessary uncertainty for market participants, and is the direct result of the slow and sometimes poor transposition of EU Directives by Member States.

Figure 1-2 Energy efficiency investments by sector (EUR billion percentage of gross fixed capital formation - CFCF)



Source: EIB (2019). Investment report 2019/20: Accelerating Europe's transformation.[42]

1.3.2 Developments in the European energy efficiency investment related regulation since 2015

Since 2015, and following COP21, the EU has significantly increased its climate and energy objectives[43]. The EU had adopted targets for 2030 to reduce greenhouse gases (compared to 1990 levels) by 40%, to reach at least a 32% share of renewable energy consumption and to achieve energy savings of at least 32.5%, and these are now being further tightened to reduce emissions by at least 55% by 2030, in line with the EU Climate Law and Paris Agreement.

In 2018, the EU adopted the Clean Planet for All communication, which provides a long-term strategic vision for a climate-neutral economy, with net-zero EU emissions by 2050. At the same time, the EU launched a comprehensive review of the relevant legislative framework to ensure delivering the 2030 targets, now being implemented through the "Fit for 55" package.

Initially, and with relevance for energy efficiency, the "Clean Energy for all Europeans" package (2019) included the revision of the Energy Efficiency Directive (EU 2018/2002) as well as the revision of the European Performance of

[42] EIB (2019). Investment report 2019/20: Accelerating Europe's transformation.
[43] EIB (2019). Energy Lending Policy: supporting the energy transformation.

Buildings Directive (EU2018/844). Finally, it introduced the Efficiency First principle in the Governance Regulation of the Energy Union (EU 2018/1999).

A few months later, in December 2019, the European Green Deal was announced, setting out the vision and roadmap how to make Europe the first climate neutral continent by 2050. The Green Deal creates the framework not only for energy and climate related legislation, but also for a range of sustainability and sustainable finance related legislation (inter alia EU Taxonomy, Circular Economy, and non-financial reporting directives).

To transpose this new carbon neutrality objective, Commission President Ursula von der Leyen proposed in September 2020 to raise the GHG reduction target to 55% by 2030 is accompanied by legislative package referred to as "Fit for 55" which requires a new revision of the climate and energy regulation. It includes, inter alia, a new revision of the Energy Efficiency Directive, launched on 14th July 2021 to implement the new climate target, and of the Energy Performance of Buildings Directive (EPBD) (scheduled for the end of 2021)[44].

Key legislative developments concerning buildings

From a financial institution's perspective, there are three pillars of the current framework driving energy efficiency investments in buildings in the EU:

- Energy Performance of Buildings Directive (EPBD): The EPBD, created in 2002, is the most important European legislative instrument in setting the energy performance standards for new and existing buildings. In mid-2018, the EPBD (2018/844/EU) was amended to accelerate the renovation of the existing building stock. It covers a broad range of policies and includes supportive measures aiming to help national governments in the EU boost energy performance of buildings and improve the existing building stock. This includes Member States' responsibilities in supporting the mobilisation of investments for building renovation and introduces the obligation to prepare long term renovation strategies (this obligation was moved from the EED to the EPBD)[45]. Member States had a deadline to transpose this latest EPBD by March 2020 into their national legislation. The EPBD is under review again to align with new -55% climate targets in 2021 and is expected to propose mandatory minimum energy performance requirements for all building types and upgrade the obligations requiring energy performance certificates.

- Energy Efficiency Directive (EED): Published originally in 2012, the EED offered to provide additional measures to ensure that the 2020, 20% energy efficient improvement target (vs 2005) was met, and it contains a

[44] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-energy-performance-of-buildings-directive
[45] Euroace (2018). A Guide to THE IMPLEMENTATION OF THE AMENDED ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE (EPBD) 2018. Retrieved from https://euroace.org/wp-content/uploads/2018/11/EuroACE-Guide-to-EPBD-Implementation-web-version.pdf

set of binding measures[46] on energy suppliers, public authorities and other stakeholders. Over the years the EED's objectives have been revised and increased to support the EU's increasing climate commitments[47]. In 2018, the EED upgraded the energy efficiency target to at least a 32.5% improvement by 2030. EED calls for each Member State to establish and revise long-term renovation strategies[48] (LTRS) to support the renovation of both residential and non-residential buildings (public and private), to decarbonise building stock by 2050. A recast EED was published as a Commission draft on 14th July 2021 and is under review to align with the EU's new climate and energy targets for 2030.

- Renovation Wave (RW) strategy: Published in October 2020, RW intends to double the building renovation rate in the next ten years. The EU's annual rate of energy renovation has been stuck at around 1% for many years,[49] with substantial variations depending on the country. Furthermore, just a fifth of these renovations are labelled deep or extensive renovations, and this represents just 1% of the floor area of all renovations, according to an EU Commission study[50]. The RW unites regulation, funding and technical assistance concepts that are usually addressed separately. This separation has been blamed for the limited effectiveness and efficiency of some policies to date. The RW also calls out the EUR275 billion of additional investment in building renovation per year[51].

Key regulation for industrial efficiency

The Energy Efficiency Directive (2012/27/EU)[52] is the main piece of EU legislation impacting industrial energy efficiency by imposing binding measures on Member States to deliver the EU's energy efficiency targets. The relevant measures for industry are energy efficiency obligation schemes (or their alternative systems), mandatory energy audits, the required use of energy management systems and waste heat recovery for industrial heating and cooling.

Since the start of the pandemic, global economic activity has slowed by 4.6% of GDP, which reduced energy efficiency investments by 9%, according to the

[46] European Commission (2021). The 2012 Energy Efficiency Directive. Retrieved from: https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive_en
[47] European Parliament (2021). Revision of the Energy Efficiency Directive / Before 2021-7. Retrieved from https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-energy-efficiency-directive
[48] Directive (EU) 2018/844 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency.
Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1529483556082&uri=CELEX:32018L0844
[49] European Commission (2020). Questions and Answers on the Renovation Wave (europa.eu)
[50] European Commission (2019). Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU
[51] European Commission (2020). Questions and Answers on the Renovation Wave: https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_1836
[52] Malinauskaite, J. et al. (2019).
Energy efficiency in industry: EU and national policies in Italy and the UK, Energy journal.

IEA[53]. However, a positive impact on energy efficiency investments is expected from the spending supported with funds from the Recovery and Resilience Facility, the centre piece of NextGeneration EU, approved by the European Council on October 9th, 2020.[54]

Aligned with the commitment of the European Council to achieve climate mainstreaming, the total expenditure from the EU budget 2021-27[55] for both the multiannual financial framework (~EUR 1tn) and Next Generation EU (EUR 750bn), Member States' recovery and resilience plans have to include a minimum of 37%[56] of climate related investments. In addition, recovery investments should not harm climate or five other environmental objectives as defined in the delegated acts to the EU Taxonomy Regulation[57].

Despite all of the above, actual investment progress has been slow and the size of the investment pipelines for energy efficiency is much lower than what is required.

1.3.3 Status and implementation of the 2015 EEFIG Recommendations

The EEFIG report from 2015 was considered a landmark because of its highly structured and new approach to analysing and creating transparency for the different drivers of demand and supply of energy efficiency investments and offering recommendations to both policymakers and market participants jointly.[58] The 2015 EEFIG report also stated that dedicated measures were required in each market segment that carefully took into account the specific needs of the stakeholders involved.

This section provides an overview of the status of the main EEFIG recommendations based upon survey data from EEFIG members complemented with inputs from the working group of co-authors of this report.

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[53] IEA (2020). Energy Efficiency 2020. Retrieved from: https://www.iea.org/reports/energy-efficiency-2020

[54] European Commission (2020). Questions and answers: Commission presents next steps for EUR672.5 billion Recovery and Resilience Facility in 2021 Annual Sustainable Growth Strategy. Retrieved from: https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_1659

[55] European Commission Website: Supporting climate action through the EU budget. Retrieved from: https://ec.europa.eu/clima/policies/budget/mainstreaming_en

[56] European Commission (2020). Commission welcomes political agreement on Recovery and Resilience Facility. Retrieved from: https://ec.europa.eu/commission/presscorner/detail/en/ip_20_2397

[57] European Commission (2020). Questions and answers: Commission presents next steps for EUR672.5 billion Recovery and Resilience Facility in 2021 Annual Sustainable Growth Strategy. Retrieved from: https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_1659

[58] EEFIG (2015), Energy Efficiency – the first fuel for the EU Economy. https://www.unepfi.org/fileadmin/documents/EnergyEfficiency-Buildings_Industry_SMEs.pdf

The majority of the recommendations proposed in 2015 remain as relevant 5 years later as evidenced through EEFIG Member surveys, and as described in subsequent chapters, and by financial instrument in the Appendix.[59]

The 2015 EEFIG report concluded that the main bottleneck for unlocking energy efficiency investments was not a lack of finance, per se, but the lack of an investment grade project pipeline for energy efficiency investments. Stimulating that project pipeline meant making sure the priority drivers of investment for the different stakeholder groups were properly addressed.

While there has been no systematic monitoring of the implementation of each of the 2015 EEFIG recommendations by the relevant actors, EEFIG members have been surveyed twice, latterly in late 2020, and this confirmed that there has been progress in some areas. A good example is the clarification of the accounting rules for local authorities that were introduced to facilitate public sector implementation and refinancing of Energy Performance Contracts. Further, EEFIG's creation of the DEEP database, now containing details on over 15,000 energy efficiency projects, is an important step forward in collecting relevant data for energy efficiency investments.[60]

There are three 2015 EEFIG recommendations, that members felt were "on track": Public accounting for EPCs, the delivery of DEEP (Europe's largest energy efficiency project database) and developing standards for the energy efficiency investment process – through the publication of EEFIG's underwriting framework. The remaining seven original EEFIG cross-cutting recommendations in the table below require further work:

Table 1-1 Progress on the top ten EEFIG 2015 recommendations

Progress on the top ten EEFIG 2015 recommendations		Status
1	Accounting for EPCs review for public authorities and private corporate Hosts	Achieved
2	Deliver EU evidence / database "DEEP"	Achieved
3	Develop standards for EE investment process	Achieved
4	Benchmarking EED Art. 7 and "best practice"	Further progress required
5	Finance plans for Member States EED Art. 4	Further progress required
6	Ratchet improvement process for Member States EED Art. 4	Further progress required
7	Ensure consistency for 2050 for EE within the EU climate and energy targets	Further progress required

[59] E.g. a survey was created for the current report, where the draft final report was distributed to +400 EEFIG members, received 58 full responses. The highest response rates came from financial institutions, but a wide group of stakeholders provided feedback, including; public administration, Commission, Finance associations, industrial associations, consultancies and more.

[60] Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088

Progress on the top ten EEFIG 2015 recommendations		Status
8	Fully implement EU Building Regulations in Member States	Further progress required
9	Engage with ECB on eligibility criteria	Further progress required
10	EnMS and BIMs systems reviews among portfolios of large investors	Further progress required

EEFIG also ranked those recommendations where progress has been the slowest. Among these are the release of energy performance data from GDPR concerns, the wide-level integration of an energy efficiency across all loans approach developed by the EBRD (aka "EBRD-model") and the engagement with client facing private financial institutions to have them work more on energy efficiency with public banks (an example of best practice here is EIB's project finance for energy efficiency "PF4EE" facility). The use of retail channels to reach buildings and SMEs continues to be under-utilised for energy efficiency and EEFIG members surveyed suggest that further work is needed in producing energy efficiency pathways for industry segments to help smaller and less energy intense industrials prioritise energy efficiency investments. The following are the bottom ten slowest moving EEFIG recommendations ordered with the slowest mover at the top:

Table 1-2 Bottom-ten slowest moving EEFIG 2015 recommendations

Top ten slowest moving EEFIG 2015 recommendations	
1	Unpick energy data from privacy concerns and utility domain
2	Wide-level integration of "EBRD model" into banking practice
3	Engage with non-public financial institutions to identify what impacts their engagement with public financial institutions
4	Assessment and critique of current usage of retail channels in 28 Member States
5	Showcase successful industry roadmap-fiscal-accelerated depreciation allowance processes
6	Review of systems for procurement of industrial EE and best practice (and sharing processes in EU)
7	Benchmark and review buildings energy labels from finance perspective
8	Benchmarks and technology maps for industrial processes
9	High profile multiple benefits campaigns targeting corporate and asset owner decision makers
10	Engage on financial institution regulation to raise EE in context of Basel 3 and Solvency 2

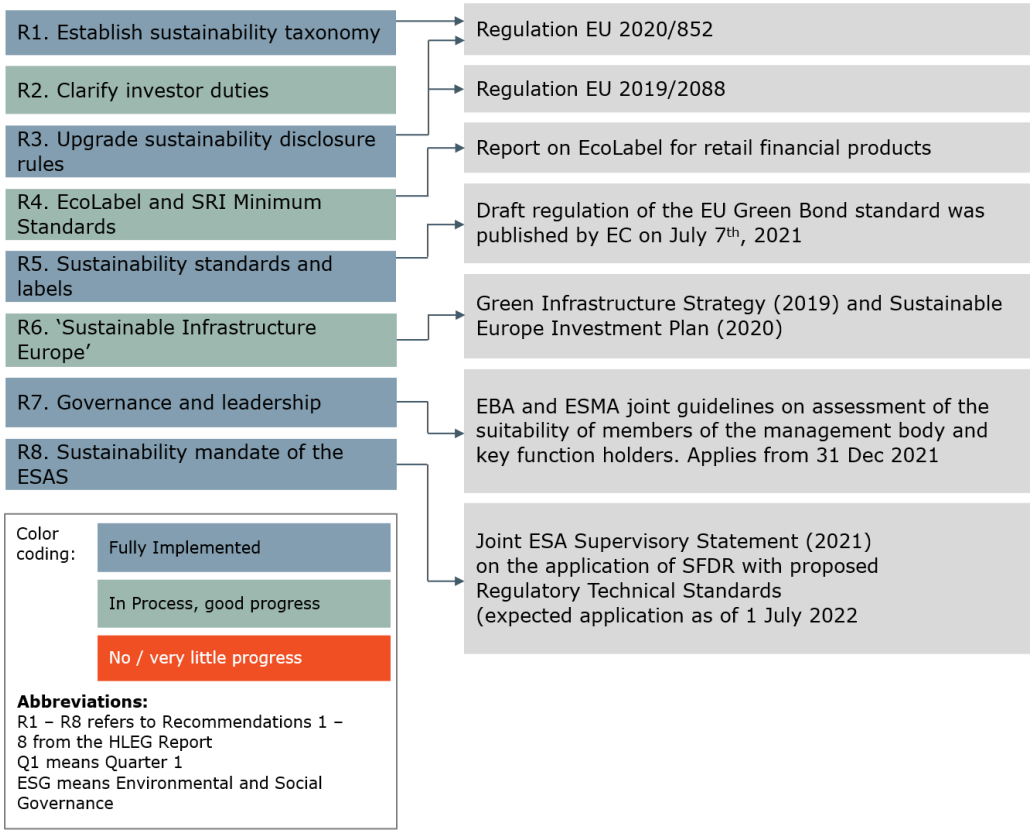
EEFIG members remain optimistic about the operationalising of the "Energy Efficiency First" principle which can address many of the 2015 EEFIG Recommendations, and believe that the "Fit for 55" package can address recommendations in the context of the Commission's review of the Energy Efficiency and Energy Performance in Buildings Directives.

1.4 Progress on the High-Level Expert Group on Sustainable Finance's recommendations

The high-level group on sustainable finance ("HLEG") was mandated in 2016 by the Commission to provide a comprehensive vision of how to build a sustainable finance strategy for the EU. A detailed analysis of the status and implementation of the HLEG Recommendations can be found in Appendix B.

The final report of the High-Level Expert Group on sustainable finance[61] forms the basis for the EU Action Plan on Sustainable Finance (March 2018[62]) and provides eight key recommendations, several cross-cutting recommendations as well as several actions targeted at specific sectors of the financial system.

Figure 1-3 Level of achievement of HLEG key recommendations



Source: Developed by the project team

1.4.1 HLEG Conclusions for Energy Efficiency Investments

Remarkable progress has been achieved transposing the HLEG recommendations into the European regulatory framework. This includes the EU Taxonomy

[61] EU High-Level Expert Group on Sustainable Finance (2018). Financing a Sustainable European Economy, Final Report.
[62] European Commission (2018). COM(2018) 97 final: Action Plan: Financing Sustainable Growth.

Regulation,[63] Non-Financial Disclosure Regulation[64], the ECO Label for retail financial products, which is under development, the development of an EU Green Bond Standard[65], the renewed EU Sustainable Finance Strategy[66], a roadmap with new actions to increase private investment in sustainable projects and activities and to manage climate and environmental risks in the financial system, and the objective to create a European Single Access Point for financial and non-financial information[67].

For energy efficiency, the HLEG recommended clarifying the public accounting treatment for energy performance contracts, which culminated in the publication of a revised guidance note from Eurostat[68] in September 2017 providing clarity to facilitate local authority use of ESCOs to fund energy savings. Together with its recommendations for accelerated action for energy efficiency investments, this facilitated the prioritisation of energy efficiency activities and an improved understanding of the total relevant exposures in financial institutions' portfolios. The implementation of these regulations and the market reaction will start to be seen in 2022 as financial institutions report against new criteria.

[63] Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088

[64] Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector

[65] Retrieved from: https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/190618-sustainable-finance-teg-report-green-bond-standard_en.pdf

[66] EU Sustainable Finance Strategy: https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/overview-sustainable-finance_en

[67] Establishment of a European single access point (ESAP): https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/2021-european-single-access-point-consultation-document_en.pdf

[68] Eurostat Guidance Note "The recording of energy performance contracts in Government accounts" (2017) https://ec.europa.eu/eurostat/documents/1015035/7959867/Eurostat-Guidance-Note-Recording-Energy-Perform-Contracts-Gov-Accounts.pdf/

2 Energy Efficiency Investments in EU Buildings

2 Energy Efficiency Investments in EU Buildings

Energy efficiency investments in buildings are significantly below the levels required to deliver increased EU climate ambition and called for by the Renovation Wave. The European Commission estimates that an additional EUR275 billion per year will be necessary over the period 2021-2030 in order to reach the EU's energy and climate objectives for 2030.[69] In order to accelerate the pace of energy efficiency investments in buildings, increases of capital allocated to energy efficiency are required but this must be accompanied by measures to address the key barriers[70]. This includes the need to put in place mechanisms to de-risk investments, scale-up deal flow from concept to bankable projects, and build capacity within financial institutions to identify, evaluate and implement energy efficiency transactions. A variety of new business models, innovations and tools tailored for each sector and sub-sector are also required.

There are sufficient examples of successful models highlighted in the 2015 EEFIG report, and now the main task is to adapt these in different markets and to scale them. Supporting and incentivising the establishment of simple-to-apply and dedicated financing instruments and aggregation mechanisms will help grow the market[71].

Market transformation also requires an integrated and systemic approach to regulatory reforms that can include:

- enforcing energy efficiency standards in buildings to bolster existing policies;
- transposing best practice policies across Member States;
- dedicating specific incentives and requirements;
- educating building owners and financial intermediaries;
- providing long-term finance.

Massive and targeted delivery of technical and project development assistance

[69] European Commission (2021) Financing Energy Efficiency. See: https://ec.europa.eu/energy/topics/energy-efficiency/financing-energy-efficiency_en
[70] Zangheri, P., Armani, R., Kakoulaki, G., Bavetta, M., Martirano, G., Pignatelli, F. and Baranzelli, C., Building energy renovation for decarbonisation and Covid-19 recovery, EUR 30433 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-24766-1, doi:10.2760/08629, JRC122143.
[71] Economidou, M., Todeschi, V. and Bertoldi, P., Accelerating energy renovation investments in buildings, EUR 29890 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-12195-4, doi:10.2760/086805, JRC117816.

to provide guidance on what measures to undertake, how to access financial support, how to adhere with relevant standards and manage the paperwork throughout the renovation process is critical and can be supported by the establishment of one-stop-shops and other channels to market.

Given the scale of the needs, and the importance of the task, it is critical to continue to convene different buildings and finance stakeholders to build understanding and develop new products, financial solutions and aggregation mechanisms.

2.1 EU Buildings Market Investment Characterization

There is a significant opportunity in Europe to create value both for commercial and residential building owners through energy efficient building renovation. Achieving the EU's targets for energy efficiency and emissions reduction can unlock the many other benefits that will come from improving the energy efficiency of the building stock but will require mobilizing significant amounts of private capital through a variety of appropriate financing instruments. This building renovation opportunity also represents a major potential market for the finance sector which is increasingly being shaped by regulation and social pressure to identify these ESG-positive and impact investments.

A large proportion of energy efficiency investments are self-funded and these self-financed investments can be overlooked in overall estimates of energy efficiency investment. The level of self-financing and third party financed renovation will be influenced by new regulation such as Minimum Energy Performance Standards, but this chapter's primary focus is on external, third party finance.

2.1.1 Market size and opportunity

Below is a description of the size of and opportunity in the EU market for financing building renovation:

Total floor space

There are some 25 billion square metres of useful floor space, i.e. around 48 square metres per capita, in the EU27, Switzerland and Norway[72]. This is an area nearly the size of Belgium (30,528 km²). Half of the total estimated floor space is located in the North & West region of Europe while the remaining 36% and 14% are contained in the South and Central & East regions, respectively. Annual growth rates in the residential sector have been around 1%. However, construction output suffered a major decline as the Covid-19 pandemic got underway, including temporary closure of construction sites in some countries.

[72] Buildings Performance Institute Europe (BPIE) (2011). Europe's buildings under the microscope: A country-by-country review of the energy performance of buildings.(This exclude Croatia)

Despite recovering ground since then, construction output in February 2021 remained 5.4% below a year earlier[73].

Non-residential buildings

Non-residential buildings account for a quarter of the total stock in Europe. Retail and wholesale buildings are the largest component of non-residential buildings, followed by office buildings which occupy 25% of the total non-residential floor space. Some of the many factors that add to the variability of the non-residential buildings sector include, variable use (e.g. warehouse versus schools), energy intensity (e.g. surgery rooms in hospitals versus storage rooms in retail), and construction techniques (e.g. supermarket versus office buildings).

The average specific energy consumption in the non-residential sector is 280kWh/m² (covering all end-uses) which is at least 40% greater than the equivalent value for the residential sector. In the non-residential sector, electricity use over the last 20 years has increased by a remarkable 74%[74].

Residential buildings

The average primary energy saving of all EU28 residential renovations between 2012-16, is estimated to be 8.8%[75] (comparing the performance of the building before and after renovation, including rebound effect). In terms of absolute savings, the average energy renovation within the European Union is estimated to reduce a residential building's specific primary energy consumption by 14 kWh/(m²y). Yet significant differences are observed for the average savings when carrying out renovations which are light or deep in a range of less than 1 kWh/(m².y) to 122 kWh/(m².y) respectively.

Renovation gap

Therefore, arguing from the market size potential, the investment in the European building sector is compelling. Yet, while buildings are responsible for the largest share of European final energy consumption (40%) and have an enormous potential for energy savings, current investment to improve their energy performance is far too low to meet the energy and climate objectives set by the EU. Indeed, energy renovation rates must triple, increasing from 1% a year today to 3%.

There is strong and growing interest on the part of financial institutions to finance energy efficiency improvements in buildings. However, most financial institutions continue to see more barriers than opportunities.

Standardised approaches to energy efficiency project development, underwriting and contracting have been developed, e.g. the Investor Confidence Project (assembling standards and practices promoting efficient markets)[76] and the EEFIG Underwriting Toolkit (a guide which aims to assist financial institutions to

[73] EURtat (2021): https://ec.europa.eu/EURtat/en/web/products-euro-indicators/-/4-19042021-AP

[74] Buildings Performance Institute Europe (BPIE) (2011). Europe's buildings under the microscope: A country-by-country review of the energy performance of buildings.

[75] European Commission (2019). Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU, Final report

[76] Investor Confidence Project (ICP): http://www.eeperformance.org/

scale up their deployment of capital into energy efficiency)[77]. Greater standardisation is essential to grow the market to its full potential and enable secondary markets including the securitisation of portfolios of energy efficiency assets. Section 2.3 analysis the approaches and instruments to energy efficiency investments in buildings, and across several approaches and instruments aspects of standardisation is highlighted as an essential feature.

2.2 Buildings Market Segmentation

Below is a short definition of the three main building types. Each of these market segments have their own drivers and barriers for energy renovation and financing. Successful financing instruments tend to be focused on specific segments and even sub-segments e.g. multi-family apartment blocks.

Commercial buildings

Commercial buildings represent 25% of EU floor space and are used primarily for business purposes and include shopping centres, offices, restaurants, hotels, hospitals, garages and stores.[78] The businesses that occupy these commercial buildings tend to lease their space and a third-party financial real estate investor typically owns the building and collects rent from its occupants. This varies among the Member States but leads directly to split incentives between landlord and tenant in respect of energy renovation, as the landlord is not incentivised to invest in reducing the tenant's energy consumption. The tenant is often unable to make improvements to the shared space that would reduce energy use.

Private Residential Buildings

Residential buildings account for around two thirds of final energy consumption in European buildings and are therefore critical to reduce emissions from buildings. Private residential buildings in Europe can be sub-segmented into multi-family dwellings (42%), semi-detached (24%) and single-family homes (34%). The management and decision-making structures for multi-family dwellings vary by Member State and this further complicates the development and implementation of energy efficiency retrofits. Owner occupation removes the split incentive between landlord and tenant, but the average duration of ownership can be a dis-incentive to deep renovation investments. Depending on the Member State, residential buildings are often highly inefficient and yet many can offer economically attractive energy efficiency investment returns. In 2019, 15% of Europeans were living in homes with a leaking roof, damp walls, floors or foundation. This represents over 50 million people[79] Residential buildings are fragmented and require a successful and low-cost retail distribution strategy to engage at scale.

Public Buildings

Public buildings are those owned or operated by a governing body (central, regional or local) and often occupied by a government entity or agency. Social housing, state schools and universities are also considered public buildings in this report. Publicly owned or occupied buildings represent about 12% of the EU building stock footprint. Energy efficiency investments in public buildings are

[77] The EEFIG Underwriting Toolkit: https://valueandrisk.eefig.eu/introduction
[78] Buildings Performance Institute Europe (BPIE) (2011). Europe's buildings under the microscope: A country-by-country review of the energy performance of buildings.
[79] Right to Energy Coalition, 06.07.2021, https://righttoenergy.org/about-energy-poverty

unique in that the public owner can perceive both the energy savings, productivity and value improvements normally accruing to the owner (as for private owners) as well as the public goods of increased employment, reduced emissions and improvements to public accounts.

In principle, public buildings share many of the benefits of commercial buildings (size, energy intensity, concentrated ownership, professionalized facilities managers), there are no split incentives and are under direct Government control, but face additional challenges of more cumbersome procurement procedures, potential differences in priorities between different Government departments responsible for procurement and for the energy bills, balance sheet restrictions and limitations under public accounting rules.

Public Services Buildings, such as schools, libraries, courthouses and Public Residential Buildings have significantly different investment decision structures and energy needs and the differences between sub-sectors within public buildings need to be considered. The technical measures, the investment scale, the building longevity, the internal technical capacity, and even procurement approaches are different in a major hospital and for a small school, or a local authority office building.

2.3 Approaches and Instruments to Energy Efficiency Investments in Buildings

Over the last five years the volume of third-party capital dedicated to energy efficiency and the number of funds and credit lines mandated to invest in energy efficiency across Europe have grown. In 2019, JRC identified EUR 15 billion of grants/subsidies, soft loans and tax incentives from public resources on an annual basis across the EU[80]. This compares to US$ 55 billion invested in the renewables sector from institutional investors in 2019[81]. Investments in renewable generation provide predictable, stable cash flows that offer attractive returns to investors in a low interest rate environment. Progress in contract and risk assessment standardisation for energy efficiency projects offers the possibility of energy efficiency portfolios delivering similar risk-adjusted yielding returns in the future. Some energy efficiency funds, both publicly listed and private, offer similar risk-balanced yields to renewable asset focused 'yieldcost'. Investors are beginning to see that energy efficiency investments offer useful

[80] Economidou, M., Todeschi, V., Bertoldi, P., Accelerating energy renovation investments in buildings – Financial & fiscal instruments across the EU, EUR 29890 EN.
[81] One factor to consider is that many capital providers combine building renovation and upgrades and behind the meter generation investments into the same instrument. This is due to the fact that the building renovation volumes are too small to support a financing structure. While behind the meter generation lowers the amount of energy that is required from a grid – it does not improve the efficiency of the building. It can, however, improve overall energy system efficiency for example by displacing centralized thermal generation. Upgrades can also include energy storage and demand response which can also have a system wide impact. Within the financial sector 'energy efficiency' is increasingly being used to cover *all* behind the meter energy interventions and not just *pure* demand side energy reduction projects.

risk diversification with less exposure to future power prices as an emerging asset class.

The EU Taxonomy Regulation and growing ESG investing have helped accelerate discussions and interest in energy efficiency investments but have not as yet succeeded in driving volume at the levels required.

2.3.1 Financial Instruments for Energy Efficiency in Buildings

There are two main types of financial instruments used to provide third party finance for energy efficiency in buildings and these are credit lines, delivered through banks or potentially non-banking financial institutions, and dedicated funds. These are presented in more detail in the following, and a table with examples of current financing instruments is presented in Appendix C. Credit lines often sit within existing financial institutions whereas funds are separate entities, usually with independent managers as required by local financial regulations. An important consideration for policy makers and other stakeholders in designing energy efficiency financing instruments is that existing financial institutions and lending facilities have an existing customer base and these can and should be a major channel for improving energy efficiency.

Experience shows that simple provision of capital is insufficient to build a functioning energy efficiency financing market and a range of de-risking tools and transaction enablers also have to be present and these can be provided via a variety of mechanisms. Specific energy efficiency financing vehicles such as ESCOs, Super ESCOs, local authority formed vehicles, energy service contracts and procurement frameworks that develop projects, can be created by combining technical assistance, funds and credit lines.

Credit lines

Credit lines are lending facilities made available for specific purposes. Credit lines for energy efficiency in the nascent energy efficiency financing market are often backed by public and multi-lateral banks. As markets evolve, local banks have to establish dedicated energy efficiency credit lines and develop home renovation products in the same way that they have car loans or mortgages. This requires proving that a market exists, or creating the market, addressing real and perceived risks, as well as building capacity within the local banks to originate and underwrite energy efficiency loans.

To scale up energy efficiency investments, commercial banks need to play a more prominent role in the energy efficiency market as they have access to and relationships with building owners. Energy efficiency credit lines[82] established by banks (and supported by international financial institutions) help mitigate the perceived high financial risk of energy efficiency projects and can lower

[82] Energy efficiency credit lines make funds available to participating financial institutions (local banks). Typically, credit lines are extended to financial institutions by an international financial institution or by government. The recipient financial institution then on-lends the funds to borrowers (private or legal persons) to invest in energy efficiency projects.

transaction costs by establishing standardised project appraisals and loan processing procedures. Guarantee instruments and technical assistance (or capacity development inside banks) also help to lower transaction costs. These public-backed credit lines and support promote the aggregation of small and medium-scale projects via national and regional intermediary banks, yet the lending decision remains with the local financial institution.

Dedicated funds

Dedicated funds can offer debt, equity or hybrid instruments, as well as specialised guarantee funds, which are considered below. These funds can be private or publicly listed on stock exchanges, and they contain entirely private capital, entirely public capital, or contributions from both private and public sectors. Each fund has a specific investment mandate in its governance structure and this will detail factors including:

- target sectors e.g. residential, commercial or public sector buildings
- investment focus, such as:
  - retrofit projects with different technologies, e.g. lighting, CHP, smart metering
  - building acquisition and refurbishment
  - new build
  - receivables forfaiting
  - building integrated renewables
- type of instrument e.g. debt or equity, or defined split between them
- target returns
- specific non-financial targets such as tonnes CO2 saved per amount invested.

Dedicated funds and financial creativity is limited by return targets and transaction costs – both of which can be addressed through public intervention – yet until now private funds struggle with smaller residential buildings. Many dedicated energy efficiency funds have mandates to invest in buildings (public and/or commercial), and there has been a tendency to focus on city infrastructure and public street lighting due to the relatively larger scale of such investments, and relatively short pay-back periods.

The role of 'transaction enablers' and 'de-risking tools'

The OECD[83] identified five components of financing instruments for making sustainable energy investments which are:

- Sources of capital;
- Type of financial intermediary delivering the instrument;
- Type of capital provided (capital instrument);
- Use of de-risking tools for risk mitigation; and
- Use of transaction enablers.

De-risking tools such as guarantees cover identified risk elements of investments. Transaction enablers, like technical assistance, help expand 'deal flow' and move projects from origination, (concept), through to bankable projects. De-risking tools and transaction enablers are considered to be

[83] OECD (2015). Infrastructure Financing Instruments and Incentives.

especially important in nascent markets due to the high perceived risks (e.g. the medium term credit risk with individual counterparties, individuals and companies), lack of familiarity within financial institutions, and lack of development capacity within the energy efficiency sector.

Any design of dedicated energy efficiency credit lines and funds should include de-risking tools and transaction enablers such as standardised contracting to enable project bundling and aggregation and standardised risk assessment.

Energy Service Contracts

Energy service contracts (ESC) provide guaranteed energy performance from equipment, renovation and upgrades installed by a third party, often funded in part or in whole by future energy savings and power sales generated from the project. An energy services company (ESCO) will use an energy service contract to cover payments for the delivery of energy efficiency in the premises of a client. In many cases projects are designed such that repayments are less than savings, ensuring the project host is making net savings from day one, (i.e. cash flow is positive). In other cases involving more extensive infrastructure replacement e.g. in large hospital projects where end of life equipment is being replaced, and there is a large backlog of maintenance, repayments may exceed savings. There are different types of ESC, some of which are set out below:

Energy Performance Contracts (EnPCs[84])

Energy Performance Contracts are the most commonly referenced and reported ESC. Under an EnPC energy service companies (ESCOs) identify, develop and install a range of Energy Conservation Measures (ECMs) in a customer's site, and guarantee a set level of performance i.e. energy savings. EnPCs are often associated with third-party finance, provided or arranged by the ESCO, in which the cost savings resulting from the ECMs exceed the repayments on the finance, thus providing a zero-capital cost solution and savings from day one for the customer, although it should be noted that EnPCs can be used with self-financing. Following the end of the contract all energy savings are transferred to the client – though to ensure the contract is off balance sheet – it is necessary that the client does not automatically own the technologies installed. These will need to be purchased for an agreed upon sum.

While EnPC contracting is possible for lighting and thermal upgrades, it is not easily applied for deep renovation of buildings in the private sector, as split incentives impact around one fifth of properties and the transaction costs to establish and monitor an EnPC are high for the smaller end of the market. The need to measure whether savings have been achieved, while attractive from a climate and commercial perspective of the owner or occupier of the building, can sometimes complicate the risk assessment of the project. Standardised contracting is helpful here to ensure that terms are clearly defined, market ready and comparable between projects.

[84] Also referred to as EPCs and ESPCs (Energy Saving Performance Contracts)

In the last decade a number of new performance-based contractual models have emerged that are designed to be attractive, particularly to the commercial buildings sector. These are described below:

Lighting as a Service (LaaS)

LaaS has primarily been enabled by the large economic benefits that occur when converting conventional lighting to LED lighting. LaaS companies design and install lighting upgrades using LEDs with no capital cost to the customer. The customer pays a fixed annual payment over the contract life (five to ten years) and the contractor provides maintenance and replacement of lamps as needed. The annual payments under the contract are less than the savings in electricity costs.

Efficiency Services Agreement (ESA)

Under this contract, unlike in a pure EnPC, the contractor owns the ECM equipment that is installed and a separate ESCO installs the ECMs under an ESPC. The ESA charges the customer a performance-based service charge. Because the contractor owns the equipment it can, subject to financial regulations, be off-balance sheet for the customer.

Managed Energy Services Agreement (MESA)

A MESA is a variation of an ESA in which the contractor also assumes the broader energy management of the customer's facilities, including taking responsibility for payment of the customer's utility bills, in return for a series of payments based on the customer's historic energy use85. MESA's can be applied to multi-tenant buildings, unlike EnPCs.

Metered Energy Efficiency Transaction Structure (MEETS)

The MEETS structure, which has been pioneered in the USA is based on metering energy efficiency using a combination of measurement and verification (M&V) and a building simulation model. The customer is billed for energy delivered and for energy efficiency delivered. MEETS helps align the interests of the customer, the contractor and the utility, and can provide a stream of cash flow analogous to a Power Purchasing Agreement, thus providing a route to financing energy efficiency measures.

DEEP RENOVATION EnPC for Office buildings

[85] Managed Energy Services Agreements Primer. IMT. 2016
https://www.imt.org/resources/managed-energy-service-agreements-primer/

As proven in international research[86], EnPC has been adopted to Deep Renovation in Buildings and has been implemented in a number of buildings in the US, Germany and France.

Procurement frameworks

Although not in themselves an ESC, the role of procurement frameworks should be noted. In the public sector, which is subject to procurement rules, procurement frameworks have been used to standardise the development of projects and to provide technical assistance to develop projects for external financing. An example from the UK and Ireland is the Carbon & Energy Fund (CEF) – which is not a fund despite the name – but rather a procurement framework that enables hospitals to develop, finance and implement large complex Energy Performance Contracts. The framework overcomes many of the barriers to implementing EnPCs by defining the work process, providing technical assistance, and accessing finance and a number of pre-qualified Energy Service Companies that develop and implement projects in response to tenders under the framework.

The following sections provide an overview of successful approaches and instruments observed in the three subsectors, commercial, residential and public buildings, that can help stimulate investments, as well as the lessons learnt based on these experiences. Functioning and successful structures are present in all buildings sub-sectors, the challenge is to scale them up.

2.3.2 Best practices for energy efficiency investments in commercial buildings

The commercial buildings sector covers a wide range of sub-sectors including commercial offices; logistics; retail and leisure and can be split between owner occupied and rented. Each segment has different technical potentials, different ownership patterns, different levels of in-house capacity to develop, finance and implement projects, and potentially different capital structures.

Buildings in some sub-sectors, notably offices, logistics and leisure are often owned in portfolios by institutional investors and managed like financial assets. The larger buildings and portfolios have their own facilities managers and access to more technical resources than smaller, individually owned buildings.

Efficiency projects in commercial buildings rarely address the building envelope, rather they usually treat technical system upgrades, such as lighting or thermal systems (Heating, Ventilation and Air Conditioning), and target short payback times of 1 to 5 years.

In the commercial buildings sector, particularly in the top end of the market, the "Green Premium" is growing as a secondary driver (after short pay-back times)

[86] EBC & IEA (2017), Business and Technical Concepts for Deep Energy Retrofit of Public Buildings (Annex 61). https://iea-annex61.org/files/results/Annex-61_Summary_Report_2017-1-05.pdf

of energy efficiency investments as many businesses position themselves as sustainable and market their green credentials. Demand is also being driven by increased regulation and reporting requirements as part of public disclosures through sector benchmarking programmes such as the Global Real Estate Sustainability Benchmark (GRESB). Costs for key energy efficiency technologies are also falling such as LED lighting, building controls (including Artificial Intelligence), and thermal system equipment.

Although there is still a long way to go there is a greater recognition of the need for healthy workplace environments, something that is being further driven by the Covid-19 pandemic. Attractive modern workplaces are a way for leading companies to attract talent, and the productivity benefits of energy efficiency and the movement towards "healthy buildings" is increasingly understood and valued by business owners, though this presently only covers less than 2% of commercial building stock.

The types of finance used in commercial buildings are discussed below.

Self-finance

The standard form of financing for energy efficiency improvements is for business owners to upgrade their building stock (assuming they own it) using their own savings, credit lines or working capital, rather than specialized credit lines. This is usually done when the existing technologies have failed or reached the end of their life. Simple 'like for like' replacements e.g. of fans, motors, chillers, are likely to result in improved efficiency simply because new technology is more efficient than the older technology being replaced. This should not be thought of as an energy efficiency investment, as it is really a replacement investment. Energy efficiency investments require going beyond business as usual which requires more design and development input than a simple 'like for like' replacement.

The driver for specifying higher levels of efficiency is that the savings can improve the returns of an investment that is needed anyway. In some cases, such as heating infrastructure replacement, the project may have very low, or even negative, financial returns and specifying greater levels of efficiency can mitigate this. The fact that many companies simply make purchasing choices in favour of efficient technologies as part of replacement decisions, means that the majority of energy efficiency investments in the commercial sector may well not be known, or indeed knowable. These investments are therefore outside this report's consideration of an 'energy efficiency market'.

For these investments to be made the business manager must: prioritize a technology for existing business purposes, own or have a long-term lease and access to the building infrastructure, be in a sufficiently financially healthy state to make the investment, have access to working capital or credit lines.

Investments are generally limited to improved heating, cooling, lighting and building controls. During building renovations, efficient solutions may also be chosen assuming they make sense in the larger business context – for example a hotel is more likely to install highly efficient windows when they also require

noise insulations for the comfort of their guests. This is an example of multiple non-energy benefits helping to drive energy efficiency.

The fact that the majority of investment sits outside any formal market structure, but are simply made through purchasing choices, points to the importance of policies that set efficiency standards for both buildings and building system technologies e.g. motors, fans, chillers etc. This will edit the choice of specifiers and drive greater levels of efficiency.

Business managers with long-term leases or ownership will use working capital with their primary focus on business growth and capital expenditure on energy efficiency does not lead to growth and can have paybacks longer than the payback periods companies prefer. The investments can also be relatively small and not command the attention of a company's leadership. Nevertheless, emerging methodologies that monetise the multiple benefits for businesses that arise following investments are beginning to change minds. Increased volumes of self-financing will only be achieved as and if efficiency requirements are raised. It is also relevant that, as stated above, commercial buildings are often run as parts of larger asset portfolios by groups of investors who hire building management firms to run them. The majority of building managers and their employers will only maintain a building to the minimum of commercial necessity or legal requirements. In the commercial space therefore, building and technology requirements will remain the main drivers of investment volume.

Third Party Financial Instruments

Multiple third parties offer financing to commercial building owners for property upgrades. These may have public banks such as the EIB as a core investor and then attract capital from a range of third-party investors. Another example of a financing instrument that includes commercial buildings in its mandate is the European Investment Bank's Private Finance for Energy Efficiency (EIB' PF4EE). This consists of three pillars: risk sharing facility, EIB loan, and expert support. The risk sharing facility is the most relevant. PF4EE was established in 2014 by the EIB and the European Commission to address the limited access to adequate and affordable commercial financing for energy efficiency investments.[87] PF4EE provides credit lines to commercial banks in several EU countries. Once agreed the PF4EE facilities provide loans for up to 75% of the capital cost of eligible energy efficiency measures with a maximum loan amount of EUR 5 million. Loans are available over a 3 to 20-year term. PF4EE also provides a risk sharing facility which is capped at 16% of each bank's energy efficiency loan portfolio. It also provides expert assistance to the banks to build local capacity in the financial sector, though the accessibility of this instrument remains relatively difficult for many market actors, due to the high credit requirements and overall complexity of the transaction.

A number of dedicated funds have been established with either a partial or total focus on commercial buildings. One example is the Carbon Neutral Real Estate fund which invests in commercial buildings that require refurbishment.

[87] Private Finance for Energy Efficiency (PF4EE), 2020.

The Carbon Neutral Real Estate fund was established in 2010 as the Low Carbon Workplace Trust, and is now part of the portfolio of a large institutional asset management company.[88] It acquires commercial buildings that require refurbishment to bring them to a higher standard of energy performance, plans, executes and finances the work. The improvement in energy performance adds value to the buildings which are then either resold or held to produce investment income. The fund has outperformed the benchmark index for balanced property funds.

Technology specific offerings, particularly LaaS, which can take advantage of the very significant energy savings that come from replacing conventional lighting with LED lighting, are growing. LED conversion and LaaS is the easiest energy efficiency measure and financing structure to standardise. There is also innovation occurring in heating as a service and retrofitting but this cannot yet be considered anything other than early stage. An example of this would be the bundling and sale of lighting as a service portfolio in the UK and Ireland. In this case, the use of standardised contracts and risk assessment has allowed for this bundle of some six lighting projects, by the ESCO Lumenstream to be sold along with access to future pipeline to a secondary fund in Italy. The total value of this particular exchange is 2.5 million EUR – indicating the small size of many portfolios and the remaining potential for the asset class in improving energy efficiency in Europe's building stock.

Lessons Learnt in Financing Energy Efficiency in Commercial Buildings

When a commercial building is owner occupied, investment in removable technologies such as lighting, heating, cooling, and air compressors create viable investment opportunities with short payback times of 1 to 5 years. These upgrades are often self-financed[89], and may not be registered as energy efficiency investments at all as they are simply included in the business' budget.

Energy service contracting such as lighting/heating/cooling-as-a-service has potential. Here the use of standardised contracts, which can later allow for projects to be bundled and sold, supports market scaling.

Dedicated credit lines are also increasingly available. A disconnect between those backing the specialised credit lines and the local bank representative, continues to act as a hindrance, as do the access requirements set by the international monetary institutions providing the credit. An interesting development is the emergence of loan facilities with margins dependent on ESG performance (lower margin for good performance), which can be applied to loans for energy efficiency investments.

Commercial buildings tend to undergo major refurbishment on a regular basis, perhaps every ten or fifteen years. These refurbishments represent major opportunities to influence energy use and if even cost-effective energy efficiency measures are missed at this stage, as is often the case, higher than required

[88] Columbia Threadneedle Investments, 2020.
[89] It should be noted that there is still under-investment in energy efficiency due to many factors including uncertainty over the results, lack of capital and competing business priorities. These are problems that should also be addressed.

energy use will be locked in until the next refurbishment cycle. It is important to have policies that inform, train and influence the actions of the owner at this intervention point and for financial institutions to put in place programmes that ensure that the opportunities are maximized. The ING REF approach is a good example of this approach.[90]

Remaining challenges

Leased properties

Lack of clear market signal from national governments: Commercial building stock is often managed by large building management firms and owned by investment funds. These parties focus on short term returns and are not incentivised to upgrade their buildings at scale. Those leasing the buildings rarely have either the means or the access rights to perform upgrades, even if they were motivated to do so.

That said, the availability of off-balance sheet financing, dedicated credit lines and returns on investment through improved re-sale and property value would allow governments to more easily justify policies requiring commercial buildings owned by financial funds and managed by management firms to reach a minimum efficiency standard in order to continue leasing the properties.

If combined with appropriate and clear tax incentives, the deeper upgrades could be achieved for existing entities, create local jobs, stimulate local economies and avoid harming any of the commercial parties involved. Building upgrades themselves, generate tax income through job creation and regional commercial growth. Renovation costs could be deducted and governments would still see a net increase in tax revenue from the projects, due to the increase in economic activity, spending and job creation, and also less future expenses thanks to multiple benefits, for example for public health given the improved indoor air quality.

Therefore the 'split incentive' dilemma between owner and occupier is only a 'dilemma' if clear regulatory signals and incentives do not exist. When these are created, the dilemma disappears and the commercial renovation sector can scale. The financial instruments needed to achieve this are in place and well understood.

Owner occupied buildings

Today building owner occupiers use their existing credit lines or working capital to make commercially viable upgrades to their buildings. These decisions are based on immediate necessity and business interest. Building owners may have difficulty accessing other forms of financing, though significant progress has been made in the past years. The transaction cost itself is a barrier, undergoing financial due diligence takes time, funds will not be available if the project is seen as too large or costly for the size of the company even if the company itself is healthy, credit guarantees tend not to meet the needs of small to medium

[90] ING (n.d.), Sustainability in Real Estate - The 5 Step Plan. See: https://www.ingwb.com/insights/ing-ref/ing-ref-sustainable-finance

sized companies, they are too difficult to access and large companies generally speaking do not require them.

External financing works best when it covers a limited number of upgrades, such as lighting only, on-roof solar only, heating only, has short payback times and will not disrupt workflows. Here EnPCs, leasing and dedicated credit lines are available. **Deeper renovation remains difficult to justify for business owners unless the monetisation of resulting multiple benefits can be clearly demonstrated. This fact will not change without progressive government requirements and tax incentives**.

2.3.3 Best practices and types of investment in residential buildings

There is a political imperative to scale up energy efficiency in the residential sector, yet renovation rates are well below 1% annually, well short of Europe's 3% target. As well as energy savings, drivers include improved well-being of the occupants, lowered default rates, lower vacancy rates for rental properties, and better re-sale value. Progress has been made in creating specialised green loans, one stop shops and training for providers, though these tend to only reach residents who own homes and have good credit ratings. Below are three best practice case studies.

Credit lines for residential buildings

One of the European best practice schemes to support energy efficiency investments in the building sector with public funds has been developed by the German promotional bank KfW in 2006.

Approx. 2/3 of the promotional activities (volume ranging in the past between EUR 75bn and EUR 80 bn, refinanced on the capital markets) relate to the domestic market and most of the domestic promotional products are deployed via a broad network of financing intermediaries (including regional promotional banks) using the so-called on-lending model.

As a consequence, KfW does not maintain its own branch offices nor takes the individual customer credit risk in relation to the on-lending business. Advantages of the on-lending approach include: (1) no need of establishing a branch network; (2) broad regional product availability, (3) neutrality with regard to competition with financing partners, (4) broad risk diversification.

The program is by far the largest targeting energy efficiency in Germany. Since its inception in 2006, 6 million housing unites benefitted from the promotional support of the program. Funds deployed by KfW since then reached nearly €180 billion (loans and grants) [91]. The investment volume triggered by supporting energy efficiency in residential and non-residential buildings in Germany was about €500 billion in total[92].

[91] www.kfw.de/Presse-Newsroom/Pressetermine/JAPK-2021/Presentation.pdf

[92] www.kfw.de/Presse-Newsroom/Pressetermine/JAPK-2021/Presentation.pdf

As of July 2021, the program has become the "BeG (Bundesförderung für effiziente Gebäude" – "Federal promotional support for energy efficiency in buildings"), under the leadership of the Federal Ministry of Economic Affairs and Environment and now formally ruled by a set of directives[93].

There are some structural and organisational changes compared to the original KfW programs, notably bundling now the most important German support programs for the building sector under one single roof. The basic principles of the program set up, however, remain unchanged compared to the KfW model:

1 Main reference point is prevailing building code: The starting point for determining the promotional support is based on the primary energy demand reduction compared to the requirements set for a reference building in the current building code (Buildings Energy Act, (Gebäudeenergiegesetz, short: GEG), in force as of 1 November 2020)[94].

2 Scope of financial support linked to energy efficiency level: The Efficiency House approach introduced in 2009 reduces the complex legal requirements of the building code to two main components: primary energy demand (PED) and transmission heat loss. An Efficiency House 55 (EH 55) for instance means, that the primary energy demand of the building seeking promotional funds is only 55% of the level set in the Buildings Energy Act for a reference building, resulting in a 45% PED saving. The basic rule: the more ambitious the energy efficiency level reached with the investment measures, the higher the level of financial support.

3 Blending loans and grants: The loans bear a very low interest rate. The main promotional element stems from a grant component blended with the loan. The size of the grant component is linked to the energy efficiency level reached with the investment measures implemented in an Efficiency House: for residential buildings, it ranges up to 20% for a newly constructed Efficiency House 40 (based on a loan amount of EUR 120.000 per housing unit for residential buildings) and up to 45% for comprehensive residential refurbishments. In case renewable energy measures are included, financial support increases by 5% (only for residential; Efficiency House 40 Plus). The investment grant amounts and partial debt relief are capped for each promotional level.

4 Mandatory involvement of an energy expert: Applying for public financial support for residential as well as non-residential buildings requires the involvement of an energy expert from a dedicated pool of experts[95]. There is financial support available to bear the costs associated with the involvement of the energy expert via a grant component, which is not

[93] BMWi - Richtlinien zur Bundesförderung für effiziente Gebäude (BEG) (deutschland-machts-effizient.de, amendments in force as of 21 October 2021)

[94] Gesetz zur Vereinheitlichung des Energieeinsparrechts für Gebäude und zur Änderung weiterer Gesetze from 8. August 2020 (BGBl. I S. 1728, PDF)

[95] Described here: www.energie-effizienz-experten.de

available on a standalone basis, but blended as an integral component into the promotional loan product.

The BeG-Program introduces new features and promotional components:

- There is always the choice between a loan with integrated grant component or an investment grant
- The promotional product set up is largely identical for residential and non-residential buildings
- Renewable Energy package: including renewable energy measures on top of energy efficiency measures results in an additional 5% grant component for refurbishments and 2.5% for new buildings.
- Sustainability package: including for instance the provision of sustainability certificates (supporting alignment with the EU Taxonomy).

KfW, as the German national promotional bank, will remain in charge of the promotional loans of the new programme structure. The investment grant part will, as of 1.1.2023, fully be managed by a governmental agency, subordinated to the Federal Ministry of Economic Affairs and Environment, called BAFA (Federal Office for Economic Affairs and Export Control)[96].

The German promotional scheme by KfW has clearly been successful in deploying large amounts of capital into residential and other types of building and is notable for addressing both the refurbishment or retrofit and the new-build market. It achieves national coverage through commercial banks and national promotion as well as through the involvement of regional promotional banks. The mandatory involvement of an energy expert is crucial to support all customer groups throughout the planning & investment process.

Lessons learnt

The more transparent and simple the structure of the overall promotional scheme, the better it is to understand for all parties involved and the easier it is to distribute.

A high degree of standardization assures program deployment at scale and allows for bundling of loans and refinancing via for instance green bonds..

The mandatory involvement of an energy expert from the beginning of the application process until completion of the construction or refurbishment project is very important to:

(1) Provide comfort to the investor regarding his energy efficiency project

[96] www.bafa.de

Lessons learnt

(2) Assure a high degree of quality and reliability regarding energy efficiency level reached

(3) Assure target-oriented use of public funds

(4) Assure high degree of reliability regarding the promotional effects

The systematic measurement of promotional effects is an important step in order to show economic and climatic impact as well as the contribution to the fulfilment of the goals of the federal government.

The Bulgaria Residential Energy Efficiency Credit Line[97]

The Bulgaria Residential Energy Efficiency Credit Line was established in 2005 as a EUR 50m European Bank for Reconstruction and Development (EBRD) credit line advanced to two commercial banks, United Bulgaria Bank and Piraeus Bank. As well as the EBRD credit line, funding, EUR 10m of grant funding came from the KIDSF fund, an international fund established to help Bulgaria shut-down the Kozluduy nuclear reactor. The credit line was used for loans to households and associations to finance energy efficiency improvement, The KIDSF funding provided grants for technical assistance and administration fees. The credit line was extended in 2011 with an additional EUR 40m (plus EUR 14.6m of KDSF grant) and again in 2016 with EUR 20m (plus a EUR 4.4m KIDSF grant).

Up until August 2019 the programme had deployed a total of EUR 90m and funded more than 55,000 building retrofits, resulting in energy saving of c.200 GWh and GHG emissions reduction of c.300,000 tCO2 per year.

Lessons learnt

Similar to the German structure, the grants worked through existing institutions and augmented products they already provide. This eased accessibility and allowed funds to be deployed.

Energy efficiency fund

Lithuania Multi-apartment Modernization Fund.

Lithuania has a population of c. 3 million, more than 38,000 multi-apartment buildings with more than 800,000 apartments of which about 97% are privately owned. About 68% of the population live in apartments built before 1993, i.e. during the Soviet era, and about 65% are heated using heat supplied from district heating systems.

[97] Residential Energy Efficiency Credit Line, 2020a.

During 2007 to 2013 the Buildings Modernization Programme had been supported by EU JESSICA funds which were used in a revolving fund (JESSICA Holding Fund Lithuania or 'JESSICA I'). Under this programme EUR 265 million was deployed in over 1,000 multi-apartment buildings, sourced from EU Structural Funds, Lithuanian national funds, private funds and recycling of repayments).

Following the successful JESSICA I, in 2015 the Lithuania Multi-apartment Modernization Fund, DNMF, was established as one of three specialised energy efficiency funds under Lithuania's public investment authority VIPA.

The goals of the programme were to:

- Increase the energy efficiency of multi-apartment buildings
- Ensure that the heating costs plus repayments for the loan did not exceed the pre-renovation heating costs.

DNMF utilised EUR 150 million from the 2014-2020 European Structural and Investment Funds. An important priority for DNMF was to leverage private finance and minimise national public investment. The European Investment Bank created an instrument called 'pre-financing' which was secured by the future inflows from the portfolio. This guarantee instrument was used to attract EUR 180 million of capital from commercial banks and the public investment agency VIPA.

Loans are at a fixed interest rate of 3% fixed for 5 years with up to 20 years loan maturity. Loans can cover up to 100% of the energy efficiency investment and there is a 2-year grace period during construction. No collateral is required. Apartment blocks are managed by associations and in order to proceed with a renovation 50%+1 of the apartment owners have to agree to the proposed works. In 2020 the National Audit Office of Lithuania reported that 35% of the 2,389 identified projects in the lowest energy efficiency apartment blocks in the period 2013 to 2019 were not implemented due to owners' objections and the rate of renovation was still well below the rate needed to achieve the target of renovating all buildings by 2050.30

The average loan granted was EUR 311,800. Average energy savings were 63% and the average building was improved from an Energy Performance Certificate E to an Energy Performance Certificate C. Typical measures that were installed include:

- Insulation of walls, roof and floors
- Replacement of windows and doors
- Modernization of the heating system
- Renewal of ventilation
- Glazing in of balconies
- Renewal of systems such as electrical wiring and elevators.

The standards for renovation work are set by BETA, the Housing Energy Efficiency Agency.

Up to 100% of project development costs could be reimbursed and up to 100% reimbursement of project costs is available to low income families. Originally up to 40% of the value of the energy efficiency investment could be reimbursed by grant subject to the level of energy savings achieved but this was phased out.

Municipalities were appointed to be the renovation administrators and were instructed to draw up lists of the worst performing buildings to develop a project pipeline. The municipality is the borrower on behalf and in favour of the apartment owner.

The Lithuanian Ministry of Environment reported that between 2005 and 2018, 2,941 multi-apartment buildings were modernized and 10,869 energy saving measures were implemented, reducing thermal energy consumption by 857 GWh. As of March 2018, nearly 700 multi-apartment buildings had been successfully renovated while another 400 were expected to be financed with the available funds from the DNMF.

In April 2018 Lithuania became the seventh country in the world and the first in the Baltic region to issue a sovereign green bond. The ten-year bond is relatively small at EUR 68 million, raised in tranches, but the proceeds will be lent to VIPA specifically for 156 multi-apartment building renovation loans administered under the DNMF.

In 2019 the EIB put in place a guarantee agreement with Šiauliu Bankas, one of the private banks involved in the DNMF from the beginning, to continue and renew their funding of renovations in multi-apartment buildings. Under the agreement EIB provides a EUR 30 million guarantee from the European Regional Development Fund for a portfolio of EUR 150 million in loans by Šiauliu Bankas to homeowners.

Lessons learnt

During the operation of the DNMF include the need for consistent and stable policies, the need to standardize and simplify, and the need to consult widely with stakeholders. Furthermore, it is important to ensure high quality projects and homeowners must be able to clearly see a return in a reasonable time scale. Prior to the re-organization in 2016 the uptake was relatively low, partly because low income households received a subsidy for heating and therefore were not incentivised to consider energy efficiency improvements. Once the subsidy was removed, uptake went up and low-income households could have the projects paid for by the fund subject to satisfying the criteria.

The 2018 green bond issue is particularly significant as it represents a further step towards a fully funded private capital model. Green bonds are in high

demand and are a clear way for commercial banks to recycle capital and raise new capital at low interest rates.

Mortgages and Green Mortgage

Mortgages account for around EUR 7 trillion (including the UK), or a third of the European banking sector's assets, and are the best-known form of property finance for consumers. Therefore, the vast majority of energy efficiency improvements made in homes are carried out while other renovation work is being performed. Indeed, while the use of electronic equipment has increased significantly in the last 30 years, residential consumption has remained flat.

Beyond standard building renovation, a green (or EE) mortgage aims to incentivise borrowers to prioritize improving the energy efficiency of their buildings and/or acquiring highly energy efficient properties. The incentives for borrowers may be favourable mortgage financing conditions and/or an increased loan amount at origination to finance the energy efficiency improvement of the property and enhance its Energy Performance level. Both aim to reflect the reduced credit risk of green mortgages and drive action to improve the energy performance of the building stock. Green mortgages have been promoted in Europe through the Energy Efficient Mortgages Initiative, a global, market-led initiative with the aim of mobilising capital markets and implementing ESG best practices in the financial sector in support of the objectives of the EU Green Deal and Renovation Wave Strategy[98].

Central to the design of energy efficient mortgages, is establishing criteria for measuring and monitoring buildings' energy performance. With the uptake of green mortgages, we are now seeing the first financial products that use existing Mortgage book lending to finance new EE mortgages.

Lessons learnt

Unlike grant structures added to traditional mortgages, green mortgages are specialized mortgages meant to encourage energy efficiency upgrades through lowered rates. However, uptake has been absent or slow in many markets and some banks offering them have thus far been unable to fully disperse the funds. This is often because "green mortgages" are positioned as "new products" with specific characteristics and prices, and yet most buildings require a renovation to "become green". Green mortgages are likely to be the result of the transformation of the underlying collateral to green, thereby "greening the old mortgage" through renovation. Many EEFIG members like ABN Amro, ING and Nationwide have strategies and targets to substantially green their existing mortgage portfolios and this seems like a positive direction of travel. The UK is considering a voluntary Mortgage Portfolio Standard to encourage lenders to support owners' renovations to deliver average portfolio energy performance targets for their collateral portfolios.

[98] Energy Efficient Mortgages Initiative H2020, 2019. Retrieved from: https://energyefficientmortgages.eu/

Example: Romania Green Homes and Green Mortgages Program.

The Romania Green Homes and Green Mortgages Program was first established as a pilot in 2012 with funding from the European Commission through a consortium comprising a bank, a project developer and an energy auditor.

The Program effectively comprises two elements:

- Green Homes Certification by the Romanian Green Building Council (RoGBC);
- Green Mortgages provided to buyers of homes with certification by the RoGBC from a number of commercial banks.

A central player in the development of this program has been the RoGBC which as part of the World Green Building Council (WGBC) certifies green homes. RoGBC promotes the program to attract prospective partner banks and generate awareness of the benefits to all parties.

All banks offering home mortgages in Romania can participate in the program as a partner bank, if they agree to the required criteria:

- Accept RoGBC criteria and process of certification of green Homes
- Offer substantive interest rate reduction commensurate with default risk reduction and enhanced long term asset value of Green Mortgage qualified homes.

The bank is responsible for all financial due diligence associated with its normal underwriting process. A key enabling factor of the program has been the National Bank of Romania, which allows green homebuyers to count estimated energy savings as an additional source of income in loan applications. This, combined with the lower interest rates, allows borrowers to borrow more for energy efficient construction or renovation which finances developers' additional costs from using green construction techniques and certifying the buildings. A lower interest rate and the accrued energy cost savings reduce the total cost of ownership compared to a standard home, reducing the risk of defaults. Banks are able to offer a lower interest rate as the certified green homes have both a lower mortgage default risk and higher asset valuation.

The program benefits all stakeholders: the developers; the bank; and the home buyer.

- For developers it provides:
  - Market differentiation
  - Increased demand for a unique market offering.
- For the banks it provides:
  - Introduction of a new financial product
  - Reduction of risk of mortgage default

  - A programme that aligns with social and environmental responsibility objectives.

- For homeowners it provides:
  - A reduced total cost of ownership
  - Health attributes from a green building
  - A higher value house.

The program has been successful. By the beginning of 2019 agreements had been signed with 25 developers to build more than 6,500 green buildings, all of which were designed to be at least 30% more energy efficient than the 'A' Category of the Romanian Energy Performance Certificate.

The wide diversity of projects supported shows the power of a market driven certification-based system. The program's provision of technical assistance through the process has helped grow the capacity of the developer community and the construction industry.

By July 2020, more than 10,000 homes, worth more than EUR 1.5 bn, have been certified or are under agreement to certify in Romania. The certification criteria have been updated to include criteria to monitor, control and reduce exposure to Radon within the homes. The new criteria also reduce or eliminate the use of materials that contain Volatile Organic Compounds (VOCs) such as formaldehyde.

As well as growing the project in Romania, the programme is now being replicated in 12 countries with the aid of EUR 1.6m of European Commission Horizon 2020 funding in a project called 'SMARTER Finance for Families'.

Lessons learnt

This programme shows the importance of a systems approach as it addresses the needs of all stakeholders: home buyers, developers, and banks. For banks the focus on being able to reduce default risk is a strength although by definition this is hard to prove in a market before there has been widespread adoption, it has to be to a certain extent an article of faith albeit based on extensive international research. It also illustrates the importance of wider green features in buildings to home buyers whereas energy efficiency on its own is insufficient to motivate action. Other major strengths of the programme include: its link to the energy policy instrument of Energy Performance Certificates; the use of a trusted, independent certification system to build confidence amongst home buyers and banks; and the need for technical assistance. Finally, the programme is an exemplar of using grants, in this case from the EU, to enable a market actor, (the Romania Green Building Council), to design and build the systems, the demand, and the supply side capacity, while the private sector banks provide the funding on a commercial basis with no public subsidy.

Home Renovation and Personal Debt

A limiting factor on home renovation overall and dedicated efficiency upgrades in particular is long term wage stagnation across Europe. The take-home pay of middle level management in rural Finland for example, is between 2,300 and 3,000 EUR a month, while in Italy it can be 2,000 or significantly less. Blue collar workers may well be living on take-home pay of less than 1,000 a month in Italy while in Finland a fully qualified welder may take home 1,500 to 1,700 a month. None of the above salary levels easily support an increase in non-essential debt – even low-cost debt. There is a reason these instruments have had difficulty scaling.

Therefore, while homeowners may wish to invest in their homes, off balance sheet financing mechanisms or grants designed to augment existing loans, are necessary in order for this sector to scale in an equitable manner.

In many markets, however, homeowners do regularly invest in non-energy upgrades such as extensions, and new kitchens and bathrooms, and often use personal debt in different forms from credit cards to second mortgages to finance them. This demand for home improvements is driven by the perceived improvement in quality of life and perceived increase in the value of the property. Energy efficiency improvements on their own are not generally seen to bring these benefits which constrains demand.

Third-Party Financing Companies set up in France as Integrated Home Renovation Services

Third-Party Financing Companies[99] set up in France are examples of 'all-inclusive' One-Stop Shops (OSS) / Integrated Home Renovation Services set up by Regions and main cities (Métropoles) to both direct the demand for renovation towards energy performance and facilitate the decision making of households and co-ownerships through an integrated financing offer.

The scope and organisation of these activities depend on local political decisions to overcome the shortcomings of the renovation market. All Third-Party Financing Companies aim at easing the financing of energy-efficient renovations.

Direct loans offered by Third-Party Financing Companies

Third-Party Financing Companies set up in France aim to provide fair access to the green housing market for households with low incomes, or who have recently taken on debt to buy their home, or who do not have easy access to

[99] https://www.iledefranceenergies.fr/
https://www.artee.fr/
https://www.oktave.fr/
https://www.facirenov.fr
https://www.pass-renovation.hautsdefrance.fr/
https://www.arec-occitanie.fr/renovoccitanie-le-service-public-regional-de-la-renovation-energetique.html
Autorité de Contrôle Prudentiel et de Résolution (ACPR)
European Commission (2013). Guide to the application of the European Union rules on state aid, public procurement and the internal market to services of general economic interest, and in particular to social services of general interest. Commission staff working document. Brussels, April 29, 2013: https://ec.europa.eu/competition/state_aid/overview/new_guide_eu_rules_procurement_en.pdf

loan insurance, and to enable them to spend less on energy. For the community, the challenge is to prevent the risk of precariousness for these households.

The direct financing offer is included in their typical "Integrated Home Renovation" offer. Firstly, they offer direct loans with repayment terms up to 25 years, depending on the useful life of the financed renovation, thanks to the long-term credit lines the European Investment Bank is providing them. In addition, Third-Party Financing Companies design the financing in such a way as to make it as easy as possible to carry out the renovation without overburdening the household's ability to repay. They take into account the assessment of energy savings to evaluate the repayment capacity of the households, as this is done under their control. They are also directly involved in the design and implementation of the renovation. Finally, by providing post-renovation monitoring, third party financing companies allow households to better control their energy consumption.

Third-Party Financing Companies are developed by the Regions and large cities specifically to encourage housing deep renovations. They take into consideration the trade-off between the social and energy benefits and the credit risk that they assume.

Initial results: Among the STFs which have ACPR approval, Hauts-de-France PASS Renovation has been carrying out financing activity since 2016, ARTEE started its financing activity in 2019, Ile-de-France Pass Renovation and AREC in Occitania in 2020.

The production of renovations by the Third-Party Financing Companies covered 2,000 dwellings in 2019 (houses and apartments in co-ownership), for a works cost of almost EUR 50m. These renovation work’s energy impact (reduction in primary energy consumption) is about 42 GWh/y. The volumes of third-party financing reached 20 million EUR at end of 2020.

The slow start can be explained by multiple factors: locally, STF have difficulties in structuring their service offer due to the low willingness of households to pay for advisory activities, the lack of qualified installers, but also due to national obstacles: instability of subsidies and competition from national incentive schemes that direct demand towards single energy-efficiency measures (such as one-euro boilers financed by energy saving certificates) and reluctance to adapt legislation to allow Third-Party Financing Companies to distribute the regulated zero-rate eco-loan.

However, it is worth noting the average amount of renovation works that is supported / carried out by Third-Party Financing Companies is high: around EUR25k to EUR50k for individual houses, EUR20k to EUR35k for co-ownership apartments. Likewise, the level of energy savings achieved is commonly greater than 50%. These indicators clearly show that Third-Party Financing Companies are faithful to their ambition to favour renovations in a way consistent with the national objective of energy transition, against the current of incentives pushing for “single-batch” work.

Lessons learnt

Complexity, high transaction times and costs have limited growth of the structure and accounts for part of the low uptake rates for this programme. The Third-Party Financing Companies in France require additional resources on top of charging their services to the final beneficiaries: individual owners and co-ownership syndicates. In fact, although there is a clear need for educational efforts and assistance in making decisions about the work to be done, this is the service for which households' willingness to pay is the lowest.

The magnitude of labour cost of Third-Party Financing Companies which are related to advisory services is about 2,000 EUR per project, i.e. about 6% to 7% of the investment cost. At the same time, implementation of OSS involves the coordination of many skills and requires significant resources: development and marketing skills, technical abilities in building physics and handling thermal performance models, etc. It needs, as well, investment in robust IT tools supporting these processes, training etc. In addition, the activity is capital-intensive due to the long duration of retrofit projects end-to-end. Public sector intervention is therefore necessary to cover the costs of EE-oriented advice and supervision.

On-tax financing - Property Assessed Clean Energy (PACE)

Property Assessed Clean Energy (PACE) is primarily a US based financing method that has attracted considerable attention in Europe and globally. PACE financing was first introduced in California in 2008. PACE is a means of collecting repayments of capital used for building renovation through an assessment, or voluntary addition, to the property tax paid by the building owner. The capital either comes from specific bonds offered by municipal governments to investors or from private funds. Loans can be used for energy renovations but can, depending on the jurisdiction, also cover other works such as seismic resilience measures. The loans are repaid over the assigned term – typically 15 or 20 years – via the annual assessment on the property tax bill. The long repayment term attached to PACE programmes allows for investments with long payback times to be considered in the renovation. In the US PACE is an adaptation of a long-standing feature of the US property tax system in which local authorities, Counties or Cities, can choose to allow additional payments to be added to local property taxes to repay specified capital expenditures that produce public good. This system, for example, allows drainage to be paid for across all properties that benefit from it. Although the tax is levied at local level, County or City, State legislation needs to be in place in order to enable this to be implemented. PACE is also facilitated by the homogeneous situation across the USA in which property tax and hence PACE assessments are considered senior even to mortgage payments, which reduces reliance on the borrower's creditworthiness and is therefore more attractive to financiers, enabling low interest rates.

PACE allows property owners to implement improvements without large up-front cash payment (in some cases there is even 100% upfront financing) and repay

the costs over a period of 10 to 20 years. PACE can be for residential properties, R-PACE, or commercial properties, C-PACE.

A PACE assessment is a debt of the property, meaning the debt is tied to the property as opposed to the property owner(s). In turn, the repayment obligation may transfer with property ownership if the buyer agrees to assume the PACE obligation and the new first mortgage holder allows the PACE obligation to remain on the property. This can address a key disincentive to investing in energy improvements because many property owners are hesitant to make property improvements if they think they may not stay in the property long enough for the resulting savings to cover the upfront costs. This feature, however, has not been without controversy or problems in the US.

Up until the end of 2020 PACE had achieved the following:

- Commercial PACE
  - Capital deployed: USD 2 billion
  - Number of retrofits / projects: 2,560

- Residential PACE
  - Capital deployed: USD 7.3 billion
  - Number of retrofits / projects: 306,000

There have been some concerns arising from PACE programmes. Due to its nature as a debt of property instrument, eligibility is based on property information rather than the homeowner's ability to pay. In isolated instances, where property owners did not receive full disclosure on the affordability and cost of financing, the property taxes ended up more than what they can repay. Many buyers and sellers have had difficulty with sales of homes with PACE tax assessments due to this reason. There can also be concerns about the quality of work undertaken although some PACE programmes do require a certain level of contractor training and quality control.

Fannie Mae and Freddie Mac, the federally backed home mortgage companies, do not purchase or underwrite loans for properties with existing PACE-based tax assessments, as PACE financing takes priority over other lien-holders. This constraint has reduced the adoption of residential PACE. However, Fannie Mae and Freddie Mac do offer refinancing to pay-off the PACE obligation and to ensure the mortgages comply with their requirements.

The PACE model has also been adapted to Canada, South Africa and Australia. It is also being developed in Europe with support from the European Commission's Horizon 2020 programme through the EuroPACE project run by GNE Finance.

The key innovation on the public policy side is twofold:

- The EuroPACE mechanism intends to enable a public administration to participate/intervene in the debt collection process in case of non-performing loans and defaults to provide security to the investors. This is the key element in attracting private funding.

- The project intends to ensure that the financing is attached to the property, thus converting it into asset financing. The lien would be pari-passu or junior to existing mortgages but never a senior one to avoid conflicts with existing lenders.

Lessons learnt

The EuroPACE project is focused on mobilizing private capital to deliver affordable and accessible financing to all Europeans. Building on GNE's partnerships with impact investors, the project can provide long-term, up-front financing to homeowners at affordable monthly repayment terms. As such PACE can address some of the barriers to energy efficiency financing. Specifically, by being able to offer long-term relatively low-cost loans it can address the barrier of high capital costs and the fact that it is tied to the property rather than the owner enables longer loan terms. It is also the first category of energy efficiency financing to have a secondary market which enables recycling of capital by the primary lenders. However, as mentioned above it has not been without problems, and attempts to replicate it in other countries are hampered by the nature of their specific property tax systems which are very different to that in the US, and also heterogeneous across the EU.

Residential Multi-Apartment

In case of condominiums, often a single household has a very limited decision power with regard to energy efficiency investments that can be undertaken. Structural investments (e.g. heating, insulation, solar panels) are often not under the control of a single household but the cooperation of owners. Residential credit lines are suited to support energy efficiency renovation of one householder or the purchase of high performing technologies; it is more difficult to promote residential credit lines for the renovation of multi-apartment buildings in some jurisdictions, due to the legal nature of housing associations and their inability to borrow from banks or access long-term finance if the housing association or board is not a credit worthy entity in the Member State. This differs from country to country. For example, in Spain, the board of a building can make decisions concerning renovation with a 51% voting margin. In other countries this is not possible.

That said, countries such as Spain have seen success in accessing these buildings and providing financing for renovations or technological upgrades, such as improved cooling. Cooperatives, and strong government incentives can support bringing households together to take advantage of their group decision making power.

For example, Italy's 110% tax write-off for home renovation (including seismic and efficiency measures) is one example of such a market signal. Incentives or requirements must be clear, strong and easy to implement in order to succeed. The Italian programme of EcoBonus, SismaBonus and Superbonus is successful. As the tax credit can be sold to third parties it becomes a specific security that

can be refinanced or securitised. Contrary to mortgage and traditional lending which is deeply regressive, if not strongly supported by public funded credit-enhancement mechanism, the SuperBonus is progressive in its impact. In fact, once the project gets executed and the fiscal credit is issued, the financing is not affected by the owner or asset credit risk. Which makes of SuperBonus an ideal instrument to renovate buildings in vulnerable and energy-poor collectives. Because of its structuring, the SuperBonus credit rating can be assimilated to the sovereign credit risk, which, in this case is the Italian one.

Lessons learnt

When decision making is simplified, for example through a cooperative's board decision, multifamily apartment buildings are possible to access. Like the examples of the grant-mortgage combination above, tax write-offs can augment existing structures to create scale. It is important to note, that due to increased spending and job creation, sales tax, income tax and corporate earnings are all increased. Therefore, both the grant and tax reductions pay for themselves.

Energy service contract

Energy service contracts have been used successfully for renovations of multi-family apartment blocks across several EU Member States. Notable examples where energy service contracts are linked to dedicated funds include the Lithuania Multi-Apartment Modernization Fund and the Latvian and Baltic Energy Efficiency Fund.

The financing of single family home residential deep retrofits through some form of energy service contract has considerable potential but as yet has not progressed beyond pilot scale. Examples include Energiesprong which offers a fully financed whole house retrofit using factory manufactured components. The model is viable in jurisdictions with support for renewable energy (one component of the retrofit) but in other jurisdictions capital costs remain too high compared to energy savings for projects to be financially viable on savings alone. Cost reductions and further innovation will be necessary to make this approach viable. There have also been developments in heat-as-a-service (HaaS) models.

2.3.4 Best practices and types of investment in public buildings

Much of the energy efficiency investment in the public sector was traditionally through self-financing through the organisation's budget. However, with austerity and downsizing of the public sector (in some/most countries) this has become less common. Furthermore, many public authorities have lost the technical and contracting skills needed to develop and implement projects. Remaining technical resources have to be focused on mission-critical functions such as basic maintenance, rather than on energy upgrades.

The European Energy Efficiency Fund.

The European Energy Efficiency Fund (EEEF) is a public-private partnership focused on financing energy efficiency, small-scale renewable energy and clean urban transport projects at market rates. It is targeted at municipal, local and regional authorities and public and private entities aimed at serving those authorities. It was capitalised in 2011 with EUR 265m with investments from the European Commission, the European Investment Bank, Deutsche Bank and Cassa Depositi e Prestiti SpA (CDP). The fund is managed by Deutsche Bank and well illustrates the difficulty with which energy efficiency funds have to deploy significant amounts of money ("turning the millions into billions"). It provides Technical Assistance (TA) to assist potential investors to develop projects through a dedicated TA facility. EEEF invests in the range of EUR 5m to EUR 25 m through a range of instruments including equity, senior debt, mezzanine debt, leasing and forfaiting loans. Typical loan terms are between 12 and 15 years.

The EEEF has a wide mandate which allows investment into energy efficiency and renewable energy in buildings as well as transport projects. By the end of 2019 71% of the total investment was into energy efficiency and 29% into renewable energy. Of the total investment 55% was deployed as senior debt, 17% as subordinated debt and 28% as equity. Funding can be direct to public authorities or through intermediaries such as Energy Service Companies.

By the end of 2019 the EEEF had achieved the following[100]:

- EUR 200 m cumulative invested capital
- EUR 145 million committed capital
- 17 investments made, 2 matured
- 15 active investments in 9 EU member states
- 921,369 MWh cumulative primary energy savings
- 530,454 tonnes cumulative carbon dioxide savings.

In order to design the projects, the public entities have had to either invest themselves or access the EIBs support mechanisms through ELENA. The application process for this support alone can require over a year. Then the public entity must also put up financial guarantees that they will move forward with whatever project is designed assuming it has a positive cost benefit. Both the delays and the guarantees form barriers to even initiating project design. The perceived risk and complexity of increasing public debt through EEEF is yet another barrier to at scale implementation.

Lessons learnt

The dedicated EEEF fund-structure has project size limits and, in practice, can only operate within the confines of specific sub-segments of projects. Public entities need time and resources to structure projects, and ELENA, an EIB facility designed to support the costs of such structures has been a bottleneck itself in the past. If large public projects are complex and slow to design and finance, the decision-making cycle can overlap with a change in administration which can additionally delay or even cancel the project. EEEF

[100] European Energy Efficiency Fund (EEE-F), 2020.

has broken new ground and provided incredible insights into the issues facing public energy efficiency projects and these lessons can promote new types and formats of blended facilities for the future.

Energy service contracting

The major part of the EnPC market to date has been in public buildings but there still remains much potential for EnPCs and off-balance sheet EnPCs in public buildings. The major challenges remain how to scale up ESCO and EnPC activity to address multi-building portfolios rather than just single buildings, and how to ensure deep retrofits rather than shallow retrofits that provide a quick return but lock in higher than necessary energy use.

In recent years, key drivers in the public sector have been the off-balance sheet EnPC classification, and clear and aggressive public sector targets, (at national and local levels) under many NEEAPs but this market segment faces more procurement constraints, potential split incentives, balance sheet restrictions and limitations under public accounting rules as compared to commercial buildings. In order to maximize the effectiveness of EnPCs it is also important that the ESCO industry, and their customers, find ways of changing the focus away from shallow retrofits and more towards deep retrofits with high levels of decarbonisation. These could include: adoption of more integrated design and a wider systems view that incorporates renewable energy sup-ply, energy storage and gird interaction as well as 'pure' energy efficiency measures.

In order to overcome the challenges in the public sector there is also a need for technical assistance, experienced external facilitators, greater knowledge sharing on the benefits of energy efficiency and internal championing, more internal incentives; and better data gathering.

Deep energy renovations may involve structural changes which significantly extend structural strengthening measures (e.g. reinforcement of roof to install insulation) in addition to energy saving investments which significantly extend the payback of these measures (>15-20+ years) and the complexity of the works. The increased project risk directly translates into increased costs for undertaking the works by the ESCO which needs to mitigate the risks associated with the project and price its equity contribution accordingly (high risk = high return). This limits the applicability of this model to light interventions unless a significant grant component is involved to reduce the payback time/risks associated with the project. Another viable and already multiple applied approach for risk mitigation in practice is bundling of different measures in building pools which allows to combine and de-risk fields of higher investment in uncharted area (building insulation) with business-as-usual technologies. This has been successfully executed in Deep Renovation EnPC in Mannheim, Germany (source: IEA-Annex61.com/case studies).

Public ESCOs

Public ESCOs operate in a similar way as private sector ESCOs, but are created with public funding promoted by local authorities and other public bodies.

An example of an ESCO in the public sector is SPL OSER which was established in 2012 by the Regional Council of Rhone Alpes and 10 local public authorities covering the towns of Bourg en Bresse, Chambéry, Cran-Gevrier, Grigny, Montmélian, Meyzieu, Romans sur Isère, Saint Fons, Saint-Priest and the Loire Inter-communal Energies Association.

SPL OSER was established as a local public sector company and created specifically to overcome technical and financial barriers that the local authorities experienced in carrying out energy efficiency projects in the public buildings sector. OSER translates to "Regional Energy Services Operator" and it acts mainly as a publicly owned ESCO. The original funding to establish the company came from the Regional authority (EUR 5.3 million) and 21 municipalities who contributed EUR 1 per inhabitant. The European Energy Efficiency Fund (EEEF) awarded a EUR 1.1 million grant for operational costs.

The company provides technical, legal and financial expertise and project management assistance to its shareholders, the local authorities, (including feasibility studies, public procurement and financial advice), to support renovation projects in public buildings that significantly increase their energy performance. The goal is for every retrofitted building to reach the French Bâtiment Basse Consommation (BBC) standard of 80kWh/m2/year.

An example of a project completed by SPL OSER is the CEP School Group building, which was built in 1972, and houses a kindergarten and an elementary school. At the time of renovation, the building had a dilapidated envelope. Implemented measures included external thermal insulation, replacement of joinery, installation of mechanical ventilation with heat recovery, renovation of lighting, repair of roof terraces, repair of the heating substation, distribution and heat emitters as well as the implementation of a photovoltaic installation. In addition, structural improvements were integrated into the renovation work that included critical improvements to accessibility and fire safety, as well as a reconfiguration of the spaces.

Before the energy renovation, annual energy consumption amounted to 472 MWh at a cost of EUR 30,200 per annum and with emissions of 9.3 kg CO2/m2. After the renovation, annual energy consumption was reduced by over 45% to 248 MWh and an annual energy cost of EUR 16,100 with emissions of 4.9 kg CO2/m²

SPL OSER itself is responsible for project development assistance, project management and getting financing. Any other services are outsourced via a competitive tender process. The loans taken by SPL OSER have a maturity of up to 20 years and the member/beneficiary pays a fixed service fee to SPL OSER as specified in a Service Agreement for a minimum of 18 years.

The company is managed by a board of directors and a special assembly to provide governance and oversight.

Lessons learnt

The availability of technical expertise to public ESCOs and through third party financing is a key success factor, which enables renovation projects despite a lack of financial resources by municipalities. Further, the engagement of local authorities, shared vision and involvement in ESCO governance means that this shared public ownership (financial as well) provides an interest to sustain the fund and activity.

2.4 Summary of Key Drivers and Barriers by Market Segment

EEFIG members in their discussions identified key barriers and drivers to energy efficiency in buildings categorized by segment. Although there are barriers and drivers to energy efficiency common to all buildings, many of the key drivers vary significantly by buildings segment. The following Table 2-1 lists the key drivers by buildings segment:

Table 2-1 Key drivers by market segment (buildings)

Residential	Public	Commercial
› One-stop-shop models › Incentives (grants/tax benefits) › Policy (new build) › Increased comfort / health benefits › Regulation (audits) › Valuation › One-stop-shop models › Campaigns on renovation by the local authority/region › risk sharing with the local/regional authority › Commitment of the banking sector › Numeric tools structuring the value chain, allowing all stakeholders to be productive › Authorization granted or not to the owners to rent or not if not renovated › Measure and communicate the "green value": increase of value of the property post renovation, to make it financially desirable › Prohibition to lend money for acquisition of a non-renovated	› Clear public sector targets › Incentives › Off-balance sheet EPC classification › Green procurement rules › Internal Champions › External facilitators / technical assistance › Increased comfort / health	› Incentives (grants/tax benefits/EEOS) › Green premium › Regulation / reporting requirements › Increased productivity › Business resiliency against energy prices › One-stop-shop models › Off balance solutions for non-public sector

property (to be included in the Bale's rules)		

EEFIG interprets this as a clear sign that, from a financial institution's perspective, buildings segmentation for investment and policy making purposes makes sense; and that there is no "one-size fits all" approach which can be equally successful in driving energy efficiency demand across all segments of buildings in the EU. Yet EEFIG has identified some common barriers in Table 2-2 and others which differ across sectors and these feed its conclusions in the next section:

Table 2-2 Barriers by market segment (buildings)

	Residential	Public	Commercial
Common barriers	› Energy prices in some markets › Institutional capacity › Low priority › Difficulty in coming to an agreement on the renovation among the owners/tenants of a (big) building	› Lack of enabling policies › Risk perception /lack of confidence in performance	› Information asymmetries › Awareness of benefits
Specific barriers	› Complex Process and lack of expertise › No performance guarantee available › Affordability › Access to finance › Fragmentation › Decision making (multi-apartment) › Bankability of homeowners/ housing association › Owner vs Tennant › Technical know-how › Cautiousness of the householders post Covid19 crisis	› Data gathering › Risk aversion › Internal financial incentives (retention of savings) › Fragmentation/ownership › Procurement rules › Technical know-how › Funding solutions	› Competition in capital budget › Long paybacks (3+ years) › Business interruption risk › On-balance sheet IFRS classification › Technical know-how › Bankability of occupier/owner

2.5 Conclusions and key enablers for market growth

In 2015, the potential for energy efficiency financing was not widely recognised and the barriers to growing the market were not systematically understood. Today, several financial institutions have made significant efforts to develop viable financing mechanisms and numerous dedicated credit lines and funds targeting energy efficiency have been launched, and have deployed capital. Energy efficiency projects have been bundled into Green Bonds, although the overall quantity with respect to global fixed-income securities issuance remains low. Nevertheless, project bundling and aggregation which was more theoretical five years ago is now an accepted concept and is in early implementation.

Nevertheless, the energy efficiency market remains small in relation to its potential size, fragmented and challenging to scale. Through the work of pioneering financial institutions, EEFIG and a dozen Horizon 2020 projects, foundational structures have been created such as standardized risk assessment protocols, project development standards, and a degree of contract standardization. Innovative financing mechanisms have been developed and launched during this timeframe.

Importantly, there is growing recognition that energy efficiency is an asset class that both represents a market growth opportunity and a way of deploying capital in support of the Paris Agreement climate goals. This is not insignificant progress for a sector dominated by banking and financial funds with multi-year decision-making processes, yet much more can and needs to be done.

Recommendations to Boost Market Drives

Within commercial and public buildings, the low demand by owners for energy efficiency investments (even presenting good returns) remains the most critical missing element preventing the greater allocation of resources from financial institutions into this sector. Efficiently addressing the scale of investment required to reach Europe's 2030 energy efficiency and carbon reduction targets will require stimulating building owner demand to match financial institutions' appetite to invest in these areas.

Drawing from the case studies in this chapter, the following high-level recommendations apply across each building sub-segment:

- Augment what already exists at scale: The most successful programs developed within the last 5 years in Europe, have built upon existing mortgage schemes and combined these with either strong tax incentives (such as in Italy) or grants (such as in Germany) for energy efficiency upgrades that otherwise would not have been made. These structures therefore access building owners when they are already intending to spend, and ensures this spending includes energy efficiency improvements.

- Simplicity is king: The extent to which a financial product is perceived as complicated, is directly proportional to delays in implementation and scaling. This is equally true for all innovative structures and building types described above. Energy Performance Contracts (EPCs), Property Assessed Clean Energy (PACE) financing, ELENA for public projects, green mortgages… these mechanisms will hold potential and should be supported, yet they will not scale at speed without ongoing support and in some cases (such as Elena) simplifications.

- Long term education and support: As stated above, while standardized risk assessment protocols, contracts and processes have been developed and implemented successfully, there are no parties close to consumers and project developers to support their continued market rollout long term. As a result, as soon as market participants start to understand the materials and use them, the party making these materials available and keeping them up to date, disappears. This creates dissonance in the market and means that neither funds, banks, project developers nor clients can ever fully implement a standardised process or document. Banks do not have the resources to train individual clients, EU projects come and go and this role is assigned to "one stop shops". Considering the amount of resources and the success of pilots establishing an entity or entities with staying power to maintain and deliver and train contractors and other parties to use the materials would be a highly effective measure in proportion to the cost. Such one-stop-shops can be promoted by regulation and supported through the European Investment Bank for 5 to 10 years to allow for genuine market uptake to take place.

Mandatory Minimum Energy Performance Standards and ways to align buildings and financial stakeholders

The 'split incentives' between owner and occupier are only a 'dilemma' when clear regulatory signals and incentives do not exist. When these are created, this dilemma will be reduced and the renovation sector in commercial real estate would scale. The financial and policy instruments to achieve this are in place and well understood. Below are examples of two clear and important regulatory signals:

Mandated minimum energy performance standards (MEPS) for buildings

Creating demand in the form of government mandated building energy performance requirements on the part of local governments or to rent or lease a property is a highly effective means of increasing renovation rates, as has been seen in the Netherlands, France and the UK. Upgrades of public buildings have had a positive return on investment over time and private as well as public funds are available, making this a viable requirement for local governments. Commercial buildings are often managed by large building management firms and owned by investment funds that focus on short term returns and are not incentivised to upgrade their buildings at scale. Those leasing the buildings rarely have either the means or the access rights to perform upgrades, even if they were motivated to do so.

Off-balance sheet financing, dedicated credit lines and returns on investment through improved re-sale and property value can facilitate commercial buildings owned by financial funds and managed by management firms reach a minimum efficiency standard in order to continue leasing out the properties. Governments can also lead by undertaking large scale, portfolio wide renovation programmes, using procurement frameworks or a super ESCO approach. The extensive government estate in most countries can be used to help scale both the supply chain and the finance available.

MEPS coupled with tax incentives or grants

If minimum energy performance requirements were combined with appropriate and clear tax incentives such as the Italian 110% tax reduction or the German KfW loan scheme, the upgrades could be achieved more easily, create local jobs, and stimulate local economies. Building upgrades themselves, generate significant taxes through job creation and regional commercial growth. Indeed, according to modelling, 110% of the actual renovation costs can be deducted and governments would still see a net increase in total tax revenue from the projects, due to the sizeable increase in economic activity, spending and job creation. The same is true of supportive grant payments (which must be designed to be additive rather than compete with the private sector). The grant payments are more than paid back to the government through increased tax revenue.

Mortgage Portfolio Standards ("MPS") for retail lenders

The nascent nature of the energy efficiency investment space in residential buildings means that there is still a lack of capacity in the finance sector to originate, develop, appraise and finance residential building renovation (other than through standard mortgages which do not account for the value of energy efficiency upgrades). To accelerate this, there is an opportunity for targeted public de-risking support, and technical assistance to help banks develop dedicated green mortgages, credit lines and funds.

The UK has recently proposed regulation[101] to increase both mortgage collateral energy performance and to align retail lenders with Government energy efficiency ambitions. Firstly, it proposes mandatory disclosure of energy performance for all registered mortgage lenders on their websites and to Government on an annual basis.

Secondly, UK lenders are requested to voluntarily agree to set a mortgage portfolio standard with an average of EPC Band C by 2030. Given the need for lenders to promote home improvements which meet expected technical quality standards, the UK also promotes a TrustMark scheme to create a level playing

[101] Improving home energy performance through lenders: UK BEIS Consultation on setting requirements for lenders to help householders improve the energy performance of their homes: [website] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936276/improving-home-energy-performance-through-lenders-consultation.pdf

field for reputable energy performance improvements installers. TrustMark businesses are vetted to meet required standards and are required to provide robust consumer and financial protection.

The UK government also retains the option to introduce primary legislation that will allow for mandatory improvement targets on lenders if insufficient action risks a shortfall in emissions savings required by its binding carbon budgets.

Promoting and valuing multiple benefits

One aspect of demand generation that requires further work is the subject of multiple benefits. This is true for commercial, residential and public projects. Energy efficiency projects have been shown to have multiple benefits which often have real financial value and strategic value to the project host. In traditional energy efficiency project development and evaluation, however, these have not been identified – the emphasis rather being on payback; invest x capital to save y in energy costs resulting in a payback of x/y. The multiple benefits of energy efficiency, especially those around health, education and welfare, as well as productivity, have to be stressed and ways of doing this could include changing energy auditing standards and energy management/ engineering training. When communicating about energy efficiency the multiple and strategic benefits should be stressed. Furthermore, there is a clear link between multiple benefits and impact investing.[102]

Multiple benefits occur at several levels including:

- Consumer level: stimulating the demand for renovation can be supported by focusing on residents' priorities and needs: to improve their comfort, health of their families and to cut costs. Here communications and marketing is key to ensure that the link between energy renovation and comfort/health is made.

- City/ region perspective: energy poverty alleviation, job creation, CO2 reduction, social cohesion and urban regeneration are a few of the additional benefits. One Stop Shops or hubs are a practical solution to centralize the decision making, marketing, and technical advice.

- From the investor standpoint a standardised methods for measuring and quantifying environmental, social and economic performance are key.

Aggregation and bundling supported by standard processes

The size of individual energy efficiency investments in buildings is relatively small from a financial market perspective, particularly when compared to energy supply side projects. Standardisation, transaction costs and risk return targets, all identified as significant drivers of supply in the 2015 report, all support the need for aggregation and overall scale of investment. Investors in larger scale more liquid investments can offer lower rates of return for the same risk while aggregating large volumes of projects can reduce the overall risk with diversification benefits. At the same time, pilots have demonstrated that contract standardisation even for projects of 50,000 EUR, coupled with

[102] This link is currently explored in a separate EEFIG working group on Multiple Benefits

standardised risk assessment protocols allow financial funds to sell portfolios of projects to each other, slowly increasing liquidity in the market[103].

The UK clearly sees high street mortgage lenders as being aggregators of choice for standard home retrofits and Germany's KfW levers retails banking distribution networks to offer its renovation products. White certificate programmes, used by France and Italy to deliver energy efficiency obligations under the Energy Efficiency Directive, positioned energy retailers as aggregators of components of energy efficiency upgrades. Early programme design promoted mainly component exchanges and lighting upgrades, but recent evolution can help promote and draw finance into deep renovations. Third party finance places local authorities at the heart of aggregation and seems to work better in low income population segments.

Standardisation of processes

Standardisation of processes can reduce the transaction cost of energy efficiency finance and is also necessary in order to grow securitisation of green mortgages and other energy efficiency assets. Standardisation can cover labelling schemes, project rating methodologies and risk assessment tools, standardised legal and financial structures of assets (loans, guarantees, energy performance contracts etc.). Despite the challenges of standardisation across the EU further efforts should be made to develop standardised approaches as have many of the financial instruments identified in this chapter.

As funds gain more experience within the energy efficiency markets, they are decreasing minimum project size and supporting the aggregation of smaller projects with increased success, as project developers understand what is required in order to meet the risk appetite and limitations of these financiers. If public funds were made available to support securitisation vehicles, this can also improve criteria and permit aggregation of longer paybacks.

The learning curve from existing projects needs to be accelerated through more performance-based data which is, unfortunately not collected in many projects today, as notable by its near absence in the De-risking Energy Efficiency Platform (DEEP) data base. Incentives are necessary to increase the number of projects willing to provide performance data.

More Targeted De-risking tools by segment

Targeted de-risking tools such as guarantees can help drive the supply of investment capital in buildings. Energy efficiency investments typically utilize well proven technologies and have maturities less than the warranted lifetime of the equipment utilized. In practice they are low risk but until proven financial institutions may still have concerns. Using proven technologies and agreeing savings at the outset can address issues identified in the 2015 report as drivers affecting the supply of energy efficiency investments in buildings including:

- Increased investor confidence
- Measurement, Reporting & Verification (MRV) and Quality Assurance

[103] LAUNCH H2020 project: Sustainable Energy Assets.

- Energy Performance Certificates
- Definition and common understanding of the value of energy cost savings

A key issue for an energy efficiency investment is the ability of the occupant of a building to enter contracts with maturities of more than five years. Many occupants of buildings do not have strong credit scores and there are few independent long-term credit ratings available. Investors and banks are unlikely to invest in or lend to long term investments with poor or inexistent credit ratings. Government finance institutions can potentially underwrite part or all of this risk. On-bill repayments are a solution to occupier term and creditworthiness as they transfer the risk to a building's occupation, from a specific occupant.

That said, in order to grow the market, these instruments must primarily benefit the end consumer rather than the local or regional bank. Today, credit guarantees and on-bill schemes can be used to promote greater engagement and improved returns from local banks, yet the investment criteria for local projects remain the same.

3 Industry Energy Efficiency Investments

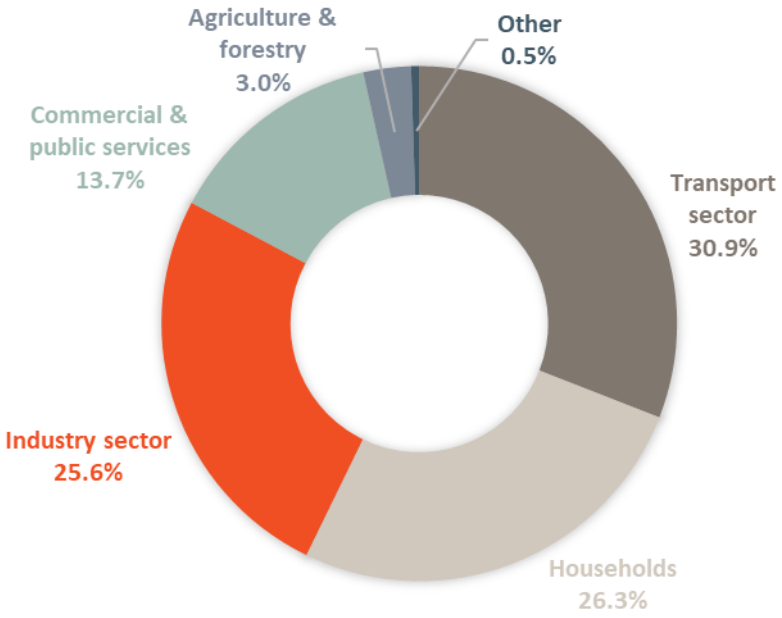
3 Industry Energy Efficiency Investments

3.1 EU Industry Market Investment Characterization

Share of energy consumption and GHG emission of the European industrial sector

The industrial sector is a major energy consumer and GHG emitter. According to BNEF, industry accounts for approximately 25% of CO2 emissions from energy and industrial processes in 2018[104].

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



Source: Own production using Eurostat 2019 data (Online data code: nrg_bal_s). % of total, based on tonnes of oil equivalent

The EU consumes 11% of the world's energy and is its third largest energy consumer after China and the US, and industry accounts for almost 26% of final energy consumption[105].

Energy-intensive industry sectors in Europe include chemicals and non-metallic minerals, which are responsible for 21% and 14% respectively of final energy

[104] Background information BNEF: "Industry today accounts for 21% of fuel combustion emissions, or 25%, if we take industrial-process emissions into account."
[105] EUROstat (2019). Online data code: nrg_bal_s

use in the sector in 2019. The table below shows the distribution of the final energy consumption by industry sector.

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

Industry Sector	Percentage
Chemical & petrochemical	21.2%
Non-metallic minerals	13.8%
Paper, pulp & printing	13.5%
Food, beverages & tobacco	11.5%
Iron & steel	10.4%
Machinery	7.1%
Not elsewhere specified (industry)	4.6%
Construction	4.1%
Non-ferrous metals	4.0%
Wood & wood products	3.6%
Transport equipment	3.1%
Textile & leather	1.5%
Mining & quarrying	1.5%

Source: Own production using Eurostat 2019 data (Online data code: nrg_bal_s). % of total, based on tonnes of oil equivalent

The potential for energy efficiency to substantially reduce GHG emission in the industrial sector is huge: According to the IEA Clean Technology Scenario, energy efficiency, together with the use of best available technology, can make up to 38% of emission reductions in key industry sectors (cement, iron, steel chemicals) until 2060[106].

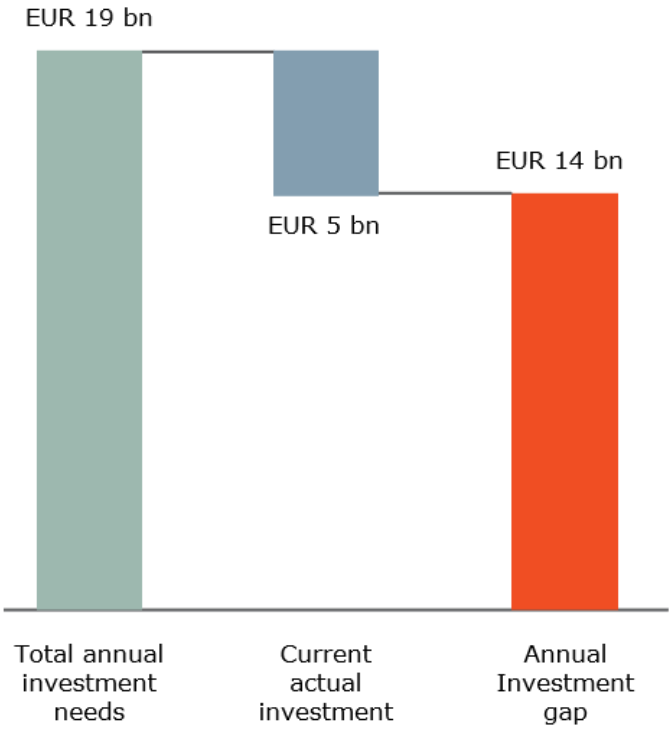
Energy efficiency investment reality and challenges

According to the IEA, global energy efficiency investments were estimated to be USD 227 billion in 2020, and USD 249 billion in 2019[107]. Within this, global industry investment in energy efficiency was estimated to have remained roughly at business-as-usual levels of some USD 35 billion in 2019[108].

The EIB Investments report 2020/2021, shows that energy efficiency investments in the EU have remained similar over the last five years[109]. EU27 2019 investments in energy efficiency were around EUR 60 billion and for comparison China was EUR 53 billion and the USA just EUR 37 billion[110].

[106] IEA (2019). Transforming industry though CCUS. p.13.
[107] IEA (2020). World Energy Investment 2020: Investment estimates for 2020 continue to point to a record slump in spending.
[108] IEA (2019). Energy efficiency in 2019.
[109] EIB (2020). Investment survey: Going green, who invests in energy efficiency and why.
[110] EIB (2021). Investment Report 2020/2021: Building a smart and green Europe in the COVID-19 era. P.137

Figure 3-2 Annual investments in energy efficiency in EU industry



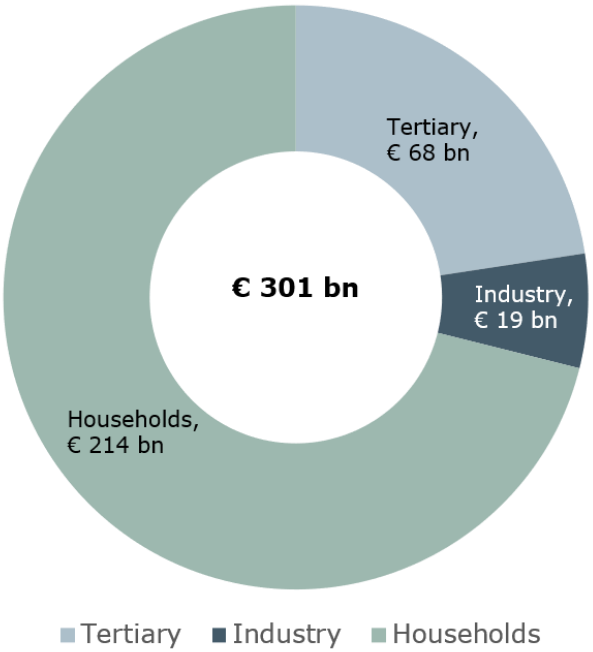
Source: Own production based on Holmes, I., Jess, T., Genard, Q. (2017). Efficiency first scorecard: is the EU's energy union on track? and IEA (2019). Energy efficiency in 2019.

According to estimates by the European Commission (2019), the investment needs for the climate transition are around EUR 360 billion per year to meet a 40% emissions reduction target, of which over half should be directed towards energy efficiency measures (equivalent to EUR 153 billion)[111]. Of these required funds, about EUR 19 billion should be directed to the industrial sector as shown in Figure 3-3[112].

The IEA found that industry in Europe invested around EUR 5 billion in energy efficiency in 2018 and 2019[113]. As a result, it could be said there is an investment gap of at least EUR 14 billion[114] in order to reach the current European climate and energy goals.

[111] EIB (2021). Investment Report 2020/2021: Building a smart and green Europe in the COVID-19 era.
[112] Holmes, I., Jess, T., Genard, Q. (2017). Efficiency first scorecard: is the EU's energy union on track?
[113] IEA (2019). Energy efficiency in 2019.
[114] This value should be taken with reservation because the inflationary to estimate this value (target - actual investment) comes from different sources and the data collection could have different assumptions.

Figure 3-3 EU Annual Clean Energy Investment Needs 2020-2030 – Demand Side (Billion EUR)



Source: Modified from Holmes, I., Jess, T., Genard, Q. (2017). Efficiency first scorecard: is the EU's energy union on track?

Energy efficiency investments in the industrial sector have not grown significantly since EEFIG published its landmark report in 2015, and this is the result of mainly low energy costs, declining global economic growth and to the low internal prioritisation of external capital for efficiency projects in industry.

Structure of the EU industry market

Large industrial enterprises have more than 250 employees and over EUR 50 million turnover and are good hosts for third party funded energy efficiency projects. However, EU industry is comprised of over 25 million active enterprises of which 99.8% are SMEs. Furthermore, 93% are micro enterprises with less than 10 employees, and just 1% are medium-sized with over 250 employees[115]. Individually SMEs consume modest amounts of energy, but collectively their energy demand is considerable.
Although it is difficult to estimate the energy consumption of this sector, it is clear that SMEs are important energy consumers, especially in urban areas. In Italy, the energy demand of manufacturing SMEs is around 70% of the total energy demand of the industrial sector[116], while in the UK, SMEs account for around 45% of total industry energy use[117].

SMEs have a high-risk perception in the finance sector and this is a hurdle to greater external finance for their energy efficiency investments, which risk

[115] European Commission (2020). Annual report on European SMEs 2018/2019: Research & Development and Innovation by SMEs.
[116] Trianni, A., Cagno, E. (2012). Dealing with barriers to energy efficiency and SMEs: Some empirical evidences. Energy.
[117] Vickers, I., Vaze, P. et al. (2009). Final Report for BERR Enterprise Directorate: SMEs in a Low Carbon Economy. Middlesex University – BERR.

mitigation mechanisms can address inter alia. Among large companies, attention to energy efficiency has increased in many cases due to the introduction of mandatory energy audits by the Energy Efficiency Directive (2012).

Important policy developments with impact on industrial energy efficiency investments since 2015

Energy efficiency investment in the EU has remained at largely the same level since 2016[118]. This is despite strong and increasing policy support over this period which included Clean Energy for All Europeans package[119] and a prior targets of greenhouse gas emissions reduction by 40% by 2030[120] and energy savings of at least 32.5% vs 2007 projections by 2030.

Currently the Commission is working on its 'Fit for 55' package, which was launched on 14th July 2021 and includes a comprehensive review of the relevant legislative framework to ensure that the updated 55% emissions reductions targets are delivered by 2030. This includes updates to the main features and legal obligations (e.g. energy audits) of the Energy Efficiency Directive (EED) which will cast more light on future drivers of energy efficiency investments for EU industry. Some provisions that would potentially be added relate to, among others, energy audits, heating/cooling and recovery of waste heat, energy services and skills[121].

The new European Industrial Strategy (2020) also pursues the reduction of emissions across the EU industrial system and will depend on an "energy efficiency first principle and a secure and sufficient supply of low-carbon energy at competitive prices"[122]. A carbon border tax adjustment mechanism was also introduced as a component of the 'Fit for 55' package in July 2021 to ensure a level playing field for energy intensive industry.

The EU is also working on a Masterplan for the Competitive Transformation of EU energy-intensive Industries which aims to provide guidance on how to transform the EU's large energy consumption industry, in line with the EU's objectives of a circular and climate-neutral economy by 2050[123]. This will require more planning and investment in low-carbon generation technologies, capacity and infrastructure, and will act as an additional driver of energy efficiency investments for European industry. Improved Sustainable Products policies and green public procurement, should act as effective further drivers of EE investments within industry.

In most European countries, the energy efficiency index of European industry kept improving by 1.3% per annum on average since 2000. However, the share

[118] EIB (2021). Investment Report 2020/2021: Building a smart and green Europe in the COVID-19 era.
[119] European Commission (2019). Clean Energy for all Europeans Package.
[120] compared to 1990 levels. Note that this target has now been increased to 55%, with renewable energy and energy efficiency targets to also be updated by June 2021.
[121] European Commission (2020). Energy Efficiency Directive (EED) Inception Impact Assessment.
[122] European Commission (2020). Communication: A New Industrial Strategy for Europe.
[123] Interreg Europe RESINDUSTRY (2020). A Masterplan for a green transition of EU industries.

of industry in the final energy consumption in 2018 had declined by 3.8 points[124].

Emissions trading and CO2 markets, however, have proved a successful in stimulating energy efficiency and renewable energy investments, and most industries in the EU are directly or indirectly exposed to the carbon market. Recent increases in the carbon price has already pushed many large and energy-intensive industries to re-evaluate their energy use and look into energy savings potential.

Standardisation and disclosure requirements also promote corporate energy efficiency investments. The EU Taxonomy and a standardisation of non-financial reporting practices make it easier to define green investments. Improved disclosure requirements create more incentives to channel funds to sustainable investments. The EU Taxonomy provides green criteria for heavy industry and the manufacturing of aluminium, steel, cement and chemicals which account for a high share of industrial emissions.

When the landmark EEFIG report was published in 2015, energy efficiency investments in industry were primarily driven by regulations and technical innovations that delivered cost savings, but they were not a strategic issue for top management. Today, hundreds of companies have set a net-zero emissions goal, and the adoption of net zero goals is an additional driver for energy efficiency investment. These companies are also setting emissions reduction targets grounded in climate science in line with the Science Based Targets initiative (SBTi) and increasingly look to their GHG protocol scope 3 (supply chain and other indirect) emissions and hence require the companies that suppy them to report their own direct and indirect GHG emissions and develop decarbonisation plans. When companies adopt a net zero target they can increase investment in energy efficiency to reduce carbon emissions in all three emission scopes. Investments into direct energy savings will improve operational cash flow and competitiveness, and are increasingly strategic in nature.

However, the main challenges for implementing energy efficiency and renewable projects in industry have remained the same since 2015: they require high upfront investments in often non-core assets with long (over 3 year) amortization times and contain credit risk (of supplier or ESCO) and technical performance risk issues.

3.2 Approaches and Instruments to Stimulate Corporate Energy Efficiency Investments (with a focus on Industry & SMEs)

"In general, there is a good correlation between the existence of the regulatory framework and how well it supports and enables investments in energy efficiency" United Nations Economic Commission for Europe

[124] Odyssee MURE (2018). Sectoral profile – Industry 2018.

(UNECE) Committee on Sustainable Energy and its Group of Experts on Energy Efficiency (GEEE) in their Report Overcoming barriers to investing in energy efficiency.[125]

The following sections describe national energy efficiency frameworks in industry, case studies of industry-facing policies and tools which have worked and other findings of the EEFIG working group.

3.2.1 National EE Initiatives

National energy efficiency frameworks

The EU Clean Energy Package which sets a target of energy savings for 2030, has been rolled out through national environmental regulations and Climate plans are being developed in EU countries. Examples include: Malta's 2030 – National Energy and Climate Plan[126] - which presents Malta's targets in the energy efficiency and renewable energy space and how the country intends to achieve them; and France's Law for the Energy Transition and the Green Growth, which sets energy efficiency targets and emission reduction targets and aims to tackle energy poverty (households where energy expense represent a significant amount of their income).

Several energy efficiency support schemes have also been developed to support the transition to a leaner European industry and production relying less on fossil fuels; they usually combine a regulatory framework, grants, subsidies and dedicated funds.

Example: Malta

- Energy Efficiency support schemes for industry in Malta originally entailed incentives exclusively in the form of tax exemptions/ incentives. However, market testing showed that tax credits were not a strong incentive for businesses as non-transferable tax rebates only work when a profit is made. This limitation caused an adaptation of the scheme that now provides the support in the form of both a grant and tax credit[127].

- Guaranteed loans with an interest rate subsidy and technical assistance are being piloted in Malta in energy efficiency[128]. The combination of different forms of assistance in one instrument is positive since the post COVID industrial environment in Malta requires multiple forms of support to

[125] UNECE (2018). Overcoming Barriers to Investing in Energy Efficiency, Intensive Learning Session at the EE Global 2018. Retrieved from: Overcoming Barriers to Investing in Energy Efficiency, Intensive Learning Session at the EE Global 2018 | UNECE
[126] Malta's 2030, National Energy and Climate Plan – December 2019. Retrieved from: https://drive.google.com/file/d/11nQdlwQghCXKjrKI-G9V6xSIvOfDZz0q/view
[127] Malta Enterprise (2019). Investment aid for energy efficiency projects – Malta Enterprise provides a tax credit scheme to incentivise investments in energy efficiency technology. This is a scheme which falls under the General Block Exemption Regulation providing tax credits of up to 30% - large enterprises, 40% - medium enterprises and 50% - small enterprises. The minimum investment amount is EUR25,000. Retrieved from: http://maltaenterprise.com/
[128] EIF Website (2020). ESIF Energy Efficiency and Renewable Energy Malta

mobilise the required investment. However, state aid clearance requirements and added transaction costs for combining grants and guarantee instruments limited the applicability of using different forms of assistance to scale up industrial energy efficiency investments.

Example: France

The industrial sector in France has six major drivers for energy efficiency:[129]

- Regulatory - Obligatory Energy Audit for all large companies (with over EUR 50 million of turnover or more than 250 employees).
- Regulatory - The "Certificat d'Economie d'Energie (CEE)" program caused EUR 640 million EUR[130] in 2019 to be channelled into the industrial sector.
- Subsidy - The "Fond Chaleur" by ADEME provided EUR 307 million[131] in 2019 in subsidies for heat recovery solutions in the industrial sector, for reuse internally or externally and through connection to a district heating network.
- Standards – support and communication around the ISO 50001 and a dedicated program to help companies to cover a part of the cost of the certification (20% of energy bill or up to EUR 40,000).
- Public Finance - Green Leases offered by the BPI (Banque Publique d'Investissement).
- Subsidy – A Fond Investissement d'avenir of EUR 1.2 billion for 2020-2022 was launched to reduce carbon emission in industry.

Public funding programmes dedicated to specific energy efficiency solutions or that impact the cost of emissions or energy waste (such as a carbon tax) will increase the implementation of the efficiency measures described in an energy audit. ADEME's "Fond Chaleur" provides state subsidy for heat recovery technologies, but in order to get the subsidy the business case had to meet the fund's criteria. The standardisation of eligible technologies provides better quality information, energy savings and their lifetime with specifications which are then used by financial institutions in their project due diligence to de-risk the investments. Linking information on funding programmes to the sending of the audit report is also recommended[132].

Energy Saving Schemes

An energy saving scheme which has a proven track record in Europe is the Energy Efficiency Obligation under the Energy Efficiency Directive (known as

[129] SIA Partners (2020). Efficacité énergétique Report.
[130] EMMY (2020). The CEE trading platform
[131] SIA Partners (2020). Efficacité énergétique Report
[132] IREES/adelphi (2017). Analyse der Entwicklung des Marktes und Zielerreichungskontrolle für gesetzlich verpflichtende Energieaudits.

white certificates)[133]. Energy providers have an obligation to accumulate a certain number of energy efficiency certificates linked to the volume of energy they sell in the market. White certificates are created according to rules defining the amount of certificates eligible per installation of energy saving devices or by providing ex-post proof of the energy savings of an investment.

In France, the CEE scheme promoted a good deal of activity and projects. On top of the financial benefit of creating CEE certificates, which could be sold to energy providers, the technology risk of a solution (and its capacity to deliver energy savings) was mitigated by scheme standardisation through precise eligible technology specifications or energy commissioning of installations (for specific projects).

The Italian White Certificate scheme, as described below, has also promoted the uptake of energy efficiency finance.

Case study: Italian White Certificate Scheme - since 2005 Certificati Bianchi (TEE)

Obliged Subject: Electricity and gas providers with more than 50,000 customers

Energy Saving Goals/ Obligation (2019): electricity: 2.77 Mtoe - 32.2TWH, natural gas: 3.43 Mtoe - 39.9Twh. TOTAL: 71,1TWh

How are the energy saving certificates created? White certificates can be created by voluntary third parties that are non-obliged distributors, ESCOs, organizations with an energy management expert (UNI CEI 11339 certified) or with an ISO 50001 energy management system and are generated from energy saving projects. Each white certificate represents a ton of oil equivalent (1toe=11,63MWh) of energy saved, and can be created through:

Deemed savings projects (DSP, method 3), where the savings were assessed through the number of installed units (e.g. number of lamps or small boilers, square meters of solar thermal collectors, kW of installed high efficiency engines, etc.) considering standardised values for the energy consumption baseline and the additionality, and taking into account corrective factors (e.g. geographical location, climate zone, working hours, etc.).

Monitoring plans projects (MPP, a type of metered savings, method 1), where the savings are extrapolated from measured energy savings and an energy consumption baseline considering additionality on the basis of one single project. The total energy savings take also into account adjustments for the variables affecting the savings (e.g. manufactured volumes, plants usage, weather, etc.).

[133] They are also referred to as energy efficiency obligation schemes (EEOSs) – see: https://e3p.jrc.ec.europa.eu/node/191

> **Simplified Monitoring Projects** - A mix of 1 and 2: White certificates can be traded through bilateral agreements between the obliged distributors and the voluntary parties or through the marketplace made available by the regulator (spot price market)

Subsidies to certain types of energy efficiency solutions in France ("standardised operations" in the CEE Scheme) and in Italy ("Deemed Savings Projects" in the Certificati Bianchi scheme) can be limited to solutions listed in energy audits, and then converted into projects down the track in energy intensive industries as well as SMEs. Regulatory energy saving schemes have provided reassurance to financial institutions as they reduce the costs for the industrial beneficiary, qualified the technology and provided assurance on the expected energy savings. Financing tools[134] were designed for and restricted to projects which could benefit from white certificates.

Institutions

National institutions provided with sufficient resources to develop energy efficiency policies or support energy efficiency investments are deemed successful by providing a framework which helps financial institutions develop energy efficiency finance solutions for industry. There is limited tracking and benchmarking of the success of these frameworks and the majority of the promoted solutions again have ex-ante design energy savings determined, as opposed to third party verified, results-based approaches.

3.2.2 Energy Saving Finance targeting industry

The following section highlights a few of the leading funds and instruments that target the delivery of energy efficiency investments in industry:

Energy efficiency or carbon mitigation funds

The UK Industrial Energy Transformation Fund (IETF) was launched in 2019, the UK's IETF 'supports the development and deployment of technologies that enable businesses with high energy use to transition to a low carbon future'. The fund is supported by £315 million of funding up until 2024. Phase 1 supports the deployment of energy efficiency projects as well as energy efficiency and decarbonisation studies. Phase 2, launched in 2021, includes the deployment of decarbonisation technologies. The fund also aims to support the commercial roll-out and permanent installation of technologies at TRLs of 8, 9 and above on industrial sites.

Refinancing of commissioned energy efficiency assets

Structured finance for energy efficiency, and renewable energy, based on Energy Performance Contracts (EnPC), Energy Service Agreements (ESA), and/or Power Purchase Agreements (PPA) are gaining ground. Typical elements are standardised terms, frameworks and financing contracts, where technical risk mitigation is achieved by the provision of long-term financing after project has

[134] Financial tools e.g. include the Chartwell mortgage and lease-to-buy arrangements

been successfully commissioned, and through the forfaiting of future receivables.

The barriers to EnPCs and energy services in industry include: the long duration of the contract which can be a problem in a fast-moving commercial world and unexpected changes in production levels and product type or design.

Development funding

Refinancing scheme are limited by the financing gap between the beginning of the project installation and its commissioning (a form of "construction finance"). Technical and project development assistance lines (like ELENA or the EIB's Advisory Hub) are good examples of development funding lines.

Eew green funds provide development funding to cover short-term installation financing gaps (examples include RGREEN Invest[135], Tiger Financial[136], Capcora[137]). The Horizon 2020 REFINE project is studying these structured finance approaches and the development and testing of instruments and facilitation services for refinancing.

Development of a secondary market

In the renewables sector site-based financial models based on factoring, leasing and forfaiting schemes sell industrial customer's repayments, as assets securitized in the capital markets, assuming the credit quality of these asset portfolios can be assessed and rated. Groups of industrial roof-top PV installations that benefit from special tariffs as well as long-term power purchase arrangements are good examples.

This approach could be generalised for energy savings projects, provided a regulatory framework (with a standardisation of the baseline calculations) and working measurement and verification protocols are put in place. Thus, a prerequisite for securitisation would be standard EnPC/ESA/PPA contracts, with standard financial terms, audits on the technical risks and adequate counterparty credit risks, which for SMEs can be enhanced by specific guarantee schemes.

3.2.3 Other instruments facilitating the finance of EE projects

In 2020, the EEFIG Member Survey provided a series of recommendations for turning industrial energy audits into action:

Knowledge sharing Networks / Databases

Several EEFIG financial institutions indicated that they lack technical capabilities internally to assess the long-term benefits of energy efficiency assets and do not have a clear vision of the project's positive impact on the balance sheet of an industrial counterparty. A database of relevant case studies (and success stories) was proposed by several EEFIG members as a possible contributor to

[135] RGreen Invest, 2018
[136] Tiger Financial
[137] Capcora (2019). Capcora arranges bridge financing for German PV rooftop portfolio from enen endless energy. Retrieved from: https://www.capcora.com/en/2019-03-26_capcora_arranges_bridge_financing_for_german_pv_rooftop_portfolio_from_enen_endless_energy.html

convert more opportunities into action. These examples of real energy saving projects should be sorted by industry sector, and contain detail on type of project, capex and ROI (and NPV) and the energy savings in MWh and EUR equivalent (and eventually in carbon emissions mitigation).

A collaborative way to increase the number of energy efficiency measures are Energy Efficiency Networks (EEN). Many small and mid-sized private sector companies and public institutions face significant barriers to implement energy efficiency measures as energy efficiency is not at the core of their usual operations. Either decision makers are unaware of the full potential of energy and cost savings of energy efficiency projects, or if institutions have decided to evaluate and implement an energy efficiency strategy, responsible project managers struggle to manage and explain the complexity of technical, regulatory and financial aspects of an energy efficiency project. The German energy efficiency networks scheme is a good example and has been providing a structure and material since 2014[138] and will save 75 PJ in primary energy from 2014 to 2020.

EENs aim to lower barriers, to better inform decision makers and empower project managers by sharing best practice energy efficiency projects as well as available financial and technical support instruments between peers. EENs promote the exchange of energy efficiency experiences in moderated meetings and consultations with energy efficiency experts. By committing to voluntary network, group and individual energy saving targets, the implementation of projects is significantly improved.

Barbara Schlomann from Fraunhofer ISI, Germany described several success factors of EENs:[139]

- The development of a network structure that provides all the services required to remove different economic and non-economic barriers;
- The provision of tools and standardized guidelines to lower implementation and transaction costs and ensure a high quality of energy savings;
- The specification of a clear timeframe for the network;
- Providing training for those operating the network (managers, moderators, consultants) and for the staff in the participating companies;
- Developing a sustainable business model for EENs that reduces dependency on government support.

EENs can be organised either on a local level or within industry groups. As a tool to increase EENs have been included by some countries in national energy

[138] Initiative Energieeffizienz- und Klimaschutz-Netzwerke
[139] Odyssee-Mure (2016). Energy Efficiency Networks. Retrieved from: https://www.odyssee-mure.eu/publications/policy-brief/networks-energy-efficiency.pdf

efficiency action plans under the EU Energy Efficiency Directive, formalising the structure, governance and support schemes of EENs. The German initiative "Initiative Energieeffizienz- und Klimaschutz-Netzwerke"[140] has been able to support the set-up of about 300 locally organised networks with over 2,500 participating companies.

3.2.4 Other Tools

Energy Audits

Typically, an energy audit will provide a high-level assessment of energy efficiency opportunities whether being done for mandatory purposes or from a voluntary perspective and could be limited in its value by the competence of the assessing body. The limited capacity of auditors to calculate the profitability of the recommended EE solutions has been pointed out[141]. The competence of the energy auditor should be certified (and regularly trained) by a technical body and the audit output requirements should be standardised[142]. The solutions on which to focus could be "suggested" to the auditors by technology specific subsidies.

The mandatory audits are typically linked with a frequency which imposes big pressure on the auditing companies to provide high number of audits every 4 years at a given date and then this number drops to almost nothing. By flattening the demand for regulatory audits, the quality of the audits should improve and the capacity to turn the recommendations into projects should also be increased. This conversion of recommendation into project should be improved by ensuring that the audit reports have to be acknowledged by members of the board of directors of the audited company.

Results of the mandatory energy audits in Italy have been scrutinised by ENEA and the results are presented in the case study below[143]:

Case Study: ENEA – ITALY -
Assessment of Energy Audits completed in 2019

Background: Pursuant to Art. 8 of the Energy Efficiency Directive, 11,172 energy audits were submitted by 6,434 companies to ENEA, the Italian National Agency for Energy Efficiency.

Results: A breakdown by sector shows that the sectors most represented are manufacturing activities (sector C, 5,916 audits) and that of wholesale and

[140] Initiative Energieeffizienz- und Klimaschutz-Netzwerke
[141] IREES/adelphi (2017). Analyse der Entwicklung des Marktes und Zielerreichungskontrolle für gesetzlich verpflichtende Energieaudits.
[142] In France the auditors for regulatory audits have to be certified for specific sectors (buildings, industry, transport and residential) and the ADEME provides specifications for energy audits which are updated to reflect the previously observed discrepancies.
[143] ENEA – 9° Rapporto Annuale Efficienza Energetica - https://www.efficienzaenergetica.enea.it/pubblicazioni/raee-rapporto-annuale-sull-efficienza-energetica/rapporto-annuale-sull-efficienza-energetica-2021.html

retail trade (sector G, 1,561 audits): the audits of the 2 sectors alone represent approximately 67% of all audits received in December 2019.

Data from ENEA is presented in Appendix E.

Actions carried out made it possible to achieve a saving of 750 ktoe/ year (8 727GWh/y). The identified actions, if carried out, would be associated with a total saving of 3.7 Mtoe / year (43 446GWh/y), divided into different types: electrical (29% of the total), thermal (7%), fuel (30%) savings, and other savings (34%). The implementation of the actions identified with a payback time of up to 3 years (13,001 actions) would imply the achievement of 42% of the total annual savings (1.6 Mtoe / year) against a total investment of approximately 1 billion euro (13 % of total investments). Carrying out the actions identified with a payback time of up to 5 years (7,647 additional actions) would reach almost 60% of the total savings compared to an investment of 3.4 billion EUR (44% of the total).

At the sectoral level, approximately 7,300 actions were identified in the manufacturing sector, for a saving of approximately 0.7 Mtoe / year (7 910 GWh/y), against approximately 580 mil-lion EUR of investments.

More than 68% of EE projects implemented, representing more than 55 % of EE opportunities (in term of number of projects) that are still to be implemented are in 4 solutions types:

- Lighting,
- Production lines
- Behavioural change (monitoring, organisation, training and ISO 50001) and
- Compressed air.

Where mandatory audits (and specific audit requirements) can be imposed on larger companies they can carry the cost, but it more problematic for smaller entities to grasp the benefit upfront of energy audits for potentially limited savings. Different regional approaches have been designed to provide cost efficient audits with high quality standards to smaller companies (e.g. 50% subsidy of qualified audits with reporting of EE opportunities on a national data base, simplified audits with pre-qualification of auditors[144]). It is recommended to have a minimum energy consumption for the eligible SMEs, as for small consumers the audit cost can outweigh the energy saving potential[145].

Although mandatory audits can be a useful tool they all too often are not turned into action i.e. investment into the identified measures. Promotion of audits should be linked to and supported by programmes to increase the levels of

[144] Bpifrance – Diag Eco Flux
[145] IREES/adelphi (2017). Analyse der Entwicklung des Marktes und Zielerreichungskontrolle für gesetzlich verpflichtende Energieaudits.

implementation of identified measures. Conditional funding upon delivered outcomes (like ESCO funding requires) is recommended.

Fiscal benefits

Fiscal benefits connected with financial instruments for energy efficiency solutions, include the possibility to "over-amortise" or to change the treatment of an EnPC in accounting rules (e.g. change IFRS accounting rules to be similar to EURTAT) and have been identified as drivers to convert opportunities into projects, but further work is required given the experience outlined in Malta.

Case Study: Energy Savings Insurance (ESI)

Decision-makers perceive a high risk when investing in energy efficiency solutions in the industry, as the CAPEX is higher than that of a conventional solution and the returns depend on the OPEX. The decision-maker has to be sure that sufficient energy savings will be generated in the future to recover the investment, otherwise they will not invest in an EE solution where the risk-return ratio does not compete with other potential investment opportunity. The Energy Savings Insurance model provides different mechanisms that guarantee the customer (with a special focus on SMEs) that they will receive the energy savings initially projected that will pay back the initial investment.

The ESI model includes financial and non-financial elements that work together to build trust and credibility among key stakeholders, and to reduce the risk of the EE investment, which includes four main elements:

a) A Guaranteed Savings Contract between the customer (Enterprise) and an EE technology contractor: The contract sets out the contractor's commitments to deliver the energy efficiency and the responsibilities of both parties. In the event that savings are not achieved, the contractor remunerates the customer for the savings not achieved.

b) Insurance: A local insurance company offers a policy insurance to cover the risk of the technology contractor failing to meet its contractual energy savings obligations. The insurance builds trust between the SME and the technology provider, and facilitates access to credit for the SME. The risk mitigation product used is the performance surety bond which is an existing instrument that is common in the construction sector to protect against potential failures to deliverer and future damages of a project.

c) Validation: An independent technical validation entity (SGS in Europe) acts as arbitrator in case of disagreement between the client and the contractor. This role is defined in the contract. The validation entity is essential to provide trust to the insurance company, as they become technical validators in case there is a claim from the customer, and also they help to resolve any disputes between the customer and the contractor in relation to the energy savings achieved.

Case Study: Energy Savings Insurance (ESI)

d) Financing: Existing loans are linked to the programme. Financial intermediaries benefit from the ESI mechanism because it reduces the credit risk of their borrower, as future cash flows are guaranteed.

Energy Savings Insurance

The ESI model has been successfully implemented in Latin America, by BASE, and is currently being developed in Spain, Portugal and Italy, where insurance companies such as CESCE, Crédito y Caución, ABARCA, Ageas, Atradius and Reale Mutua provide the energy savings risk coverage. The cost of the insurance is around 1-2% of the project value, and the customer is covered for the committed annual energy savings for a period of up to 5 years. The contractor undertakes the monitoring, maintenance and annual reporting for the client, who must approve them. The validation entity is asked to perform an initial valuation of the project, which provides a technical opinion. The ESI model will be scaled up to Greece, Croatia and Slovakia in the following years but further support is required to raise awareness and build capacity.

Carbon Pricing Mechanism

By putting their own Internal Carbon Price (ICP) on their CO2 emissions, companies can create alignment and shared values for climate protection, evaluate investments, manage risk, design strategy, and communicate their ecological commitment also externally even when they are currently not exposed to external carbon-pricing or carbon-related regulations[146].

An ICP can be a theoretical price or a "shadow price" used only in internal economic and strategic analysis but may even be levied as an actual fee on business units within a company. It can be attached to the production of physical goods, or to the whole value chain of produced goods and services and all other activities of a company. Internal carbon pricing will bring decisions about capital investments to a carbon-related level playing field, even if such projects do not directly affect emissions, energy efficiency, or changes in the portfolio of energy sources. Internal carbon pricing can also be implemented by SMEs and is a powerful tool for leadership and cultural change, which has to be promoted by the top management. At the same time, it is a strong strategy for prioritizing internal funding of energy efficiency investments.

Internal funds for energy efficiency investments: Internal carbon pricing can also be the basis for establishing internal funds allocated for internal energy efficiency investments. The fees collected go into a central fund and are used to

[146] Aldy, J.E., Gianfrate, G. (2019). Future-Proof Your Climate Strategy. Harvard Business Review. Retrieved from: https://hbr.org/2019/05/future-proof-your-climate-strategy. Carbon pricing in companies is also promoted by the UN Global Compact – see: https://www.unglobalcompact.org/take-action/action/carbon.

finance investments that enable the company to reduce emissions and be net carbon neutral, like in the case of Microsoft[147].

In the case of the "Adidas Group Venture Capital Energy Fund" Adidas is investing directly into an internal venture capital fund that provides financing, expertise, project management, and monitoring and verification to facilitate investments in energy efficiency and renewable energy projects while delivering a net profit.[148] This fund is able to overcome internal competition for capital, short payback horizons, and a lack of time or budget on the part of facility managers. It is framing energy efficiency and renewable energy projects as profitable investments for the company targeting a rate of return above that of the core business. The Fund has a flexible 'portfolio approach" and can bundle more strategic long-term energy projects together with those with quick returns. Projects are also evaluated according to their CO2 abatement cost.

The Fund's corporate energy team audits facilities and shares best practices to accelerate investments like lighting and HVAC upgrades, building automation and on-site renewables. Finally, the Fund monitors and verifies energy and cost savings and shares the results across the company.

Internal funds dedicated to energy efficiency can be established in very different ways and structured for a wide range of energy efficiency investment strategies. When they are organized as separate and financially independent entities, they can overcome internal organizational and financial hurdles and promote cultural change. They are suitable primarily for large companies and can also be established in public organizations. Also, SMEs are able to create similar organisational structures.

3.3 Summary of key barriers and drivers of EE investment by industrial segments

This section illustrates the key barriers and the drivers of energy efficiency investments for industry (large companies and SMEs). These findings are based on the results of the 2020 EEFIG member survey and are complemented with inputs from industry experts and relevant publications.

3.3.1 Focus on industry size segments

Most of the instruments, drivers and barriers are common to all the sizes of the industrial companies with obvious variations linked to the benefits depending on size of projects but mainly the energy intensity of the company.

[147] DiCaprio, T. (2013). The Microsoft carbon fee: theory & practice. Microsoft Corporation. Retrieved from: https://download.microsoft.com/documents/en-us/csr/environment/microsoft_carbon_fee_guide.pdf.
[148] Adidas Group - Venture Capital Energy Fund. Retrieved from: https://rilastagemedia.blob.core.windows.net/rila-web/rila.web/media/media/pdfs/sustainability/adidas-im-greenenergy-fund.pdf.

Large companies (both energy intensive and not) prefer market actions such as Industrial process certification and Project rating systems. These types of 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, according to the EEFIG Report on Energy Intensive Industries[149]. Long term stability of regulatory frameworks are another prerequisite to facilitate investments.

Mid-cap companies prefer access to EU funds (ERDF, LIFE, H2020, etc.) and linkage with national industrial strategies and to the increased use of targeted fiscal (or grant) instruments.

SMEs, on the other hand, identified a strong need for Public Technical Assistance and Project Development Assistance. This technical assistance can come from standardising eligible energy efficiency projects (See section on Energy Saving Schemes above) or by providing resources to help SMEs implement an energy management system. The Speedier[150] project is a good example of energy audits and to implement the recommended solution, through SME mPower[151] project.

3.3.2 Barriers to Energy efficiency investments in industry in Europe

Research[152] identifies the origin of the energy efficiency gap as market failures and barriers. Market barriers are heterogeneous and influence all market players. Even though the barriers to demand might influence energy intensive industry, SMEs and the other industrial companies differently, they seem to be common in the three subsectors studied.

External barriers to EE finance in the industry can be categorized into ten categories

Low and distorted energy prices and the effects of the health crisis are all market barriers to industrial energy efficiency investments. In 2020, there was a widespread recessionary environment in which Europe registered double digit percentage declines in capital spending and in energy efficiency investments[153]. In light of available studies[154], competitive prices of fossil fuels are caused by the combination to fossil fuel subsidies, which in the EU amounted to an estimated EUR 50 billion in 2018[155], and substitutes not being competitive

[149] EEFIG WG on Energy Efficiency in Industry - Interim Report (not published)
[150] https://speedierproject.eu -
[151] https://smempower.com
[152] Zuoza, A. & Pilinkienė, V.(2018). Barriers of industrial energy efficiency. Cyseni 2018, Kaunas, Lithuania. Retrieved from:https://www.researchgate.net/publication/330359518_Barriers_of_industrial_energy_efficiency
[153] IEA (2020). World Energy Investment 2020 – Investment estimates for 2020 continue to point to a record slump in spending.
[154] IEA (2020). Energy Prices 2020.
[155] European Commission (2020). 2020 Report on the State of the Energy Union pursuant to Regulation (EU) 2018/1999 on Governance of the Energy Union and Climate Action. Retrieved from:

enough yet. This situation can be improved through subsidy phase-out and improved carbon pricing. According to the IEA, in 2019 gasoline and diesel prices decreased both globally and on a country level following the 10% lowering of the crude oil marked price[156].

Government policies

Government policies, programmes, and practices affect business decisions regarding investments and operation of energy-intensive technologies, as do distortions in fiscal policies including subsidies and taxes. The current industrial policy framework does not adequately provide long-term signals for industry to prioritise investments in energy efficiency. As an example, the EED has weak impact as long as it does not require recommendations from mandatory audits to be implemented.

Fiscal policy

The lack of a generalised (EU wide) fiscal framework to facilitate an off-balance sheet investment possibility for compliant energy efficiency solutions is key as EPC and ESAs offered by ESCOs remain as assets and liabilities remain on the balance sheets of industrial customers.

Technology and service suppliers

Suppliers and especially service suppliers are not always interested in sharing best experience related to energy efficiency investments with their customers. Suppliers may get higher incomes if their clients use out-of-date energy efficiency technologies. If technology and service suppliers are not paying enough attention to the education of their staff, then they also will not share best practice with customers or may lack the communication skills to do so.

Designers and manufacturers

High initial costs reflect high research and development investments required for new energy efficiency technologies. In some cases, energy-efficiency technologies are hard to adopt, or adoption budgets are inadequate.

Energy suppliers

Distortion of energy prices for large energy users is a serious issue. Energy savings values may be insufficient stimulus for the installation of the new technologies.

Capital suppliers

https://ec.europa.eu/energy/sites/ener/files/progress_on_energy_subsidies_in_particular_for_fossil_fuels.pdf

[156] In China, the Government regulates the energy market and, in the EU, European consumers pay high taxes on fuels. According to IEA Prices 2020, May 2020.

Capital suppliers face two main barriers: Firstly, the upfront cost for investing third party capital and, secondly, the difficulty in identifying the quality and performance of the investments.

Internal barriers can be divided into

Economic

Hidden costs are often used to explain an energy efficiency investment gap: Hein and Blok reported that the hidden costs in the sizeable energy-intensive enterprise were between 3% and 8% of the total investment cost. In smaller enterprises, such cost should be even higher[157].

Behavioural

Investments in energy efficiency are not considered as core to industrial activity, and compete with other investment opportunities that have better understood risks and returns for business decision-makers, or are more strategic and part of the core business activity. Investments are regularly directed to renew core industrial processes, limiting the scope for energy efficiency investments.

Organisational and competence of staff

A significant hurdle to overcome for successful implementation of EE projects comes from a lack of agreement between different organisational departments regarding the mid to long-term energy strategy. A clear energy strategy needs to be developed and key stakeholders should share an understanding of the energy consumption of their company and the ramifications of implementing new energy efficiency technologies. Limited knowledge of EE solutions gives a high-risk perception to EE investments, due to the lack of standardised EE technology specification and imperfect evaluation criteria of an EE project's risks and benefits.

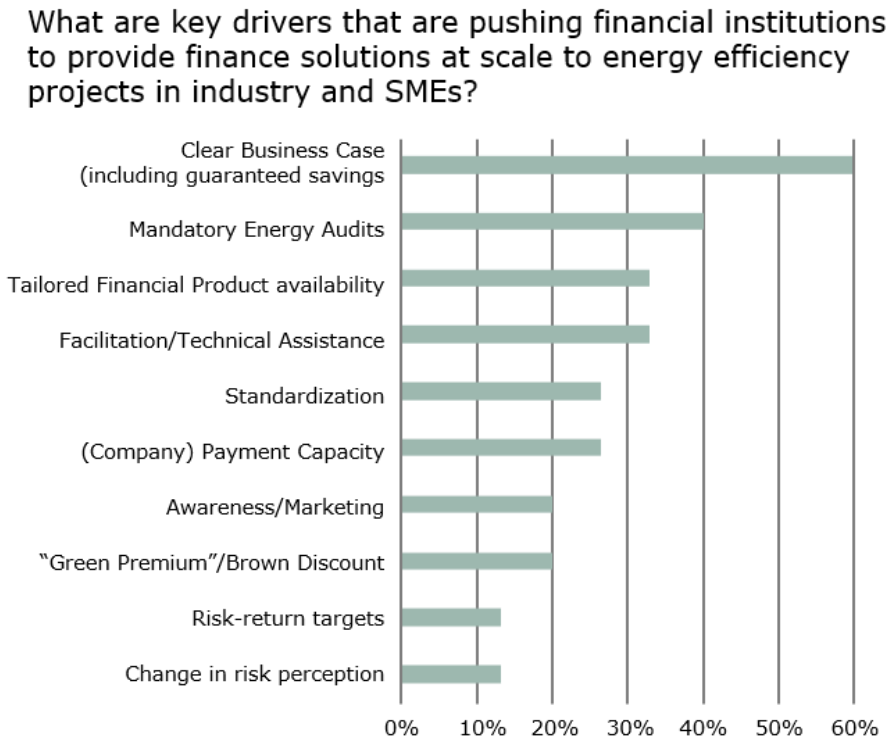
3.3.3 Connecting the Key Drivers with Specific Approaches

EEFIG members discussed and revised the markets and policy-led approaches and the instruments identified in the 2015 report. This updated analysis provides elements for the stimulation of energy efficiency investments in industry & SMEs.

In 2015, an EEFIG survey was conducted that identified the most important drivers affecting the supply of finance for energy efficiency investments in industry. In this 2021 report, the EEFIG working group was again surveyed and Figure 3-4 shows the drivers selected by the respondents.

[157] L. G. Hein and K. Blok (1995), "Transaction costs of energy efficiency improvement," in The energy efficiency challenge for Europe. ECEEE summer study.

Figure 3-4 EEFIG ranking of key drivers of supply of corporate energy efficiency investments in industry and SMEs



With 60% of votes, the most important driver appear to be a clear business case, followed by mandatory energy audits (40%) and tailored financial product availability and facilitation / technical assistance (35%).

The survey identified twenty drivers, and these are the most relevant six:

- Providing clear technical background to EE project. Three main drivers for financing EE projects in industry are linked to the alleviation of the technical complexity surrounding energy efficiency projects with the development of clear business cases including the expected energy efficiency benefits (technical development diligence of EE projects) and the mandatory energy audit which familiarize the decision makers to EE projects and which can only be undertaken by certified professionals. These drivers can reduce the need for financial institutions to have the internal resources to undertake technical assessment of projects and their benefits; namely in term of calculation of the Net Present Value (NPV) and Return On Investment (ROI) of these projects and to qualify the yearly savings generated from the project which could be considered in the reimbursement capacity of the beneficiary of a credit (if the financial institution has confidence in the technical due diligence undertaken). The provision of technical assistance can support the first two items and provides further reassurance for financial institutions and beneficiaries to take the right decisions and prioritise the most relevant projects. Country specific quality standards and norms have been issued to assist in energy audits and developing EE project business cases which help to deliver reliable technical due diligence of potential investments.

- Tailored EE Financial products are increasingly available and are now often proposed to manufacturing companies. Even though the difficulty of gathering enough data to design those products has been pointed out by the financial institution, it seems that there is increasing investor appetite for green products. This development helps gain awareness and capacity building within financial institutions which in turn drives more of their financing towards green projects and then of course towards EE. Furthermore, these tailored solutions provide the opportunity to structure enhanced financing solutions with existing clients. Key client account managers within financial institutions value the enhanced scope of financing they can offer to their clients on the basis of energy efficiency measures.

- Payment Capacity. Finally, facilitation of the capacity of payment of the company has been also highlighted as one of the key drivers to invest in energy efficiency project.

- Standardisation. The EU Taxonomy regulation and the standardisation it brings will make it simpler for financial institutions to develop specialised EE financing products. Increased sustainability and disclosure are also needed to maintain access to funding from an investor base that increasingly focuses on climate and green impact. The increasing importance of this aspect is confirmed by the survey results, where "standardisation" appears in the top five most important drivers of supply for EE investments. Dedicated use of proceeds can help, as has already been demonstrated by IFI-funded credit lines to private banks. As investor expectations around green solutions has Increased, the taxonomy will allow sound disclosure of climate and green impact of projects.

In supply drivers, the results differ considerably from the same survey results in 2015. Regulatory stability, which was considered the top driver for the supply of corporate energy efficiency investments, received only 13% of the votes in 2020. This could be a sign that the successful roll-out of energy efficiency legislation in the EU member states makes regulatory stability a given condition, rather than a driver for further investment opportunities. Another element which has reduced in importance is the need of financial institutions to have expert services to enhance their ability to tap into opportunities created by the green economy transition. This is reduced by clear technical background on EE projects and will be further reduced by the standardisation brought by the taxonomy.

3.4 EEFIG's Conclusions on financing industrial energy efficiency

Company size needs to be taken into consideration when designing energy efficiency financing instruments. Small and medium-sized enterprises face significant difficulties in accessing any form of competitive financing, regardless of the type of investment envisaged – and so there will always be a prioritisation problem unless energy efficiency instruments are designed with this in mind.

Financial incentives for energy efficiency investments need to be well aligned with post-Covid recovery priorities and in line with the objectives set out as part of the Paris Agreement, and financial support for post Covid recovery should integrate the energy efficiency first principle (Article 3 of draft recast Energy Efficiency Directive) and the objectives of the Paris agreement.

CO2 market pricing does stimulate energy efficiency investments in EU emissions traded systems covered companies. Most industries in the EU are currently directly or indirectly exposed to the carbon market. The recent surge in the carbon price has already pushed many industries into re-evaluating their energy use and look into energy efficiency savings potential.

To ensure that the industrial sector can up-scale finance for energy efficiency EEFIG offers six recommendations:

1 Regulatory and fiscal support for contracting forms and specialist finance providers, e.g. energy service companies and special purpose vehicles for energy efficiency

Providing the appropriate regulation, the fiscal rules, the energy efficiency assessment frameworks and guarantee systems of energy efficiency projects will facilitate acceptance of energy efficiency projects finance and enable the elaboration of contractual arrangements around Energy Performance Contracts. Financial institutions will benefit from a solid framework to provide finance direct to the energy service companies and can develop Energy Savings Insurance, which could enable ownership of the equipment concerned by the Energy Performance Contracts.

2 The industrial sector needs to use results of energy audits to manage their energy consumption

Measuring and managing energy consumption is increasingly mandatory for industrial sites and this provides the foundations to invest in energy efficiency solutions. An appropriate framework is required to ensure that energy management systems and energy monitoring are implemented well in all European industries. This can be achieved through mandatory implementation of energy management systems, energy monitoring with obligatory energy saving targets, and specific attention to adapting the set of rules to the size of the company. The industrial framework will need to:

- Require energy intensive non-emissions traded systems enterprises to conduct energy audits;
- Require recommendations in energy audits for emissions traded systems covered companies with less than three years (potentially increasing over time) of payback time to be implemented;
- Ensure more enterprises commit to energy management systems through voluntary agreements (with incentives when relevant); and
- Require mandatory reporting of data to national authority (as Portugal has).

3 Standardisation and disclosure requirements

By establishing national Energy Saving Schemes (Energy Suppliers Obligation Scheme, Energy Saving Targets for Large Energy Intensive Companies), a standardisation of eligible energy efficiency solutions and energy saving measurement procedures are created. The standardisation of energy efficiency solutions offers a base to structure finance around the energy savings expected and the fact that energy efficiency projects are audited (to allow the creation of energy saving certificates) provides a solid base for financial institutions to propose dedicated project financing instruments.

Standardisation and disclosure requirements for financial institutions are helping to stimulate corporate energy efficiency investments. The EU Taxonomy will streamline the development of energy efficiency financing products, making it easier to define green investments, while disclosure requirements create more incentives to channel financing to sustainable investments.

4 Energy efficiency dedicated financing instrument provide financial institutions with a great commercial opportunity.

Whether it is to improve the financial institution's ESG rating or to de-risk their portfolio from future carbon pricing or increasing energy prices, financial institutions should have a range of financing instruments dedicated to energy efficiency. Dedicated teams in financial institutions, allow energy efficiency investments to be considered a relatively low-risk investment, and would encourage new finance projects for existing and new clients. A few financial institutions already consider the benefits of energy efficiency projects in their risk assessments and provide their clients with dedicated energy efficiency finance.

5 Improve overall knowledge around energy efficiency

Lack of knowledge and awareness (in industry as well as within financial institutions) of the general energy market, of the industrial energy consumption characteristics and of energy efficiency solutions have to be addressed. This will reduce the high-risk perception and enable bold energy efficiency strategies to be developed (by non-energy efficiency experts) that can be financed. This is also likely to be a key factor in the competitiveness of European manufacturing in the coming decades. Significant resources should be dedicated to support or develop knowledge sharing structures, providing networking opportunities, toolkits, solution benchmarking, standardised energy efficiency solutions, ISO 50001 consulting and other climate corporate governance instruments. energy efficiency investment considerations should be embedded into the core business strategy and processes, and clear incentives must exist within companies to assess how EE savings can improve the competitiveness of their business in the long-term.

6 Improve research in energy efficiency investment in the Industry in Europe

There is a lack of comprehensive and consistent data reflecting industrial energy efficiency investments in the EU. A better coordination of national energy efficiency bodies should be established, and translation should be available for all EU energy efficiency agency report of importance to the other countries to identify best practices.

4 Common Themes and EEFIG'S Recommendations to the EU Commission

4 Common Themes and EEFIG'S Recommendations to the EU Commission

4.1 Imminent challenges to overcome

Since the EEFIG's landmark report was published in 2015, the EU has significantly tightened its climate and energy objectives[158]. It has adopted much more ambitious climate and energy targets for 2030 and intends to reach net-zero emissions by 2050. These new targets and the European Green Deal launched a legislation package, "Fit for 55", that aims to provide the policy framework to deliver 2030 targets and the EU Climate Law in 2021. These include a revision of the EPBD, the EED, and other key climate-related legislation[159].

There will be some uncertainty around the national European energy efficiency related legislation, until the "Fit for 55" package is agreed and transposed at Member State level. However, some Member States have already tightened their energy efficiency policies, in anticipation, also now face pressure to do so from the courts. A leading example is that offices in the Netherlands already have to have a minimum energy performance certificate rating of C by 2023, and homes with an EPC of G or less cannot be rented from 2023 in France. This strongly influences the way in which financial institutions think and hence finance will dry up for those non-performing assets ahead of such deadlines.

A strong boost for energy efficiency investments is coming from the EU Recovery and Resilience Facility that was approved by the EU council on October 9th 2020[160]. Member State recovery and resilience plans need to include a minimum of 30% of expenditure related to climate, broadly in line with the criteria stated

[158] EIB (2019). Energy Lending Policy 2019
[159] European Commission, Communication on the European Green Deal, COM(2019)640; European Commission, Stepping up Europe's 2030 climate ambition - Investing in a climate-neutral future for the benefit of our people, COM(2020)562; and EP Legislative Observatory, Procedure file on Framework for achieving climate neutrality, 2020/0036(COD)
[160] European Commission (2020). Questions and answers: Commission presents next steps for EUR672.5 billion Recovery and Resilience Facility in 2021 Annual Sustainable Growth Strategy. Retrieved from: https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_1659

in the EU Taxonomy regulation[161]. New regulation[162] and pressure by investors and financiers on large listed companies are other strong drivers promoting investments in clean technologies, including energy efficiency, and preventing harmful fossil fuel investments.

Signatories of the Principles for Responsible Investment (PRI) are developing case studies on their portfolio alignment with the EU Taxonomy[163]. Lenders and investors are documented as having a limited capacity to properly assess and monitor energy efficiency projects and screen them against the EU Taxonomy's technical criteria. The reports also note a lack of criteria for those sectors not yet covered in delegated acts, or for the four remaining non-climate environmental components where details are expected by the end of 2021.

These policy developments will contribute to an increase of energy efficiency investment and should make them more attractive. According to EU and EIB analysis, investment in energy efficiency in buildings and industry needs to increase to over two to three times the current level[164] to achieve the EU targets. Many think these multiples are even higher.

At this stage, key trends can be summarised as follows:

- The energy efficiency of new buildings will increase, as Nearly Zero Energy buildings (eligible under the taxonomy) are mandatory for all buildings built from 2021.

- EEFIG members are concerned about the expansion of investment in energy efficiency renovations of existing buildings[165]. The objective to at least double the level of building renovations (from 1% to 2%) of the "Renovation wave"[166] published in October 2020, seems challenging. Its achievement will depend on the capacity of Member States to implement ambitious renovation plans, the skills of hundreds of thousands of renovation operators, the demand from the household segment and the availability of finance to support these investments.

[161] Ibid.
[162] See European Commission COM (2018) 97 final, Action Plan: Financing Sustainable Growth (link)
[163] PRI Website. EU Taxonomy alignment case studies. Retrieved from: https://www.unpri.org/policy/eu-sustainable-finance-taxonomy/eu-taxonomy-alignment-case-studies
[164] EIB (2019). Energy Lending Policy 2019
[165] European Parliament – DG Internal Policies (2016). Boosting Building Renovation: What Potential and Value for Europe? - "They (recent surveys) conclude that the 3% per year figure included in a 2012 EC consultation on finance for energy efficiency in buildings20 is over optimistic. The range that emerges from the literature they review21 is 0.5% to 2.5% a year, with the rate varying as a result of time limited renovation programmes and other factors, with a typical figure being 1% (about 250 million m2) per year.
[166] European Commission (2020). Renovation wave. Retrieved from: https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en

- EEFIG members remain uncertain whether energy efficiency investments in industry will increase significantly. In recent years the investment amount has remained unchanged and its increase will depend on measures adopted by Member States in development of the revised Energy Efficiency Directive in 2021, in particular mandatory measures around the implementation of measures recommended in mandatory energy audits.

- In respect of energy savings in transport, investments in electric and hybrid vehicles and the necessary infrastructure to connect those vehicles will significantly increase[167]. The 50gCO2/km threshold set in the EU Taxonomy for 2025 and 0 gCO2/km for later years is a strong push to decarbonise transport and will boost EVs, and alternative fuels such as hydrogen in the next five years.

Significantly increasing energy efficiency investment depends on the capacity of national governments implementing large energy efficiency investment programmes, as have only been undertaken by a few of the leading EU countries.

4.1.1 Imminent challenge to overcome: Driving demand

Most of the energy efficiency investments reported by the IEA and other sources relate to investment components within packages that have other purposes, such as when buying a more energy efficient car or buying an energy efficient house. IEA estimates of energy efficiency investments rely on the difference between the investment cost of a baseline piece of equipment and the investment cost of a more efficient one.

There are well-established ways to finance many of these investments, such a mortgage in the case of a new house or a company loan. In other cases, energy efficiency investments are small; thus, reducing the need for external finance. This is often the case for an investment in the energy efficiency renovation of private residential buildings, which are generally small and self-financed in the EU (over 80%[168]) or partially or totally financed with grants in the case of low-income families.

This situation has created some frustration among financiers that would like to develop business lines to finance energy efficiency investments, as they discover few projects to be financed, as evidenced by several EEFIG members.

EU policies can significantly contribute to increasing the level of energy efficiency investment, once they are implemented at the national level. These policies will increase investments in low carbon solutions and installations, such as insulation, the developing of low-carbon heat solutions (like heat pumps,

[167] IEA (2020). World Energy Investment 2020 – Energy use and efficiency. Retrieved from: https://www.iea.org/reports/world-energy-investment-2020/energy-end-use-and-efficiency#overview-of-energy-efficiency-investment-trends
[168] European Parliament – DG Internal Policies (2016). Boosting Building Renovation: What Potential and Value for Europe?

biomass or solar heating) and decentralised electricity production, notably PV. All these investments are more capital intensive than the fossil fuel alternatives replaced and thus will increase the capital investment required, often by two to three times (e.g. heat pump versus a gas boiler), but then the fuel costs are lower. This form of life-time improved economic performance is often hard to explain to retail customers.

EEFIG surveys in 2020 confirm the conclusions of the 2015 report, and that the key issue remains driving energy efficiency demand. EEFIG sees developing energy efficiency investments as being a key responsibility of policymakers; while removing the barriers to access to finance is the prime responsibility of financial institutions. Many of the EEFIG's 2015 recommendations were related to developing the demand for finance energy efficiency investments and they are still relevant today.

As noted by B. Broadman[169] **"the market rarely delivers energy efficiency improvements spontaneously, as there is no market push. Consumers are not providing a pull towards energy efficiency, usually because they are ignorant of (or indifferent to) the range on the market or the implications of their purchase".**

This comment, which refers to energy efficiency in housing, is also applicable to non-residential buildings and industries, except for the energy intensive industries. As a result, companies and buildings owners tend to invest in just the energy efficiency measures with short-term paybacks (less than 3 years, the so-called "low hanging fruit") instead of implementing a holistic or a programme of measures, such deep building renovations.

Buildings

The issue for buildings is improving the energy efficiency in existing buildings, as new buildings must be constructed with nearly zero energy needs from 2021. According to the EEFIG 2020 survey, the actions concerning regulation standards and access to public funds (grants, EU financing, etc.) remain a top priority.

For buildings the actions recommended include improving building certification and establishing minimum energy performance standards for existing buildings, developing the institutional capacity to implement national long-term building renovation strategies at scale, and the availability of public technical and project development assistance. Finally, greater facilitation of EU funds (ERDF, LIFE, H2020, etc) in support of energy efficiency within national strategies remains important.

A BPIE study of the quality of building certificates in 2014[170], identifies significant weaknesses of the certificates in some countries. However, recent national initiatives aim at significantly improving energy performance certificates

[169] Boardman, B. (2004). New directions for household energy efficiency: evidence from the UK. Energy Policy, Vol. 32, Issue 17, p.1.
[170] BPIE (2014). Energy Performance Certificates across the EU

for buildings. These certificates, their quality and availability, continue to play an important role in investments and policies aimed at improving energy efficiency.

Few countries have established mandatory minimum energy performance standards for existing buildings and often energy efficiency standards are not very demanding. As for Energy Performance Certificates, recent policies propose tightening these standards for commercial buildings and for rented housing. This is the case in France, the Netherlands and the UK. These minimum energy performance standards have the potential to significantly scale up investment in energy efficiency in buildings. However, Governments are taking a conservative approach in this area to avoid negative reactions by their population and hope to facilitate the financing of the renovations with grants and low-cost financing. This is just a short-term fix as there is insufficient public funding to ensure this delivers the investments required.

The public sector needs to play a genuine exemplary role in improving the energy efficiency of its buildings, as this has often not been the case[171]. Large programmes aiming at improving the energy efficiency in public buildings have been announced, but often only a very few buildings have been renovated. Such programmes, if implemented, have the potential to significantly increase the investment in energy efficiency in the public sector. They would also contribute to developing the ESCO market. ESCOs can also play a significant role in commercial buildings.

Public procurement rules should include operating costs in the calculation of public benefit and thus promote low carbon solutions on a level playing field. Clean and efficient solutions are often more capital intensive but have lower operating costs. There are interesting initiatives in this area, such as the PRO-energy efficiency initiative[172], but they should be more widely adopted.

Public technical assistance (TA) and project development assistance (PDA) is critical to drive demand. In this respect, the EU facilities ELENA, EUCF and the H2020 PDA, have been successful in mobilizing investment in energy efficiency, notably in public infrastructures, public and private buildings. There are many initiatives in the EU offering energy efficiency advice, notably for the renovation of private residential buildings. This is a relatively new area and we do not know at this stage which initiatives will prevail in the long run.

Improving the use of EU funds supporting energy efficiency is highlighted. Two reports of the Court of Auditors point out some significant weaknesses in the use of structural funds for energy efficiency in residential and public buildings[173]. Among others, these weaknesses relate to project selection where it is reported that the funded investments are not focused on achieving the greatest potential energy savings for the budget invested. Further, operational programmes

[171] EURAI WGEA (2018). Energy Efficiency of Public Sector Buildings. Retrieved from: http://www.EURaiop.org/docs/upload/documents/Riigikontroll_aruanne_veeb_1548765711.pdf
[172] See also Guidelines published by the JRC
[173] See EU court of auditors reports on energy efficiency in residential buildings (2020) and public buildings (2012)

financing energy efficiency investments in buildings do generally not sufficiently quantify their potential energy savings and corresponding investment needs.

The accounting treatment of Energy Performance contracts for the public sector was recommended to be changed urgently in the EEFIG 2015 report, in order to unblock significant investment in public buildings, especially in public entities with debt ceilings. This issue was addressed and in 2017 EUROSTAT[174] prepared a note that clarified the approach and conditions, in order that these investments do not count as public debt. Many public authorities remain unaware of these changes and further promotion of the EUROSTAT guidelines in Member States with local authorities and the organisations which serve them is recommended.

Industry

For industry and SMEs, the main recommendations to scale up demand for energy efficiency are surprisingly similar to those for buildings, and EEFIG prioritises the following:

- Increased public technical and project development assistance;
- Facilitate financial innovations, such as ESCO-driven performance-based payment contracts;
- Implement industrial process certification/ Mandatory energy management systems (ISO 50001);
- Improve the use of EU funds (ERDF, LIFE, H2020, etc) and link them with national industrial strategies;
- Increase the use of targeted fiscal (or grant) instruments (e.g. Accelerated depreciation schedules for energy efficiency equipment);
- Establish Energy Saving Schemes (Energy Suppliers Obligation Scheme, Large Energy Intensive Companies, EU ETS);
- Regulatory frameworks must support and promote corporate energy efficiency programmes;
- Improvement of information flows (e.g. Energy efficiency networks);
- Voluntary sectoral and network energy savings targets propagated through Energy Efficiency Networks;
- Increase corporate institutional capacity to implement energy savings plans;
- Introduce project rating systems (by industrial sector)

The action plan for sustainable finance that promotes investors and financers to take into account ESG criteria in their investment decisions needs to lever the energy efficiency first principle to incentivise the improvement of energy efficiency in industry.

Energy efficiency investments in industry and SMEs require significantly less aggregate investments than for buildings. Considering their total energy consumption and the potential for improvements, there is a substantial untapped potential to improve energy efficiency in SMEs and non-energy

[174] EURtat (2017). Guidance Note: the recording of energy performance contracts in government accounts. Retrieved from: EURtat Guidance Note-EPCs (europa.eu)

intensive industries. More incentives and penalties are required to focus these corporate actors to develop this energy efficiency potential[175].

These corporate energy efficiency investments are often very profitable. However, they are not developed mainly because they use pay back periods that are too short or because these investments have a lower priority in relation to those relating to improved production capacity. Regulatory frameworks that incentivise industries to develop energy efficiency must be put in place[176]. Provision of technical assistance through sector approaches and EENs was also considered very important, especially to reach SMEs.

Information flows in industry should also be improved to facilitate financing of energy efficiency investments[177], as well as further develop the accounting treatment of EPC for the private sector in line with EUROstat guidance[178].

Large corporations usually have the financial capacity to implement energy efficiency investments and they will do it if they are incentivised. The situation is different for SMEs, which have a more limited capacity to finance energy efficiency investments, as well as a lower capacity to identify and implement them. ESCOs can support the development of energy efficiency investment in industry, and SMEs, by providing advice and finance. However, sometimes corporates, particularly SMEs, do not have the technical capacity in-house even to engage with ESCOs nor understand the relative complexity of an ESCO contract.

The integration of ESG criteria by companies will support them to put in place an action plan to reduce GHG emissions. This action plan should include many investments in energy efficiency. Pressure by investors and financers will also push them to reduce their GHG emission and energy footprints. SMEs will also face similar drivers as for large companies, but with a certain delay and once the ESG criteria for SMEs are developed.

4.1.2 Imminent challenges to overcome: Facilitate financing energy efficiency investments

Currently, there is a stronger supply of funds to invest in sustainable projects, including energy efficiency, than the supply of projects to be financed.

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[175] In some countries there are energy management obligations or obligations to carry out energy audits (see for France B.Ballot-Minguet and others, Industrie et grande distribution: sociologie de l'éfficacité énergétique. Revue de l'Energie Sept/Oct 2019). A recent incentive with growing importance is the pressure to be "green", from regulations (non-financial reporting), shareholders, clients or financers, among others

[176] The EU taxonomy will help here. Also, the QUEST project is ongoing – see: https://cordis.europa.eu/project/id/846739

[177] EREK has some interesting info available https://www.resourceefficient.eu/en. And some sectorial numbers for some sectors.

[178] https://ec.europa.eu/easme/en/news/new-financing-models-energy-efficiency-smes and http://www.energyefficiencynetwork.eu/

Significant financial barriers to the development of energy efficiency investments do exist, and financial institutions can contribute to lowering them. The main barriers, identified in 2015, that remain are: high investment costs (as energy efficiency solutions are more capital intensive than less efficient solutions and often have long pay backs); high transaction costs - as energy efficiency investments are generally small; some energy efficiency projects have poorly known risk characteristics, and some market segments have a difficult access to finance (low incomes or SMEs). In addition, there is often limited availability of reliable information on energy efficiency performance data.

Reducing some barriers requires public action, such as grants or CO2 prices, through an extension of carbon markets, and others can be dealt with mostly by financial institutions.

Investment expansion will drive the engagement of more financial institutions and the parallel development of new and tailored energy efficiency financial products. These financial instruments supporting energy efficiency should reduce cost of finance and have longer tenors similar to the life of the assets to be financed, using grants if necessary. Loans of over 7 years maturity have greater capital requirements for banks and credit enhancement vehicles and structures are welcomed to support liquidity and capital treatment of lifetime aligned energy efficiency loans. The EIB's InvestEU instrument is developing support approached for FIs in this area.

High transaction costs are mainly related to the fact that energy efficiency investments are generally small and often complex to assess. Developing a business line to finance energy efficiency implies having the capacity to identify and evaluate these investments. The financial intermediary needs to confirm that the investment to be financed improves energy efficiency, for instance that they are eligible to the taxonomy, measuring the energy efficiency gains and sometimes confirming that energy efficiency performance expected has been achieved. A significant investment challenge is the capacity of lenders and investors to carry out (or alternatively outsource) these technical tasks.

Therefore, developing the energy efficiency market for a financial institution is costly, due to the small size, heterogeneous nature of energy efficiency investments and immaturity of the market. The creation of an energy efficiency business line and the "technical" evaluation of the projects has significant costs. This makes entry into this business unattractive for many financial institutions.

Within private financial institutions and Banks, there is still a clear issue with the internal organization that limits the capacity to develop the market or increases the costs of energy efficiency funding. This includes the availability of resources, and the need to build capacity among the loan officers and to develop a sale force for energy efficiency products. Evidence points for the need to build appropriate internal processes and procedures, and to adapt the IT processes to enable the process implementation and collection of the relevant data. The provision of technical assistance to Banks and Financial Intermediaries has also proven successful to trigger increased project development (see case studies in previous chapters).

Standardisation of processes is also crucial to facilitate project aggregation and reduce the transaction cost of energy efficiency finance (though good practice is available: EEFIG under-writing tool, SFSB, etc). Standardisation is necessary to develop securitisation for energy efficiency projects. Standardization can cover labelling schemes, project rating methodologies, risk assessment tools, standardised legal and financial structures of assets (loans, guarantees, energy performance contracts etc.). However, it should be acknowledged that standardization is difficult to deliver in energy efficiency and the various national market characteristics can limit the feasibility of this process.

It is important to gradually put in place an integrated framework that connects end to end the implementation of climate related actions, built upon technical and performance standards, with accounting, financial, social standards for the purpose of reporting and disclosure obligations under the EU regulation, taking into account the requirements of the taxonomy. This would support policy makers and financial institution to direct and scale up investment towards carbon neutrality.

Financial products: Blending sources of finance and incentives

Apart from innovative instruments, it is necessary to develop financial instruments adapted to the issues of different promoters and projects. These issues are different for each energy efficiency market. The EEFIG identified several cases, in buildings, notably private residential, commercial buildings and public buildings. Within these groups, one can separate, for instance, low incomes, rental buildings from the rest, or large commercial buildings from small ones. The type of instruments needed include those presented below and have been analysed in the previous chapters of this report and detailed examples are provided in the Appendix D.

Credit lines and revolving funds

Several dedicated credit lines have been launched that offer long tenor loans (over 20 or 30 years). A leading example is KfW in Germany, and successful facilities have been established in Lithuania, Estonia and Bulgaria, among others.

Blending sources of finance and incentives

There has been good progresses and success in blending loans with grants and guarantee risk mitigation mechanisms to address the transaction cost, reduce cost of financing and to facilitate financing of certain market segments, such as low incomes, SMEs or for building renovations that achieve high energy efficiency standards. However, state aid rules in the case of industry and the added costs of the multiple requirements of grants and guarantee continue to limit the size and growth of such initiatives. The efficient blending of grants and loans (from both public and private sources) was raised in many of EEFIG's discussions as important to achieve EU energy efficiency targets especially in the more disaggregated sectors such as residential buildings and SMEs.

On-bill and on-tax financing and green mortgages

Several financial instruments were proposed to facilitate the financing of energy efficiency investment in 2015. They concern mainly on-bill and on-tax financing and green mortgages. Progress in this area has been noted and yet these instruments are still in their infancy.

Energy efficiency performance guarantees

Some energy efficiency markets are exposed to energy efficiency risks (such as efficiency gains being less than expected, or costs higher). This is often the case for ESCOs and in general for companies that provide energy efficiency performance guarantees or are exposed to energy efficiency market risks, such as for heat networks. Financing institutions are reluctant to take such risks, as these markets are rather new, and their risks characteristics are not well known. In these situations, cost of finance is high or not available, and it is a barrier to the development of these energy efficiency markets. For certain types of projects, various types of insurance can be available including project performance insurance which mitigates some of the technical performance risks that can lead to projects under-performing financially and leading to losses.

De-risking

Targeted de-risking tools such as credit guarantees can help drive the supply of investment capital for energy efficiency. Credit enhancements can also expand customer access to capital by enabling the financing instrument to offer loans to customers who would not pass the normal credit criteria of private sector lenders.

Difficult access to finance segments

Another financial gap is related to the segments with difficult access to finance that prevent them to finance their energy efficiency investments. This relates mainly to low incomes and small enterprises. Public support might be needed in this case, as these segments have a limited capacity to pay or they cannot increase their indebtedness level. However, for very low incomes, a large or the totality of the investment may need to be financed by grants. In addition, financing condominium can be difficult, notably related to cover the risk that one or several members of the housing association do not pay the loan. EEFIG members noted the existence of condominium accounts and joint renovation sinking funds against which lenders can finance block renovations especially in central and Eastern Europe as useful mechanisms to facilitate joint and cooperative funding solutions.

Energy efficiency funds

In recent years have seen the emergence of energy efficiency funds, yet the size of this market remains marginal. However, these funds can play a significant role in certain markets, as they have a deep knowledge of the energy efficiency risk characteristics.

Multiple dedicated energy efficiency funds have been founded throughout Europe in the past five years. A good portion of them report challenges in deploying their financing after their first raise, and have a focused their investments in low risk and short pay back energy efficiency measures. However, more recently some EE funds are making adjustments to their investment criteria for the second round of raising, and have increased the range of EE sectors targeted (building retrofit, Building Management System improvements, heating as a service, storage. Etc.).

Funds create specialised financial players who know the market well. Though a majority of capital is dedicated to different forms of behind the meter generation, the funds do have specialized staff on hand who are able to support the development of building renovation, and street lighting upgrades. They also create a known source of capital for such projects and this supports the education and development of dedicated service providers.

Secondary market

A significant increase in financing energy efficiency will require the development of a secondary market for this financing, such as refinancing through securitization of energy efficiency financing. This implies developing an approach that allows investors to understand the risks of this assets and usually credit enhancement. Public and private refinancing facilities with this purpose need to be developed.

Capital requirement rules

As the new regulatory capital requirements of Basel III impact EU banks, and Solvency II impacts insurers, the availability of risk capital and balance sheet for all financial institutions is under pressure and impacts energy efficiency financing in all categories. EEFIG participants were concerned that these new regulations do not often take into account environmental risks and many of the long-tail impacts of climate change and the stranded assets that unsustainable and low resilience investing can create.

4.2 Role of financial institutions, national and local governments and other stakeholders

Key stakeholders

The complex, cross-sectoral and cross stakeholder nature of energy efficiency requires promoting multiple and flexible approaches adaptable to local and sectoral needs. These approaches need to cover the whole lifecycle of energy efficiency finance and target specific audiences based on their characteristics and needs. The Table 4-1 below maps key stakeholders and their needs.

As in most energy efficiency markets, we do not yet have financial products that have been developed at scale, the support of public financial institutions to quick start these markets, is needed. These institutions are the EIB, ERBD and national promotional banks. They should support emerging and promising financial instruments in the different energy efficiency markets.

Table 4-1 Stakeholders Needs - based on lessons learned (EIB operations, Elena, EIAH, PF4EE)

	Needs (based on lessons learnt)
EU level & NATIONAL states and regional hubs	› Building renovation programmes › Focus on countries / regions with most potential (JRC Central and EU countries)
Regions/ cities/municipalities	› Establishing project implementation units › Preparation of tender documents and signature of work contracts (legal and tech) › Importance of team stability and skills › Preparation public tenders in line EU and Member State public procurement and market demand; Establish central purchasing body › Evaluation of offers; Preparation and negotiation ESCO/providers contracts › Prepare project design and documentation; Carry Energy audits › Permit request process › Certified Measurement & Verification (M&V) training; Monitoring performance during operation › Increase awareness of EPC in local markets › Dissemination and best practice learning › Continuous capacity building › Development of long-term multi-stakeholder climate plans (e.g. Leuven 2030, Nantes), to show political alignment in the climate action and a stability in these policies (assuring its continuity regardless election cycles) › Establishment of one stop shops for technical advice of citizens
Financial institutions and Banks	› Develop in-house project development unit – in effect › Establish one stop shop support to clients › Technical Assistance to offer Energy audit for clients (SMEs, Residential) › Build capacity loan officers, develop sale-force for energy efficiency products › Standardised EPC contracts
Homeowners Associations (central and eastern Europe) / Social Housing Bodies (public or private depending on Member State)	› Legal structure – capacity of taking on loans on behalf of owners / conditions / insurance › Decision making processes › Technical analysis of energy efficiency measures

	Needs (based on lessons learnt)
	› Request for quotes / Evaluation of offers › Awareness of Building management companies (Syndic / PMs)
Homeowners direct	› One Stop Shops › Green Mortgages › Subsidies and grants
ESCOs	› Develop commercial proposal
SMEs	› Intermediated lending and TA › Bankable project concept & design
Utilities / District Heating Bodies	› One stop shop › Prepare project design and documentation › Utilities obligations – CEE
Insurance	› Required to underwrite credit risk in project cash flows since many individual homeowners and companies, especially SMEs, are not bankable for medium/long term financing required to amortise cost of energy efficiency projects › Government support required for this

EU finance facilities and national promotional banks

These banks have supported blending of loans, guarantees with grants and with technical assistance, these tend to be targeted to sectors with a clear social justification and positive outcomes overall to society, or where the legal structure or economic viability of the projects prevents other types of investments, such as in Social Housing, Municipal buildings, Multi-apartment blocks or targeting worst performing assets.

Public and private financiers need to work together to strengthen their mutual impact on the ground. Numerous initiatives have shown the effectiveness to reduce the transaction costs associated with energy efficiency investments.

Private finance supported by public guarantees or loans is proving an effective channel to target segments where guarantees are necessary to reduce risk, such as low-income homeowners and SMEs. The development and growing uptake of green or energy efficiency mortgage, or the growth of corporate loans to SMEs and ESCO to finance energy efficiency and other climate investments is a good starting point. The growth of independently verified green labels aligned with the EU taxonomy can give these products better visibility in the market.

Overall, these institutions have a significant role to play to scale up energy efficiency financing. They should support the development of new innovative financial solutions. They should contribute to support initiatives in countries where the energy efficiency market is still very immature. They have played in the past this role by developing these types of initiatives and they should continue and expand this role.

National, regional and local entities: providing advice and facilitate access to grants and to finance

TA plays a critical role in developing a project pipeline. The importance of TA and PDA leading to bankable projects is crucial to scaling up energy efficiency investments. As the EIB's ELENA initiative shows, there is no more effective process to allocate public monies, as just one euro of ELENA grants through have delivered 37 EUR worth of energy efficiency and renewables investments. In addition, the European City Facility (EUCF) supports mainly smaller and medium sized cities to develop investment concepts and increase bankability of energy efficiency projects. The EUCF can be an effective tool to support these cities to prepare an ELENA or, for simpler projects, to directly attract private finance.

Emulating the successful EU level initiatives, at national, regional and local level seems necessary. TA and PDA facilities could achieve scale, accessibility and emergence of support mechanism tailored to the specific characteristics of a locality. However, the use of EU funds for advice is often not easy, mainly due to the reporting requirements. These requirements are adapted to large projects, but not for small or very small advice activities. The RRF facility and national plans provides an opportunity to allocate monies to national and regional technical assistance facilities.

One-stop shops remain the favoured mode of deploying technical assistance, whether located within municipalities, utilities or as seen more recently within retail banks themselves.

Lessons learned from TA and PDA initiatives among cities and municipalities show the importance of facilitating the identification of bankable projects, that is selecting the grain from the shaft, as numerous wish list of projects will not make the cut. Too often project development teams underestimate the amount of work required to prepare bankable projects, and the skills necessary to prepare tender documents in line with public procurement and private bidding requirements. Another issue TA can address, is facilitating access to grants or other public financial support (fiscal rebates, etc), as this is often complex. While replication of best practice is often limited by different regulatory frameworks in Member State and at times regions.

TA has to be complemented with tailored financial products, in order that the one stop shops or other ways to provide technical assistance, can also provide adapted finance to the different project needs. In addition, systems to advance the availability of grants can be very useful to incentive energy efficiency investment, as grants are often available well after the financing is put in place.

4.3 EEFIG conclusions and recommendations for the EU Commission

Energy efficiency investment in the EU has not increased from 2016. According to the studies available, investment need to at least double the current levels to achieve the EU objectives. The achievement of these ambitious objectives depends on the full implementation of the policy measures proposed by the EU. The detail analysis of investment trends points out that a particular focus should

be put on certain sectors, notably on the renovation of existing buildings and industry, notably small and medium-sized enterprises.

Overall, the analysis carried out confirms that the large majority of the recommendations proposed in 2015 remain relevant. Most of the recommendations considered critical in terms of relevance are related to Market, Institutional and Economic Action. This confirms the opinion of the 2015 working group that came to the same conclusion on the importance of driving the energy efficiency market through mainly policy, regulatory, as well as fiscal, grant and CO2 prices support.

Recommendations to the European Commission

This section features the specific sectoral recommendations to policy makers, and they are directed towards the European Commission. It includes proposals to address the imminent challenges mentioned before and integrate the recommendations from the previous sections on buildings and industry, as well as some final cross-cutting recommendations directly concerning financial institutions. Many of these recommendations were already proposed in the previous 2015 report, but they have only been partially implemented.

Table 4-2 Recommendations to the EU Commission

General Recommendations	
General	Ensure an adequate and rapid implementation of the policies proposed by the EU Commission in recent years related to energy efficiency. This includes the EEFIG recommendations of 2015, as many of them are only partially implemented
General	Develop large energy efficiency programmes by segment to facilitate the growth of energy performance contracting and ECSOs, notably for public and commercial buildings and energy-intensive SMEs.
General	Evaluate periodically the energy efficiency policies and activities, including at Member State level, in order to assess the effectiveness and efficiency of them. This is particularly important in the next few years, as many new policies will be put in place to achieve the long term objective of net-zero emissions
General	The EU Commission should promote that public procurement rules incentive the use of low carbon technologies, including energy efficiency. All projects financed by EU funds should be procured applying these rules.
General	Facilitate the development of new low-carbon heat networks and the modernisation of existing ones, in order that they become low-carbon
General	Improve the use of EU funds (ERDF, LIFE, H2020, etc) when used to improve energy efficiency. This funding should only be used to support energy efficiency investments eligible to the taxonomy. Grants can only be used when it can be demonstrated that other alternatives are not feasible, such as a financial instrument. The development of financial instruments should be encouraged, in order to mobilise larger amounts of investment with the grants available. Reporting requirements for small energy efficiency investments should be streamlined.
General	The development of large-scale financial instruments can be encouraged, in collaboration with distribution partners to reach millions of corporate and buildings related customers in order to mobilise larger amounts of investment with the grants available.
General	Produce reliable statistics on energy efficiency investment in the EU, in particular for existing buildings and industry.

Recommendations for buildings	
Buildings	Promote that Member States increase the amount of grants available for building renovations, including tax incentives. These grants should be focused on low incomes, small and medium-sized enterprises with difficult access to finance, deep renovations and to facilitate the penetration of low-carbon technologies in their early penetration phase
Buildings	The EU should scale up funding for technical assistance, including one-stop shops, notably to support building owners and local authorities to improve the energy efficiency of their buildings. These funds should also be used to incentivise Member States to put in place similar technical assistance facilities, but financed with their funds
Buildings	Promote that Member States implement plans to significantly improve the energy efficiency of the existing public buildings, including social housing, as many plans have not been implemented. The EU Commission should monitor their implementation.
Buildings	Support Member States to increase the amount of grants available for building renovations, and in the provision of fiscal incentives. These grants should be focused on low income homes, small and medium-sized enterprises with difficult access to finance, on deep renovations and to facilitate the market entry of clean and energy efficient technologies in their early penetration phase.
Buildings	Support Member States in improving the quality and transparency of Energy Performance Certificates. It remains low in many countries.
Recommendations for industry	
Industry	Industrial companies should monitor and manage their energy consumption using mandatory Energy Management Systems, ISO 50001 standards, energy monitoring systems, mandatory energy efficiency targets (sector and entity level), energy audits (mandatory and including reporting on product carbon footprints). Subsidies should be used only to support organisations which clearly need them.
Industry	Standardisation and disclosure requirements: The standardisation of energy efficiency solutions is a good base to structure finance around the energy savings expected and this can be a solid base for financial institutions to propose dedicated project financing instruments
Industry	The industrial sector should monitor and manage their energy consumption: Mandatory / Subsidy for Energy Industry Management Systems, ISO 50001, Energy Monitoring Systems, Mandatory energy efficiency Targets, energy audit (subsidized or mandatory, including reporting of its carbon footprint.
Industry	Grow 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.
Industry	Increase research investments into energy efficiency investments in Industry.
Industry	Extend 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.
Industry	Financial institutions must systematically evaluate the benefits of energy efficiency projects in their risk assessments of industrial clients and provide their clients dedicated energy efficiency finance lines.
Industry	Facilitate financing of energy service companies and energy efficiency special purpose vehicles: Support asset finance vs corporate finance of energy service companies.

Recommendations for financing	
Financing	Develop de-risking tools such as guarantees from Governments (i) to mitigate credit risks related to financing energy efficiency especially for low income households or to small and medium-sized enterprises or other companies with weak credit ratings; and (ii) to reduce risks with innovative technologies or technologies in the early market penetration phase; and (iii) to adequately cover long term risks related to long tenor products.
Financing	Promote the development of scalable innovative financial instruments to finance energy efficiency investments, such as on-tax financing[179], green mortgages or on-bill financing. Their development generally implies changes in the legislation or regulations
Financing	Standardising investment assessment processes, contract terms and investment structures to support the aggregation of projects. This is very relevant for small projects in buildings and small and medium-sized enterprises.
Financing	Develop more specialised financial instruments for individual segments of the market and in conjunction with those market operators (energy service companies, heat networks, mortgage lenders, start-ups, etc).
Financing	Retail lenders should engage on energy performance for all registered mortgage lenders and implement mortgage portfolio standards that deliver improved portfolio collateral energy performance in line with national Paris-aligned decarbonisation pathways.
Financing	Blending grants with loans to better support the implementation of energy efficiency investments, but focussing on households and SMEs with difficult access to finance
Financing	Develop a secondary market for energy efficiency. This will become necessary when the energy efficiency market has achieved a certain scale

[179] According to EuroPACE experience is more appropriate framing on-tax financing as home-based financing. During the implementation of EuroPACE it was learned that public authorities, across the board, are not keen on any fiscal changes, which the attachment to the property can be operationalized through non-fiscal means - hence a more appropriate name "home-based financing".

Appendices

Appendix A Energy Efficiency Financial Institution Group's Mandate

The Energy Efficiency Financial Institution Group ("EEFIG") was established to determine how to overcome the well documented challenges to obtaining long-term financing for energy efficiency. In order to ensure EEFIG's representativeness, practical knowledge base and deep engagement with the finance sector, around 40% of EEFIG participants either work for, or represent the views of, financial institutions. The remaining participants have either worked for finance institutions or were selected for their prior experience and track record of engagement in matters pertaining to the financing of energy efficiency and/or as representatives of buildings, industries or SMEs, and the specialist firms which support them.

This report is the final delivery of EEFIG summarizing its work and thinking over the 16 months between October 2013 and February 2015. During this time EEFIG has met nearly every month and addressed energy efficiency investments, their drivers and trends, for buildings, industry and SMEs in the European Union (EU).

The group was tasked to consider the following questions to increase the flow of energy efficiency investments from a financial institution's perspective:

1 What are the most imminent challenges that must be overcome?

Given the large amounts written on this subject, this question was designed to bring focus to EEFIG's discussions without ignoring the complexity of the topic. The group addressed this question by identifying and discussing the main drivers that would enable the development of a vibrant market for energy efficiency investments in two target sectors: buildings and industry (which covers large energy intensive and non-energy intensive companies and SMEs).

2 Who would be the right party to address them?

Having identified multiple challenges to be overcome, and the drivers for developing such a market, these were prioritized and the relevant, or most suitable, actors identified to address them. While EEFIG would wish that there were a single party to address each challenge, its recommendations are characterized by the adoption of appropriate methods or approaches by many parties to "develop confidence and support the emergence of a market" and "establish synergies between stakeholders" often working from different directions at the same time.

3 What should the European Commission/ EU do?

Having prioritized the drivers and assessed a set of approaches and instruments applicable to the different stakeholders, EEFIG is keen to provide a set of practical recommendations to policy makers to increase the flow of energy efficiency investments in Europe.

The structure of this report reflects the structure and organization of EEFIG process and is written in the name of EEFIG as the consensus and collective opinion of the members and participants in the group.

Appendix B HLEG recommendations

The key recommendations of the report focus on actions and policies to introduce market consistency with regards to energy efficiency investments, extend the mostly short-term view of investors, make ESG a priority for the financial sector and enhance climate disclosure rules and regulations, develop EU standards for sustainable finance and relevant competencies of the actors that will have to comply with these standards.

Financial Institutions and Sectoral Recommendations focus on specific actions in banking, insurance companies, asset managers, pension funds, credit rating agencies, stock exchanges, investment consultants and investment banks. The recommendations include, but are not limited to support for development, coordination and sharing of best practices on ESG and long-term sustainability risk assessments for banks; incorporating climate risk more explicitly into assessments of insurance companies; high standards of competence in ESG of asset managers; reflection of sustainability preferences of clients in pension fund portfolio strategies, etc.

B.1 Implementation of the key recommendations in the HLEG report

At time of writing, five out of the eight of the key recommendations in the report have been either implemented, or a good progress has been made to their implementation. Only one of the cross-cutting recommendations has a direct link to energy efficiency investments (No. 6: "Accelerate action to finance energy efficiency investments").

A number of key recommendations have led to regulatory initiative with important impact on sustainability finance and investment.

Key Recommendation 1: Establish and Maintain a Common Sustainability Taxonomy at the EU Level

The need to re-orient capital flows towards investments which clearly support the goals of the Paris Agreement and the sustainable development was the main motivation of the HLEG to call for a "robust classification system to establish market clarity on what is sustainable"[180].

The "EU taxonomy regulation" (Regulation 2020/852, in force since 12 July 2020, on the establishment of a framework to facilitate sustainable

[180] EU High-Level Expert Group on Sustainable Finance (2018). Financing a Sustainable European Economy, Final report, p. 15

investment[181] (here referred to as the "Taxonomy Regulation") is at the heart of the European Commission's Action Plan on Financing Sustainable Growth[182] (the "EU Action Plan") published on 8 March 2018.

The regulation is the framework for a classification system for ecologically sustainable economic activities, with technical details to be provided in a series of EC Delegated Acts, starting in 2021[183].

The main purpose of the Taxonomy Regulation is to create transparency and common language as regards sustainable economic activities, inter alia to prevent "green washing" by establishing science-based sustainability criteria

The regulation establishes new transparency and reporting requirements by amending the Disclosure Regulation (Regulation on sustainability-related disclosures in the financial services sector, commonly known as Sustainable Finance Disclosure Regulation (SFDR) (Regulation 2019/2088))[184]: as a result, the providers of financial products have to disclose how and to which degree the projects and activities financed by the financial products they offer "comply with the criteria for environmentally sustainable activities"[185] defined by the EU Taxonomy.

In addition, the regulation amends the Non-Financial Disclosure Directive ("NFRD", Directive on disclosure of non-financial and diversity information by certain large undertakings and groups – (2014/95/EU))[186].

As a result, all entities obliged to report under the NFRD have to provide transparency to which extent their activities "are associated with economic activities that qualify as environmentally sustainable"[187] the EU Taxonomy defined economic activities and comply with the relevant technical screening criteria[188].

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[181] European Commission (2020). Law details: Information about Regulation (EU) 2020/852 (Taxonomy) on the establishment of a framework to facilitate sustainable investment including date of entry into force. Retrieved from: https://ec.europa.eu/info/law/sustainable-finance-taxonomy-regulation-eu-2020-852/law-details_en

[182] European Commission (2018). Action Plan: Financing Sustainable Growth. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0097&from=EN

[183] The Delegated Acts specify the technical criteria to be met in order to count as taxonomy aligned.

[184] Regulation (EU) 2019/2088 on sustainability-related disclosures in the financial services sector. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32019R2088&from=EN

[185] Regulation (EU) 2020/852 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 - Taxonomy Regulation, Art. 5 (b).

[186] Directive 2014/95/EU amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groupshttps://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0095

[187] Regulation (EU) 2020/852 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 - Taxonomy Regulation, Art. 8 (1)

[188] At time of writing, the NFRD is under revision.

Key Recommendation 3: Upgrade Disclosure Rules to Make Sustainability Risks Fully Transparent, Starting with Climate Change

This recommendation has been implemented in 2019 through the "Disclosure Regulation" - Regulation EU 2019/2088 on sustainability-related disclosures in the financial services sector (SFDR).

- The SFDR requires disclosures on the integration of so-called "sustainability risks" by firms in their investment decision-making and an assessment of the likely impact of such risks on investment returns.

- Firms will also have to inform whether they consider the "principal adverse impacts of investment decisions on sustainability" and, if they do, make disclosures in relation to those impacts. The SFDR is closely linked to the EU taxonomy regulation (2020/852), as it creates the obligation to disclose the degree of compliance with the EU taxonomy criteria. Disclosures are required to be made on the firm's website as well as at the pre-contractual stage and in periodic reports.

Further, as part on the sustainable finance strategy, published in July 2021, the European Commission announced to " work with the European Financial Reporting Advisory Group (EFRAG), the European Securities and Markets Authority (ESMA) and the International Accounting Standards Board (IASB) to assess whether international financial reporting standards (IFRS) appropriately integrate sustainability risks."[189]

On 2 August 2021, several European Commission delegated acts on the integration of sustainability risks and factors have been published in the Official Journal:

- Commission Delegated Regulation (EU) 2021/1255 amending Delegated Regulation (EU) 231/2013 (the AIFMD Delegated Regulation) as regards the sustainability risks and sustainability factors to be taken into account by Alternative Investment Fund Managers;

- Commission Delegated Regulation (EU) 2021/1253 amending Delegated Regulation (EU) 2017/565 (the MiFID Org Regulation) as regards the integration of sustainability factors, risks and preferences into certain organisational requirements and operating conditions for investment firms;

- Commission Delegated Regulation (EU) 2021/1254 correcting Delegated Regulation (EU) 2017/565 (the MiFID Org Regulation) as regards the integration of sustainability factors, risks and preferences into certain organisational requirements and operating conditions for investment firms and defined terms for the purposes of MiFID II;

[189] https://eur-lex.europa.eu/resource.html?uri=cellar:9f5e7e95-df06-11eb-895a-01aa75ed71a1.0001.02/DOC_1&format=PDF

- Commission Delegated Directive (EU) 2021/1270 amending Directive 2010/43/EU (the UCITS Implementing Directive) as regards the sustainability risks and sustainability factors to be taken into account for Undertakings for Collective Investment in Transferable Securities (UCITS).

All the Delegated Regulations and Directive will enter into force on 22 August 2021 and will all apply from **2 August 2022**.

Key Recommendation 4: Key Elements of a Retail Strategy on Sustainable Finance: Investment Advice, Ecolabel[190] and SRI Minimum Standards

The recommendation aims to empower citizens to invest in portfolios that reflect their sustainability and ethical preferences, thus creating pools of sustainable capital finance. Notable progress has been made in the implementation of this Recommendation. The Commission is in advanced stage of development of an Ecolabel[191] for Retail Financial products. The EU Ecolabel builds on the Taxonomy framework to assess the underlying assets of financial products linked to environmentally sustainable economic activities and to establish whether the financial products are sufficiently "green" to be awarded with the label.

Key Recommendation 5: Develop and Implement Official European Sustainability Standards and Labels, Starting with Green Bonds

The recommendation focuses on the development of a EU Green Bond Standard and suggests to subsequently create an EU Green Bond Label confirming alignment with the EU standards for green bonds., High degree of implementation can be noted with the development of a Proposal for an EU Green Bond Standard[192] and a Usability Guide[193]. In July 2021 the Commission adopted the Regulation on a voluntary European Green Bond Standard (EUGBS) and is now submitted for approval to the European Parliament and Council as part of the co-legislative procedure[194].

Issuing Green Bonds under the new standard requires full compliance with the EU Taxonomy Criteria of the assets financed by a green bond.

Key Recommendation 6: Establish "Sustainable Infrastructure Europe

- The HLEG recommendation to build up a new standalone entity called Sustainable Infrastructure Europe (SIE), focus primarily on the

[190] European Commission – List of Retail financial products documents: https://susproc.jrc.ec.europa.eu/product-bureau//product-groups/432/documents
[191] Ibid.
[192] EU Technical Expert Group on Sustainable Finance (2019). Report on EU Green Bond Standard, TEG Report, Proposal for an EU Green Bond Standard. Retrieved from: https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/190618-sustainable-finance-teg-report-green-bond-standard_en.pdf
[193] Ibid.I
[194] Sustainable finance (europa.eu)

improvement of sustainable infrastructure project development capacity (including financial structuring/bankability).

- The HLEG recommendation to set up a standalone entity to provide a one stop shop for capacity building and project development assistance, has not been transposed.

With the creation of the Invest EU Advisory Hub[195] in 2021 however, 13 existing, advisory services have at least been bundled under one roof, now managed by the EC providing a single point of access for all types of advisory requests. However, the landscape of support for advisory and project development is still complex and highly diversified, leading to a lack of transparency and focus.

Key Recommendation 7: Governance and Leadership

Key Recommendation 7 refers to strengthening the individual and collective ability and duties of the members of governing bodies in financial institutions to address sustainability risks. In July 2021, EBA and ESMA published joint guidelines[196] on the assessment of the suitability of members of the management body and key function holders, taking into account the Capital Requirements Directive (CRD V) and the Investment Firms Directive (IFD). The guidelines apply as of 31 December 2021.

Key Recommendation 8: Include Sustainability in the Supervisory Mandate of the ESAs and Extend the Horizon of Risk Monitoring

Key Recommendation 8 refers to actions aiming at including sustainability in the supervisory mandate of the ESAs to extend the horizon of risk monitoring. The implementation has made some progress. In April 2020, the three European Supervisory Authorities (EBA, EIOPA and ESMA) started looking into sustainability aspects of risk and issued a Consultation Paper[197] seeking input on proposed ESG disclosure standards for financial market participants, advisers and products. In February 2021, they made a joint supervisory statement[198], providing guidelines on the application and national supervision of the SRDF. They also developed a detailed joint Regulatory Technical Standards[199] on ESG disclosures, which the EC intends to bundle in a single delegated act, which us planned to be adopted and enforced as of 1 July 2022.

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[195] About the InvestEU Advisory Hub | InvestEU (europa.eu)

[196] https://www.eba.europa.eu/eba-and-esma-publish-final-guidance-fit-and-proper-requirements

[197] EIOPA (2020). ESAs consult on environmental, social and governance disclosure rules. Retrieved from: https://www.eiopa.europa.eu/content/esas-consult-environmental-social-and-governance-disclosure-rules_en

[198] https://www.esma.europa.eu/sites/default/files/library/jc_2021_06_joint_esas_supervisory_statement_-_sfdr.pdf

[199] https://www.eba.europa.eu/sites/default/documents/files/document_library/Publications/Draft%20Technical%20Standards/2021/962778/JC%202021%2003%20-%20Joint%20ESAs%20Final%20Report%20on%20RTS%20under%20SFDR.pdf

B.2 Implementation of the cross-cutting recommendations of the HLEG report

The cross-cutting recommendations (CR) revolve around a broad spectrum of different subjects: promoting sustainability principles, empowering EU citizen to engage sustainable finance issues, and support EC to implement evidence-based policies.

Some of the progress made in response to these recommendations include:

- (CR1) "Short termism, sustainability and the tragedy of the horizon" has been addressed by consulting on and planning a Renewed Sustainable Finance Strategy[200/201], with the objective to provide a roadmap with new actions to increase private investment in sustainable projects and activities to support the different actions set out in the European Green Deal and to manage and integrate climate and environmental risks into our financial system.

- (CR3) "Establish an EU observatory on sustainable finance to support evidence-based policy making" has been followed up with the establishment of the Platform on sustainable finance, created in order to advise the EC as regards further development of the EU Taxonomy[202]

- (CR4) "Benchmarks": The development of climate benchmarks and ESG benchmark disclosures was part of the Sustainable Finance Action Plan. IOSCO[203] and ESMA made progress on the integration of sustainability principles in market benchmarks. The EU parliament amended Regulation 2016/1011 as regards EU Climate Transition Benchmarks, EU Paris-aligned Benchmarks and sustainability-related disclosures for benchmarks Amended Regulation (EU) 2019/2089.

- (CR 6) "Accelerate action to finance energy efficiency investments": According to the HLEG, the largest investment gap relate to energy efficiency, pointing out that at the same time the growing momentum for energy efficiency financing among banks and investors.

According to the HLEG, the EC should:

[200] Ibid.
[201] European Commission (2020). Summary Report of the Stakeholder Consultation on the Renewed Sustainable Finance Strategy. Retrieved from: https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/2020-sustainable-finance-strategy-summary-of-responses_en.pdf
[202] European Commission (2020). News article: Call for applications to the expert group for the Observatory on the Online Platform Economy. Retrieved from: https://ec.europa.eu/digital-single-market/en/news/call-applications-expert-group-observatory-online-platform-economy
[203] IOSCO (2020). Sustainable Finance and the Role of Securities Regulators and IOSCO, Final Report. Retrieved from: https://www.iosco.org/library/pubdocs/pdf/IOSCOPD652.pdf

- Facilitate data collection and analysis to examine further, how energy efficiency investments improve the underlying asset value.
  Various initiatives, led by market participants and supported by the European Commission, have been developed to accelerate energy efficiency investments. Some via improved data collection and analysis – EEFIG's De-risking Energy Efficiency Platform (DEEP)[204], Energy Efficiency Mortgage Initiative (EEMI)[205]. Others via non-reimbursable or reimbursable financing – the European Structural and Investment Funds (ESIF)[206], the EU H2020 program[207], the new EIB financial instrument Private Finance for Energy Efficiency (PF4EE)[208] launched in 2015 with the Delegation Agreement signed in 2014, Smart Finance for Smart Buildings Initiative[209] (SFSBI)

- Consider the wider impact of energy savings for financial risk management. "Green tagging" of energy efficiency investments should be explored by the European Supervisory Authorities Some European banks[210] have begun adoption of green tagging practices (mainly for housing and real estate lending). But the principles are not yet adopted by the ESAs.
  Financial Institutions and Sectoral Recommendations cover:

  - Banking
  - Insurance companies
  - Asset management
  - Pension funds
  - Credit/sustainability ratings
  - Investment consultants
  - Investment banks

Recommendations for asset managers have also been addressed with several regulations on sustainability-related disclosures in the financial services sector, such as 2019/2088[211];

[204] De-Risking Energy Efficiency Platform (DEEP)
[205] Energy Efficient Mortgages Action Plan (EeMAP)
[206] Interreg Europe (2019). Funding Energy Efficiency through Financial Instruments: a policy brief from the policy learning platform on low-carbon economy. https://www.interregeurope.eu/fileadmin/user_upload/plp_uploads/policy_briefs/TO4_PolicyBrief_Financial_Instruments.pdf
[207] European Commission Horizon 2020
[208] Private Finance for Energy Efficiency (PF4EE), 2020.
[209] European Commission (2018). Smart finance for smart buildings: investing in energy efficiency in buildings. Retrieved from: https://ec.europa.eu/info/news/smart-finance-smart-buildings-investing-energy-efficiency-buildings-2018-feb-07_en
[210] ABN AMRO, BBVA, Berlin Hyp, HSBC, ING, Lloyds, SEB, Suedtiroler Volksbank, Triodos, UniCredit
[211] Regulation (EU) 2019/2088 on sustainability-related disclosures in the financial services sector. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R2088&from=EN

Of the financial and sectoral recommendations, the insurance industry has largely adopted the recommendations in the report via Regulation 2019/2088 and the reporting requirements under Solvency II Directive[212]

Recommendations for asset managers have also been addressed with several regulations on sustainability-related disclosures in the financial services sector; Climate Transition Benchmarks and sustainability-related disclosures for benchmarks[213] and integration of sustainability risks, factors and preferences.[214] These recommendations also impact pension funds.

Recommendations for Credit Rating Agencies were implemented via the European Securities and Markets Authority guidelines and documents[215].

[212] EIOPA – Supervisory Reporting and Public Disclosure requirements. Available at: https://register.eiopa.europa.eu/regulation-supervision/insurance/reporting-format/supervisory-reporting-and-public-disclosure-requirements

[213] Proposal for a Regulation amending Regulation (EU) 2016/1011 on low carbon benchmarks and positive carbon impact benchmarks. Retrieved from: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52018PC0355&from=EN

[214] European Commission (2020). Published initiative: Sustainable finance – obligation on investment funds to advice clients on social & environmental aspects. https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12067-Strengthening-the-consideration-of-sustainability-risks-and-factors-for-financial-products-Directive-EU-2017-593-

[215] ESMA (2019). Final Report: Guidelines on Disclosure Requirements Applicable to Credit Ratings. Retrieved from: https://www.esma.europa.eu/sites/default/files/library/esma33-9-320_final_report_guidelines_on_disclosure_requirements_applicable_to_credit_rating_agencies.pdf

Appendix C Examples of current financing instruments

Table 4-3 Examples of current financing instruments

	Residential	Public	Commercial
Dedicated fund	› Lithuania Mult-Apartment Modernization Fund › LABEEF	› European Energy Efficiency Fund › London Energy Efficiency Fund › Mayors Energy Efficiency Fund › SDCL Energy Efficiency Income Trust › Triple Point Energy Efficiency Infrastructure Fund › SUSI Energy Efficiency Fund › SUMA › SOLAS Sustainable Energy Fund › Aquila Energy Efficiency Strategy Fund › Italian Energy Efficiency Fund I & II	› European Energy Efficiency Fund › The Carbon Neutral Real Estate Fund › Hypo Bank [CHECK] › SDCL Energy Efficiency Income Trust › Triple Point Energy Efficiency Infrastructure Fund › SUSI Energy Efficiency Fund › SUMA › SOLAS Sustainable Energy Fund › Aquila Energy Efficiency Strategy Fund
Credit line	› KfW › Romania Green Homes & Green Mortgages Plan › Bulgaria Residential Energy Efficiency Credit Line › Green mortgages by Union de Creditos Inmobiliarios	› PF4EE	› PF4EE
Other	› Energiesprong › PACE › On-bill Schemes › Renovation EnPC	› Energy Performance Contracting › SPL (Public ESCO) › Carbon & Energy Fund (procurement framework) › Lighting as a Service contracts › DEEP EnPC	› Lighting as a Service contracts › PACE › On-bill Schemes › Deep EnPC

Appendix D Selected energy efficiency financial instruments and activities

The following is a list of financial instruments prepared and updated by the EEFIG working group from the list in the EEFIG 2015 report. These are not intended to be presented in an analytical form, merely a descriptive one. In future work, EEFIG recommends that these instruments can be compared using common criteria including, but not limited to:

1 Assessment of the effects of mobilizing public funds in terms of activating external sources of financing thermo-modernization.

2 Assessment of the effects of mobilizing public funds in terms of reducing environmental pollution, CO2 reduction and combating smog.

3 Assessment of the effects of mobilizing public funds in terms of the number of residential houses in which thermo-modernization and renovation were carried out.

4 Assessment of the effects of mobilizing public funds in terms of jobs created or maintained, especially among small and medium-sized enterprises.

5 Assessment of the effects of mobilizing public funds in terms of the volume of implemented investments.

6 Assessment of the effects of mobilizing public funds in terms of the solutions used, including renewable energy sources and the effects on reducing the consumption of energy resources.

7 Assessment of the effects of mobilizing public funds in terms of introducing an energy efficiency standard taking into account future Union requirements.

8 Assessment of the effects of mobilizing public funds from the investor's point of view, including maintaining the thermal comfort of residents.

9 Effects on the state budget.

D.1 Dedicated credit lines

Dedicated credit lines	
Definition	› Dedicated credit line is a line of credit (a commitment to fund specific assets, although no transactions exist until funds have

Dedicated credit lines	
	been advanced) issued by a financial institution to be disbursed as a set of individual loans for a defined use – in this case energy efficiency – usually in a specific sector (e.g. Residential buildings, SMEs etc)..
Link to Energy Efficiency	› Dedicated credit lines are an established financing practice for energy efficiency. In 2015, they had the widest applicability in all building segments. This is thanks to the long-term track-record and backing of several of the EU's public financial institutions, where energy efficiency credit lines have been widely used and tailored, providing leverage, long maturities, low costs and mobilizing private financing directly and through their partner banks.
Examples	› EIB provided the Spanish Airport Authority (AENA) with €86 million credit line to improve the energy efficiency of its airports in Spain, in 2019. › EBRD: Between 2006 and 2017 EBRD financed 290 dedicated credit lines for local financial institutions. › KfW provides Euro billions of energy efficiency credit lines both, with offices in Germany and approximately 70 countries worldwide. › P4Fenergy efficiency is a programme sponsored by DG CLIMA and managed by EIB that provides dedicated credit lines and technical assistance to key financial partners in most Member States.
Opportunities	› Easy to roll out and higher leverage effect in comparison with grants › Well understood form of finance which can be accessed by all local banks. › Each credit line can be specifically dedicated for on-lending to industrial and/or residential sector borrowers, including SMEs and municipalities. › Commercial property and business owners as well as homeowners are both familiar with accessing credit, supporting engagement and customer uptake. › Credit lines can build capacity in borrowers even after the credit line is closed › Help government mandated measures create the framework for market development and can develop customer appetite.
Challenges[216]	› Capacity of the borrower to take more debt – which means that a significant percentage of consumers and small businesses are not able to access this type of financing. › Risk aversion of banks (calling for Government Guarantees) › Banks developing these credit lines may possibly have difficulty dispersing them as their conditionality is sometimes more than regular loans. › Reporting seems to be a particular challenge for banks, as energy is a technical topic falling outside their own field of expertise (namely finance).

[216] Institute for Climate Economics (2017). Using credit lines to foster green lending: opportunities and challenges. Retrieved from: https://www.cbd.int/financial/2017docs/ice-creditlines2017.pdf

Dedicated credit lines	
	› Technical and methodological difficulties in putting in place the necessary procedures › Many projects do not include measurement or verification requirements › Financial risks – e.g. foreign exchange risks – and difficulties in development of in-house capacity and centres of competence to promote the new financial product
Future trends	› Comprehensive framework required in each Member State, including energy audits and independent expert advice where required › Large network of on-lending banks and long-term, low interest rates offered › Long term horizon and instrument stability › A set of criteria that can easily be understood, processed, and checked (MRV), possibly using software or AI. › An effective information marketing and awareness directed to the final beneficiaries. › Greater involvement with Energy Performance Contract providers in selected subsectors

D.2 Energy Performance Contracting

Energy Performance Contracting	
Definition	› Energy Performance Contracting is a practice whereby a counterparty (often an energy service company (ESCO)) commits through an energy performance contract (EPC) to install necessary equipment and guarantees its specific energy savings performance. In addition, the EPC establishes the upfront terms and splits of ongoing payments which are intended to be less than the financial savings realized by the project's energy savings.
Link to Energy Efficiency[217]	› The EPC model has been growing in commercial and public buildings as well as through public ESCOs and to some degree also giving rise to factoring funds and being key investment assets for dedicated energy efficiency funds.
Examples[218]	› EUEsco (Aramark, Broen, Belimo, Danfoss, Delta Dore, Deistech control, Frese, GFR, Hager, Herz, Honeywell, IMI, Johnson controls, Kieback&Peter, LOYTEC, Oventrop, Priva, Schneider Electric, Sonder Regulación, Theben, Wago and others)
Opportunities	› EPCs offer a one stop turnkey contract for the customer, with only one counterpart for the entire duration of the contract › EPC provider manages the performance risks and guarantees the savings

[217] Moles-Grueso, S., Bertoldi, P. and Boza-Kiss, B., Energy Performance Contracting in the Public Sector of the EU – 2020, EUR 30614 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-30877-5, doi:10.2760/171970, JRC123985.
[218] European Commission JRC (2017). Energy Service Companies in the EU. Retrieved from: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC106624/kjna28716enn.pdf

Energy Performance Contracting	
	› High professionalism and expertise of Energy Performance Contract providers › Energy Performance Contract provider can help bring financing or facilitate access to finance if its guarantee can be monetised.
Challenges	› In many cases, focused on short payback times due to low requirements of the client host, although the private sector is able to deliver deep renovation through Energy Performance Contract (when requested) › Increases transaction costs › High capital required to ensure continuity of operations, since ESCOs are refinanced with small-value, long term instalments. › Requires more developed skills on the client side › Lack of standardised framework and templates.
Future trends[219]	› Member States may apply national recovery and resilience plans to earmark funds for qualified ESCOs. › Member States may utilise InvestEU funds to provide guarantees for ESCOs, in line with InvestEU programme objectives of de-risking projects by providing guarantees to help leverage private finance, thus boosting building renovations.

D.3 Risk-sharing facilities

Risk-sharing facilities	
Definition	› A risk-sharing facility is an agreement between a financial institution and an asset originator which shares defined risks between them. Typically, a portion of principal losses incurred on defined assets is split between the two entities with a first loss often being incurred by the originator.
Link to Energy Efficiency	› Risk-sharing facilities are useful in many sectors to promote energy efficiency as an alternative or complement to other financing instruments as markets mature. Risk sharing facilities have been put in place in order to mitigate credit risk, as well as technological and/or performance risk.
Examples	› EFSI: Renovation Loan based on a Risk sharing loan model with interest rate and collateral reductions › Trustenergy efficiency, Horizon2020 – an EU-wide forfeiting fund / securitisation vehicle for industrial energy efficiency with an internal guarantee facility to reduce risks. › KredEx Revolving Fund for energy efficiency in apartment buildings. › Off-the-shelf renovation loan designed to be State aid compliant, and include a minimum set of governance requirements providing funding to residential building owners to prepare and implement building renovation projects[220].

[219] BPIE (2020). Energy Services and the Renovation Wave. Retrieved from: https://euagenda.eu/upload/publications/report-esco_final.pdf.pdf
[220] European Parliament – DG Internal Policies (2017). Research for REGI Committee – Financial instruments for energy efficiency and renewable energy. Retrieved from:

Risk-sharing facilities	
Opportunities	› Reduces the risks for banks and enables them to lend greater amounts › Can mitigate and cover credit risks in buildings and SMEs with project size less than €200,000 and benefitting from portfolio diversification. › If energy efficiency loans experience "market standard" or better credit performance, then risk sharing facilities can support the transition phase until energy efficiency is mandatory › Extends private sector funds by allowing them to operate at higher leverage factors. › Can boost energy efficiency services market in EU
Challenges	› In practical execution it seems to have been used to reduce the risk of financial intermediaries without the benefits being passed onto the end customer or extending to lower risks or more transactions. › Moral hazard if substantially all risk is removed from bank lending › Long time may be required to structure and negotiate › Know-how missing to implement at regional and local government levels › Often extensive and complex handling of risk-sharing facilities at EU level, EIB can be more helpful.
Future trends	› The need for risk mitigation strategies is growing and a more an equitable application of benefits ensured. › Guarantees if unconditional, irrevocable and payable on first demand should be considered unfunded credit protection within the meaning of the Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 for prudential requirements for credit institutions and investment firms amending Regulation (EU) No 648/2012 (Journal of Laws UE L 176 of 27.06.2013, p. 1, as amended) ("CRR"). This will significantly affect the economic value of the collateral from the point of view of banks' capital requirements.

D.4 Energy efficiency funds

Energy Efficiency Funds	
Definition	› Energy efficiency investment funds are specific investment vehicles created to invest only in energy efficiency projects targeting both buildings and industry usually seeking a return based on savings achieved.
Link to Energy Efficiency	› Multiple dedicated energy efficiency funds are active in Europe. They initially struggled to deploy funds. However, they have made adjustments to their investment criteria for subsequent rounds of fund raising. Return expectations are often set between 6% and 12% as the investments are seen as perhaps too high risk. These funds look for investments of between €1,000,000 and €5,000,000. The average energy efficiency project in the private non-government market requires less than €200,000 in financing.

https://www.europarl.europa.eu/RegData/etudes/STUD/2017/601992/IPOL_STU(2017)601992_EN.pdf

Energy Efficiency Funds	
	Many specialized energy efficiency funds (indeed all funds familiar to this team) have adjusted their investment criteria to encompass both building retrofits and behind the meter generation. This has allowed them to grow the project sizes sufficiently to deploy their capital.
Examples	› European Energy Efficiency Fund (EEEF) public-private partnership (PPP) with a layered risk/return structure, to enhance energy efficiency and foster renewable energy › SUSI Energy efficiency fund – a conservative, sustainably oriented fund for institutional investors financing energy efficiency retrofits of buildings, industrial facilities, and public infrastructure › Energy Efficiency and Renewable Sources Fund (Bulgaria), a revolving energy efficiency fund operating as a PPP › Octopus Energy (UK) and Foresight (EU)
Opportunities	› Dedicated vehicles for energy efficiency investing, which allows to better track the use of proceeds than in a general investment fund › Creates specialised financial players who know the market well. These funds have specialized staff able to support the development of building renovations, street lighting upgrades, and other projects. › While much of their capital is dedicated to different forms of behind the meter generation, they support the education and development of dedicated service providers. › Can bid on projects enabled through government backed mandates, a core enabler of at scale market growth. › Attractive to SRI investors.
Challenges	› High return and liquidity requirements may entail a focus on short and medium paybacks, not tapping higher energy savings potential. › Often include renewables as a form of efficiency. › Need to encourage the aggregation of multiple small efficiency projects. › By performing due diligence on projects and the credit checks on all involved, EEF provide a significant challenge to market participants. › Accessibility remains an issue for small projects. › Dedicated funds do not, as a rule handle any residential investment as they are unable to perform the credit checks in a cost-effective manner.
Future trends	› As funds gain more experience within the energy efficiency markets, they are decreasing minimum project size and supporting the aggregation of smaller projects with increased success. Gradually project developers are also beginning to understand what is required in order to meet the risk appetite and limitations of these financiers. It is therefore expected that more funds will be established and that their access to project will continue to improve. Without generation resources, these funds will have difficulty deploying their capital, particularly in buildings.

D.5 Subordinated loans

Subordinated loans	
Definition	› Subordinated loans are debt instruments that rank behind other senior loans with respect to claims on assets and earnings in case of a debtor's liquidation or bankruptcy.
Link to Energy Efficiency	› Subordinated loans are a niche instrument for energy efficiency with a potential to augment grants as the markets mature. Subordinated loans have been used to a very limited extent for energy efficiency to date
Examples	› European Energy Efficiency Fund › Industrial Energy Efficiency - providers of subordinated loans in NL for industrial energy efficiency include NLII-ALF, Funding circle, Oneplanet, Onecrowd, FundIQ › Green Growth Fund
Opportunities	› Leveraging private bank funds (i.e. for every euro of grant the bank is obliged to add its equivalent euro of private funding thereby multiplying the size of the fund with private funds) › Reducing the interest paid › Increasing the term of the financial package › Reducing default risks for the senior lenders
Challenges	› Long time may be required to structure and negotiate › Moral hazard if substantially all risk is removed from bank lending › Know-how to implement at regional and local government levels › New application of "old technology" requires adjustment period
Future trends	› Subordinated loans have a role to lever senior debt and equity investors in securitised portfolios and to support the refinancing of existing energy savings contracts for cities.

D.6 Financial and operating leases

Financial and operating Leases	
Definition	› Lease is a contract by which one party "Lessor" conveys land, property, or service to another party "Lessee" for a specified time, in return for a periodic payment.
Link to Energy Efficiency	› Through leasing the host obtains the use of machinery, vehicles or, in this case, highly energy efficient equipment, or other energy efficiency measures, on a rental basis. This avoids the host's need to invest its own capital in the equipment.
Examples	› Siemens - An operating lease enables products and equipment to be financed 'off balance sheet' as the technology is accounted for as a rental expense. The equipment is never owned by the lessee, but by Siemens, and is accounted for as a rental expense with no asset or liability appearing on the lessee's balance sheet

Financial and operating Leases	
	› GSG Energy Finance offers an "Energy Efficiency Lease". Greenavise terms their program E3L, for "Energy Efficiency Equipment Leasing". [221] › PolSEFF Leasing program by the European Bank for Reconstruction and Development[222]
Opportunities	› Can be made available to small and large projects on a repeated basis. › Widely available throughout Europe, particularly to customers with good credit records.
Challenges	› Restricted to removable assets (e.g. energy management systems, boilers, cogeneration, printers, IT, etc.), which reduces the level of energy savings that can be achieved. › Host may pay a higher price over the long term (depending upon implicit finance costs etc.) › Leasing commits host to retaining a piece of equipment for a certain time period, which causes a degree of "lock-in". › Integrates life cycle costs › Can obtain off-balance sheet accounting treatment (equipment can be included in income statement as a lease expense, not on balance sheet as a purchase) › Some tax advantages in some jurisdictions › Conserving working capital and avoiding down payments › Well understood instrument by equipment suppliers and hosts. › Leases are not available to those who do not have adequate credit or household owners. › Customers with good credit often prefer a bank loan than lease, as the benefits of a lease versus a loan are not always clear to them.
Future trends	› Leases are helpful finance mechanisms for equipment replacement and industrial applications.

D.7 Green leases

Green leases	
Definition	› Green lease: also called aligned leases, high-performance leases, or energy-efficient leases are rental agreements in which tenants commit to or gain incentives by participating in water/energy conservation, waste reduction and recycling, use of non-hazardous cleaning products, or other sustainable actions. Green leases are appropriate for large, commercial buildings and are being developed by commercial real estate managers.

[221] Power Dynamics Blog – Will Lease Financing do for Energy Efficiency what it did for Solar? Retrieved from: https://powerhousedynamics.com/blog/will-lease-financing-do-energy-efficiency-what-it-did-solar/

[222] Interreg Central Europe Website – Leasing. Retrieved from: https://oneplace.fbk.eu/en/financing-energy-efficiency/financing-energy-efficiency/transnational-methodological-framework/financing-models-for-energy-efficiency/leasing/

Green leases	
Link to Energy Efficiency	› Green leases bridge differences between landlord and tenants by splitting costs and benefits between the parties in such a way that both parties can benefit from an energy efficiency upgrade. If necessary legislative foundations exist, they can bridge the differences between landlords and tenants in a way that both parties can gain from an energy efficiency upgrade.
Examples[223]	› Boston properties › Brixmor property group › Clarion partners
Opportunities	› Many member states can use green leases in the context of the long-term renovation strategies for commercial real estate
Challenges	› Green lease application requires concerted uptake by commercial real estate owners and tenants. › Greater awareness of the mutual benefits and training is required
Future trends[224]	› Going green must be both easy and cost-effective. › Green clauses must be collaborative › Green clauses should facilitate an ongoing dialogue between tenant and landlord on environmental topic

D.8 Direct and equity investments in real estate and infrastructure funds

Direct and equity investments in real estate and infrastructure funds	
Definition	› Direct investments in real estate and infrastructure through funds or acquisition of stakes in a specific property and equity investments, such as ownership interest in a company that owns a specific property and indirect investment; and indirect investments through ownership of shares in real estate or infrastructure funds.
Link to Energy Efficiency	› Real estate and infrastructure funds provide large amounts of 'invisible' energy efficiency investments in the building and infrastructure sectors. This investment takes place during a fund's investment life cycle, new developments, renovation, planned and preventive maintenance and active building management. Therefore, in renovation or overhaul, energy efficiency can be included.
Examples	› Portfolio Decarbonisation Coalition[225] – is a multi-stakeholder initiative that will drive GHG emissions reductions on the ground by mobilizing a critical mass of institutional investors committed to gradually decarbonizing their portfolios › SDCL Energy Efficiency Income Trust – the UK's first listed energy efficiency fund › Triodos Sustainable Real Estate Fund

[223] Green Lease Leaders
[224] UK GBC Blog (2020). How will green leases deliver a more sustainable future? Retrieved from: https://www.ukgbc.org/news/headline-how-will-green-leases-deliver-a-more-sustainable-future/
[225] Portfolio Decarbonization Coalition – Latest annual report. Available at: https://unepfi.org/pdc/

Direct and equity investments in real estate and infrastructure funds	
Opportunities	› Existing instruments well established across the EU › Higher leverage possible › Lower default rates, as well as improved building resale values associated with energy efficient buildings. › Limits need for public funding at market level › Rewarding companies' efforts to reduce their assets' obsolescence risks by investing in best performers › Sustainability and environmental criteria can be embedded as part of company's due diligence and valuation process › marketing and communications benefits as funds can be labelled ESG and sustainable meeting thresholds in EU Taxonomy › Fund managers can influence companies' environmental policies in relation to energy efficiency › Can aggregate energy efficiency gains from buildings at portfolio level.
Challenges	› Difficult to estimate proportion of funds invested in energy efficiency › Limited to cost effective investment within the investment timeframe of each fund › Split incentives, where the building owner does not directly benefit from the lower energy costs. › Should deliver adequate return investment performance returns to investors, aligned with the investment risk, and (if possible) measurable and comparable to financial instruments that provide a similar level of returns › In the absence of specific regulatory requirements, achievements will occur but could be limited to best practice within the industry, or to focus on the low-hanging fruit, e.g. just "quick wins". › Can be combined with government backed building standards that provide clear requirements to increase overall risk-returns.
Future trends	› Will only scale when governments create robust and meaningful standards that buildings must meet (e.g. Minimum Energy Performance Standards) in order to be rented or sold. Not only must these standards be created, but they must be enforced. In most member states, no standards exist which determine the legality to leasing or rent.

D.9 Green bonds

Green Bonds	
Definition	› A green bond is differentiated from a regular bond by its ring-fencing commitment to exclusive use of funds raised to finance or re-finance green projects, assets, or business activities – as currently defined in the Green Bond Underwriting Standard and to be updated by the EU Taxonomy regulation GBS.
Link to Energy Efficiency	› Green bonds are issued mainly for energy assets (i.e. renewable energy sources and energy efficiency). The energy efficiency category covers new and refurbished buildings, energy storage, district heating, smart grids, appliances, and products.

Green Bonds	
Examples	› Vasakronan (Sweden) was the first non-financial corporate and first property company to enter the green bond market. › Dutch property company OVG raised capital finance the redevelopment of existing commercial properties into four sustainable office buildings. › Pfandbriefe, Berlin Hyp's Green Pfandbriefe are used to finance or refinance mortgage backed real estate loans. Properties used for a Green Pfandbrief have been awarded an appropriate energy performance certificate or a green building certificate from internationally recognized certification bodies
Opportunities	› Large and deep pools of investor finance › Are being applied to energy efficiency investments, but often as part of larger portfolios › High leverage effect › No need for public funding › Strong market signalling › Simplifies means to attract new investors › Need for greater focus on energy efficiency thresholds and portfolios of deep renovations for buildings › Diversification of investor base
Challenges	› Need to meet investors' expectations in terms of size of issue and liquidity: energy efficiency is still produced in very small volumes › Issuers need to provide a minimum level of assurance to investors: green quality of the buildings financed, external verification of the use of proceeds, management of proceeds and environmental impact measurement › Most critical challenge for growing green bonds market is environmental integrity: current green bonds use a wide range of measurement for environmental performance and provide limited information on what the proceeds will be used for › Investors are not able to exit if use of proceeds is not in line with their expectations or if the investments are not implemented.
Future trends	› It is expected that the energy efficiency market in buildings and related project volume will remain too low for the foreseeable future, assuming there is not a robust change in policy in Member States.

D.10 Covered bonds

Covered bonds	
Definition	› Covered bonds are debt securities issued by a lending institution and collateralised by a pool of assets that, in case of failure of the issuer, can cover claims at any point of time. They have a superior credit ratings and lower funding cost compared to unsecured debt thanks to a dual recourse structure of claim against the issuer and over a dedicated pool of assets. They are highly regulated to protect bond holders and asset pool composition is monitored.

Covered bonds	
Link to Energy Efficiency	› Covered bonds sit at the heart of the European financial tradition for buildings, and they continue to play a pivotal role in both the financial system itself as well as the real economy.
Examples	› EBRD approved a framework of investments in a series of newly issued covered bonds by Slovak banks › Berlin Hyp issued the first green Pfandbrief backed by commercial real estate loans meeting certain environmental and sustainability standards › SpareBank 1 Boligkreditt (Spabol)226 is a Norwegian covered bond issuer jointly owned by the saving banks › SCBC, Swedish mortgage bank, issued a covered bond backed by residential mortgages for energy efficient properties
Opportunities	› Provides cheap capital for banks › Lower capital requirements for investors than standard bonds › Covered bonds are a solid and well-established legal framework which allow access to capital at a lower cost › There is an opportunity for green buildings which meet EU Taxonomy renovation thresholds to provide increasing collateral for covered bonds to promote energy efficient renovations.
Challenges	› The average size of a covered bond is usually around EUR 0.5 to 1bn, but smaller bonds can also be issued, down to EUR 150m: This remains very high for single energy efficiency projects and therefore relies on strong aggregation › Most covered bonds remain on the issuer's balance sheet › Present collateral requirements need to recognise solidity of energy savings (e.g. the building needed not just the cash flows of energy savings) › Lack of experience of covered bond originators in "energy efficiency loans" › Legal framework at national level need to be clarified regarding the inclusion of energy efficiency › Lack of clear definition of "green covered bond"
Future trends	› It is expected that the energy efficiency market in buildings and related project volume, will remain too low for the foreseeable future, assuming there is not a robust change in policy in Member States.

D.11 On-bill Schemes

On-bill repayment	
Definition	› On-bill repayment is a method of financing energy efficiency usually using utility () bill as the repayment vehicle. Within this arrangement, borrowers pay back the cost of efficiency improvements on their utility bill which is both convenient and familiar and reduces credit risks and collection issues.

[226] SpareBank 1 Boligkreditt (SpaBol)

On-bill repayment	
Link to Energy Efficiency	› On-bill repayment is a mechanism used to improve the creditworthiness (or de facto seniority) of energy efficiency investments by having them repaid within the utility,, bill and recovered through the existing payment collection infrastructures of utilities or public authorities.
Examples	› California On-Bill Financing & On-Bill Repayment ("OBR") is working in both residential areas, and under PACE schemes in identified municipalities.
Opportunities	› Energy savings connected to energy bills › On.bill schemes can access lower to medium income households as well as property owners more broadly to offer more access to finance due to reduced credit concerns. › Public sector actors and utilities are more trusted by decision makers › Can reduce transaction costs › Can overcome the split incentive between user and owner as it is connected to property (or corporate asset) not user › Can be important for the building owner that debt sits on the Network tariff and is therefore attached to the house. › Overcomes the "split incentive over time" (i.e. short detention/occupancy time for buildings) as repayment obligation can be passed attached to the asset on to the next owner/user › Overcomes the lack of finance capacity of homeowners and SMEs.
Challenges	› May initially require additional public support (in form of risk sharing facility) to provide finance at an acceptable cost › Requires the cooperation of DSOs and government and has only been attempted once in the UK › Complex instrument to manage/ market › Administrative requirements can be heavy and this may have contributed to the low UK customer interest. › Might crowd out small ESCOs. › OBS requires the cooperation and engagement of a wide range of stakeholders, including distribution system operators, energy regulators, financial funds, one stop shop development, and ESCOs.
Future trends	› As the EU searches for equitable means of encouraging building renovation, on-bill repayment may be supported. › Member States could consider regulatory changes to allow for transferability of OBS repayments when buildings/dwellings are sold, tenants change, or tenants wish to change utility/energy providers

D.12 On-tax financing

On-tax financing	
Definition	› On-tax financing involves a specific tax being a repayment vehicle. Property Assessed Clean Energy (PACE), a flagship energy efficiency on-tax financing program provides loans for energy efficiency home improvements through specific contractors and

On-tax financing	
	treated as tax assessment against the property, secured by property tax lien.
Link to Energy Efficiency	› If the building is sold, the "loan" can be reimbursed, or taken on by new owner. If the building is rented, it is the tenant who pays the tax and benefits from the savings, and the change of tenant has no impact on the repayments. Financing can be provided by the local authority or by private funds; in the latter case, the role of the public sector is to secure reimbursement by integrating it in tax collection (usually against a collection fee), while private companies are in charge of engaging building owners and signing contracts with them
Examples	› PACE consists of a scheme in which money is lent to a building owner to retrofit a building, but the loan is attached to the property and reimbursed through local taxes by the occupant › EuroPACE has had good success in accessing finance for this mechanism in Spain and in creating a one stop shop for both ESCOs and homeowners.
Opportunities	› Can overcome the split incentive between user and owner as it is connected to property (or corporate asset) not user › Overcomes the "split incentive over time" (i.e. short detention/occupancy time for buildings) as repayment obligation can be passed attached to the asset on to the next owner/user › Building renovation investment is paid back through the property tax attached to the home rather than the network tariffs › Reduces the default risk (taxes are the most senior debt) › Provides one of the few accessible means of renovating homes for low income and median income households, as their credit worthiness is not as critical a factor when making an investment decision. › Can be used to finance deep renovation if that is the intention of the scheme › Can be run with public or private finance.
Challenges	› Impact on public debt if financed through public money › Legal complications related to the lien priority can occur › Requires changes to local tax law or regulations and can therefore be difficult to implement. › Some mortgage lenders can refuse to finance PACE mortgages because in case of default PACE loans are paid off before the main mortgage is paid to the lender. › One stop shop where household owners can access a package service needed to improve uptake as well as protect customers from ESCOs with poor performance records.
Future trends	› Mechanisms such as on tax financing are important, as they are one of the few financing mechanisms which could be made widely accessible to lower income homeowners and small businesses. › The need for changes to local or regional tax laws remain a challenge, as does the creation of robust one stop shops and public education around the availability of the program. › With support the structure could have a strong future.

D.13 Energy Services Agreements

Energy Services Agreements	
Definition	› Energy Services Agreements (ESAs) are performance-based contracts by which a service provider finances, develops, and deploys energy efficiency/RE project for client with no upfront capital expenditure.
Link to Energy Efficiency	› The Energy Service Agreement (ESA) is a "pay-for-performance" service contract between a third-party investor and an asset owner to deliver energy savings as a service
Examples	› Metrus Energy, with financing from Citi, has signed agreements, with a large technology company › Armenia Renewable Resources and Energy Efficiency Fund (R2E2) signed ESAs totalling over US$12 million
Opportunities	› Bilateral contract does not require new regulations › Energy service agreements can now be found in standardized forms and have been used in a wide range of projects. › As a performance-based form of finance, energy service agreements encourage measurement and verification of project results, and long-term commitment on the part of the project developer. › Overcomes some traditional energy efficiency barriers (e.g. split incentives) › No capex for owner, aligns incentives of project developer, building owner and investor. › When combined with off-balance-sheet financing and standardize contracts, they have also supported sales, as customers tend to like the combined package.
Challenges	› Limited scale to date › Fragmented market › Energy service agreements are still reliant on the credit worthiness of the end clients as banks tend to not understand the structure and cannot support performance-based investments. › Can create the need to spend resources educating clients, which can prove expensive for the project developer. › 10-year contract period can limit third party measures installed to low hanging fruits (high returns) › Limited willingness to commit to one energy supplier and the current price level (lock-in) as well as with contractual obligations on the side of the supplier › Increases transaction costs › Requires more developed skills on the client side › Due diligence and risk assessment process as well as the contracting itself, can take an extended period of time which poses another serious challenge for small to medium project developers. › Lack of standardised framework and templates.
Future trends	› Has a great potential for public sector clients (like cities) which can provide aggregate contracts for a set of services that require long-term management and have energy savings potentials.

D.14 Factoring funds for EPC

Factoring funds for EPC	
Definition	› Forfaiting/factoring is a financial transaction in which an entity sells its accounts receivable (typically invoices) to a third party (a factor) at a discount. Through forfaiting, the funds would take over the credit of the clients.
Link to Energy Efficiency	› In energy efficiency terms a factoring fund for Energy Performance Contracts would purchase funded Energy Performance Contracts from their originators (usually ESCOs) at a discount, freeing up the balance sheet of the originators to originate more Energy Performance Contracts
Examples	› EEEF (European Energy Efficiency Fund) can provide financing in the form of debt or equity as well as leasing structures and forfeiting loans for specific industry partners › LABEEF: The SUNSHINE project aims to boost market uptake of energy-saving solutions with an innovative investment scheme and business model, as a factoring fund › RENESCO has invested over €4m in 15 Soviet-era blocks in Latvian towns and are developing a factoring fund with the European Bank for Reconstruction and Development › Bulgaria: The Factoring Fund for Energy Performance Contracts for use by ESCOs
Opportunities	› Secures refinancing for Energy Performance Contract providers, clearing their balance sheets and contributing to lower their capital costs › Could contribute to standardise energy efficiency assets › When combined with off-balance-sheet financing and standard contracts, they have also supported sales, as customers tend to like the combined package. › Dedicated vehicles to support the Energy Performance Contract procurement model, which should allow easier tracking of their performance than when spread across many small ESCOs › Potentially attractive to SRI investors.
Challenges	› New concept that will take time to mature › Banks tend not to understand the structure and cannot support Performance based investments. › Unclear what "discounts" will make this work for Energy Performance Contract originators › Requires public money to kick-start.
Future trends	› Private equity funds are increasingly interested in factoring for their current or future investments

D.15 Public ESCOs

Public ESCOs	
Definition	› A Public Energy Service Company ("ESCO") is a special purpose publicly-owned company designated to manage energy efficiency investments and deliver guaranteed savings to a counterparty of EPC which is set up with public funds.

Public ESCOs	
Link to Energy Efficiency	› A public Energy Service Company ("ESCO") is set up with public funds in order to accelerate the implementation of Energy Performance Contracts in sectors and regions where the private sector offer is not sufficient
Examples	› Belgium: Fedesco, Infrax and Eandis, Vlaams energiebedrijf and GRE-Liège › France: OSER, POSIT'IF semi-public ESCO, the Region of Hauts-de-France › Super ESCO: Saudi-Arabia and as promoted by WorldBank.
Opportunities	› Overcomes lack of capacity of public authorities and homeowner associations › Creates a trusted entity which makes investing easier › Debt could be securitised once it reaches the right scale › Potential way to overcome the lack of willingness of private ESCOs to finance long-term investments through Energy Performance Contract › Stronger capacity to raise debt or receive extra public funding to finance long term operations, as compared to private ESCOs. › A transitional instrument to demonstrate the feasibility and create a market for private ESCOs in the future › Public sector actors are trusted by homeowners and public authorities › Targets deep renovation.
Challenges	› Impacts on public debt › May crowd out private sector ESCOs › Unclear if public authorities have the right personnel structures to scale as fast as is required. › Energy Performance Contract seems technically feasible on multifamily buildings, but the main obstacles remain the split incentives (in rental housing) and the long payback times.
Future trends	› Public ESCOs have played a critical developmental role in the markets, they should now be in the business of catalysing an ecosystem of regional actors to replicate their success.

D.16 Energy savings insurance

Energy savings insurance	
Definition	› Energy savings insurance covers the energy savings generated by specific projects typically in terms of material damage, failure, and asset performance of the installed equipment for investors and financiers of the energy saving projects and ESCOs.
Link to Energy Efficiency	› Energy savings insurance emerged as a solution offered by a small number of financial institutions, private companies and insurance companies, as a way to reduce the risk of an energy efficiency project. It is particularly useful for ESCOs or smaller enterprises with poor credit or who lack the means to secure third party financing.

Energy savings insurance	
Examples	› Technical: the insurance provider covers ESCO or technology provider in the event that promised energy savings are not achieved, assuming the technical risk of energy efficiency projects. › Credit: the insurance provider assumes the credit risk of a project, thereby ensuring that repayments owing to the ESCO can continue to be made, in the case of customer credit default. › The Inter-American Development Bank has championed energy savings insurance through projects in seven Latin American countries, in particular in Mexico, Columbia, El Salvador, Peru, Nicaragua, and Brazil
Opportunities	› Can make small and medium-sized businesses (SMEs) in developing countries more competitive and more productive, saving them money while reducing their emissions of harmful greenhouse gases › Can stimulate investment in energy efficiency projects in the agro-industry sector, among others
Challenges	› The market for such upgrades is typically limited to those with very short payback periods, such as lighting › 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, starving the sector of investment
Future trends	› Should be developed to dramatically scale-up SME and ESCO activities and lead to an overall improvement in standards and performance.

D.17 Energy efficient mortgages

Energy efficient mortgages	
Definition	› Energy efficient mortgages are loans allowing to finance the cost of incorporating energy-efficient features into a new housing purchase or the refinancing of existing housing.
Link to Energy Efficiency	› According to IEA (2019), one of the key trends in energy efficiency lending was the increase in energy efficiency mortgages globally which was also a key driver of green bonds market growth.
Examples	› The EeMAP is a market-led initiative focussed on the design and delivery of an "energy efficient mortgage", which is intended to incentivise and channel private capital into energy efficiency investments. BUILD UPON project, which supported governments across Europe to establish strategies to renovate the region's existing buildings › SMARTER Finance for Families program, funded by Horizon 2020 and led by Romania Green Building Council (RoGBC) is supporting introduction of green mortgages by European banks
Opportunities	› A green mortgage offers a way of unlocking additional finance for renovation from the private sector, bringing a whole new group of stakeholders into the campaign for green buildings - mortgage banks. › It also puts the topic of energy efficiency and sustainability front of mind for the building owner at an important stage in the

Energy efficient mortgages	
	building's life, when, typically, decisions about property renovations may be made.
Challenges	› Current mortgage affordability calculations may not always take account of energy performance › Banks do not always understand green buildings and developing enough data to prove that 'green' really does mean lower risk › Many owners aren't willing to invest despite good payback times
Future trends	› European energy efficiency Mortgage Initiative is promoting with over 60 banks and was cited in the renovation wave strategy as being one of the most promising developments for 2020.

D.18 FinTech and crowdfunding

FinTech and crowdfunding	
Definition	› FinTech supports or enables banking and financial services via technology. It is a way of describing the companies that offer financial services using software and modern technology. Hence, FinTech is used to improve and automate the delivery and use of financial service. › Crowdfunding can be defined as an open call for 'the collecting of resources (funds, money, tangible goods, time) from the population at large through an Internet platform. In return for their contributions, the crowd can receive a number of tangibles or intangibles, which depend on the type of crowdfunding'. It generally takes place on crowdfunding platforms, that is, internet-based platforms that link fundraisers to funders. Crowdfunding campaigns can raise funds for not-for-profit and for-profit projects or organisations.[227]
Link to Energy Efficiency	› Many financial institutions have already developed apps to support energy efficiency investments and motivate property owners to become more sustainable.
Examples	› ING provides its Dutch customers with insights into energy efficiency financing opportunities via 5 steps. › Citizenergy EU-funded platform of offerings in sustainable energy across Europe: cooperatives, crowdfunding, and others. › Bettervest: Crowdfunding for Energy Efficiency (CF4EE) has been pioneered by German crowdfunding platform Bettervest
Opportunities	› Digital technologies create new opportunities for innovative financing options to emerge › Reduce costs due to reduced need for intermediaries and adoption of automation
Challenges	› Managing regulatory risk and compliance inherited "automatically" from the financial sector › Managing Cyber security

[227] Interreg Central Europe – Crowdfunding. Retrieved from: https://oneplace.fbk.eu/en/financing-energy-efficiency/financing-energy-efficiency/transnational-methodological-framework/financing-models-for-energy-efficiency/crowdfunding/

FinTech and crowdfunding	
Future trends	› There is a strong growth of FinTech and this is certainly required for retail banks to access homeowners today. › Crowdfunding is a less obvious need for energy efficiency as it does not lack liquidity – or even cheap finance – but a mechanism to get to market.

Appendix E Case studies, ENEA – Italy

Table E-1 Case study, ENEA - ITALY: EE projects Carried out and identified interventions by NACE code

NACE sector	Energy efficiency actions carried out	Annual saving actions carried out [GWh/y]	Energy efficiency actions identified	Annual saving from actions identified [GWh/y]
Agriculture, forestry and fishing	45	13,4	187	65,5
Extraction of minerals from quarries and mines	10	143,0	121	17,3
Manufacturing activity	5,438	7 198,9	19,998	24 075,6
Supply of electricity, gas, steam and air conditioning	177	403,3	445	4 001,8
Supply of water; sewerage, waste management and remediation activities	210	116,6	1,205	1 257,4
Buildings	49	34,3	294	83,2
Wholesale and retail trade; repair of motor vehicles and motorcycles	474	7,9	3,711	651,5
Transport and storage	264	557,3	1,502	4 348,0
Accommodation and catering services activities	111	10,3	548	181,0
Information and communication services	243	73,8	663	288,6
Financial and insurance activities	56	14,2	810	3 029,1
Real estate activities	25	1,8	190	60,3
Professional, scientific and technical activities	36	9,7	253	4 824,3
Rental, travel agencies, business support services	26	2,0	227	44,5
Public administration and defense; compulsory social insurance	0	-	14	0,6
Instruction	0	-	17	1,9
Health and social assistance	78	67,0	558	304,3
Arts, sports, entertainment and fun activities	15	3,0	120	28,8
Other service activities	8	0,3	90	26,2
TOTAL	7.265	8 727,7 GWh/y	30,953	43 446,0 GWh /y

Table E-2 Case study, ENEA ITALY: EE projects Carried out and identified interventions by Area

Areas of intervention	N° carried out interventions	%	N° interventions identified	%
Lighting	1.907	26,30%	6.249	20,20%
Production lines	1.235	17,00%	2.622	8,50%
Generic (monitoring, organization, training, ISO 50001)	1.113	15,30%	4.693	15,20%
Compressed air	718	9,90%	3.456	11,20%
Climate control	598	8,20%	2.338	7,60%
thermal power station and heat recovery	410	5,60%	1.484	4,80%
Electrical installations	299	4,10%	2.678	8,70%
Cogeneration/Trigeneration	201	2,80%	1.088	3,50%
Production from renewable sources	198	2,70%	3.529	11,40%
Process cooling	166	2,30%	436	1,40%
Structural shells	110	1,50%	443	1,40%
Suction	85	1,20%	492	1,60%
Others	70	1,00%	401	1,30%
Transports	71	1,00%	338	1,10%
Electric motors/inverters	65	0,90%	642	2,10%
Work on distribution networks	19	0,30%	53	0,20%
Power factor correction	-	-	11	0,00%
TOTAL	7.265	-	30.953	-

Appendix F Working Group Approach

The chapter provides a description of the working methods of the working group, including the representation of the working group, the role and scope of the WG and the timeline of activities of the working group.

Following an in-depth and targeted outreach process, expressions of interests were received from 55 wanting to join this WG. 32 candidates were selected based on appropriate expertise and balance criteria and invited.

This working group is unique since it required financiers and investors with significant transactional expertise as well as experts involved in MRV and evaluation of the performance of financial institutions. The working group include a balanced across:

- financiers and investors as well as energy efficiency finance experts and researchers
- EU regional coverage with some international expertise
- Both public and private experience
- Experience across the various financial instruments and practices being reviewed

F.1 The role and scope of the working group

The WG has structured and gathered available information on the financial instruments delivering energy efficiency into a knowledge library, which has ensured that each financial instrument was properly documented and referenced from mainstream literature. This also included that specific case studies were captured and the most relevant information on each stored in a shared drive.

The WG was initially tasked to review the knowledge base compiled as a part of the inception work and offer perspectives as to how best to arrange and order the information for easiest access. The WG has identified leaders in the field of energy efficiency investment and finance to help evaluate and identify best practices and real-market experience in instrument progress and performance. Furthermore, a task of the working group was to review and complement the knowledge library, comment upon an overview of existing knowledge and initiatives on the topic and the main challenges, which were then addressed by the working group.

Representatives of financial institutions in the working group was encouraged to share their experiences with use of specific financial instruments. Furthermore, they provided case studies and shared their own specific financing instrument experiences in working group meetings.

The working group has provided an updated view (from the 2015 EEFIG report) on the current state of the market and practices around the use of each type of instrument, as well as – again – repeating a survey exercise to the wider EEFIG group (designed by the working group) to reach an updated consensus around what works for what sector and how the world has progressed in the context of financial instruments and best practices since 2015.

Once the knowledge base was complete, the working group addressed the sufficiency of the financial instruments and whether the lack of increasing investments is due to a lack of instruments, hurdles facing certain instruments or other reasons. Further, the WG opined on which of the instruments has the greatest capacity in industry and buildings sub-sectors to help deliver the EU's climate and energy targets and contribute to the European Green Deal. This assessment then formed the base of a set of recommendations which has been written up in this report and consensualised for the purpose of the EU Commission's market and policy work.

Finally, working group members were asked to review the reports prepared by the Consortium and support the dissemination of outcomes via their own networks.

The scope of the work performed by the working group is summarised in the following bullet points:

- Provide expert input and assist in identifying financial instruments, investors, information and best practices that may support assessment of the key questions:
  - What are the current set of public funding instruments and private financial instruments being used to incentivise, invest in and finance energy efficiency?
  - Can we identify multiple best practices and case studies for all of them?
  - What categories can we use to best describe these instruments and are some performing better than others, or have greater potential and why?
  - What are the factors used to determine a successful instrument and are these replicable as a way to address the necessary up-scale of the overall amount of energy efficiency investment required to deliver EU's climate and energy targets? Which financial instruments are the most scalable?
- Provide recommendations on:

- Whether there are sufficient financial instruments at scale to deliver energy efficiency measures to deliver the EU Climate and Energy targets?
- How - if the WG concludes that some instruments perform better than others in given conditions and for given markets – can we promote best practices and instrument proliferation using the EEFIG platform?
- Are there ways to promote the faster instrument uptake and greater financing for energy efficiency through links to other policy processes like the EU Action Plan on Financing Sustainable Growth?

F.2 Subgroups

The work was subdivided into five subgroups. A Thematic Lead and a supporting Co-Lead was appointed to each subgroup to enable flexibility and move activities forward.

The teams were divided into the following focus areas:

- TEAM 1: IMPLEMENTATION OF PREVIOUS EEFIG RECOMMENDATIONS
- TEAM 2: EVOLUTION OF FINANCING PRACTICES FOR EE FOR BUILDINGS
  - Task: Monitor, collect data and gather intelligence to analyse the evolution of financing practices for energy efficiency for buildings
- TEAM 3: EVOLUTION OF FINANCING PRACTICES FOR EE FOR INDUSTY
  - Task: Monitor, collect data and gather intelligence to analyse the evolution of financing practices for energy efficiency for industry:
- TEAM 4: RE-FINANCING AND THE DEVELOPMENT OF SECONDARY MARKETS
  - Task: Monitor, collect data and gather intelligence to analyse the evolution of financing practices for energy efficiency re-financing and the development of secondary markets
- TEAM 5: RECOMMENDATIONS OF THE HLEG ON SUSTAINABLE FINANCE RELATED TO EE
  - Task: Assess how the recommendations of the HLEG on Sustainable Finance related to energy efficiency could be operationalized and provide suggestions for appropriate actions that could be taken.

F.3 Timeline

The timeline and key milestones for the working group are shown in the table below.

Table F-1 Timeline and deliverables

Activity	Timing	Note
Kick-off meeting	22 October 2019 (virtual)	
Submission of Inception report	8 January 2020	
Inception report meeting	7 February 2020 (virtual)	Discuss current status of the WG members and comments received on the Inception report
1st working group meeting	3 March 2020 (Brussel, Belgium)	› Introduction and discussion of questions to be answered
Submission of 1st Interim Report	8 April 2020	
Update meeting	26 May 2020 (virtual)	Next steps: › Establishments of five teams with individual focus › Population of the shared folder with new studies relevant to individual financial instruments and country studies
Between meeting work (BMW)[228]: 1st Interim Report, WG team strategy formation, country research		
2nd working group meeting	8 July 2020 (virtual)	› Launch of the five teams
BMW: Working group preliminary knowledge development		
3rd working group meeting	13 October 2020 (virtual)	› Team workplans › Survey planned
Survey results	19 October 2020	
BMW: Working group knowledge output, 2nd Interim Report		
Submission of 2nd Interim Report	8 December 2020	
4th working group meeting	20 January 2021 (virtual)	› Team presentations
BMW: Align findings and composed 1st draft of Final Report		
5th WG Meeting	07 April 2021 (virtual)	› Overview of chapters for final report
Submission of Draft Final Report	8 August 2021	
6th working group meeting	14th June 2021 (virtual)	› Presentations on feedback and final steps
BMW: Finalize Final Report		
Final working group meeting	21 September (virtual)	
Submission of Final Report	8 October 2021	

[228] Between meeting work is side-work carried out by the working group between larger working group meeting. It mainly consists of independent research and writing as well as team collaborations.

Appendix G Working group meetings package

[attached as separate file due to size]

Appendix H Overview of literature and documents

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Acta Innovations	Kochański, M.	2014	Financing of instruments improving energy efficiency in Poland in the years 2014-2020	Research paper	Financial institutions	Market-based mechanisms, EU Regulation	Energy efficiency investments, EU grants	Poland
ADEME	n.a.	2017	Actualisation du scénario énergie-climat. ADEME 2035-2050.	Report	Residential buildings, Non-residential buildings	Demand, Supply, Industry	Transport, Mobility, Urban organisation, Renewable energy , Greenhouse emissions	France
Agencia para a Energia	n.a.	2018	Energy Efficiency trends and policies in Portugal	Report	Residential buildings	Industry, Residents, Demand	Transport, Energy efficiency targets, Services	Portugal
Agenzia Nazionale Efficienza Energetica	n.a.	2018	Rapporto Annuale Efficiencza Energetica	Report	NZEB, Residential buildings, Non-residential buildings, Commercial property	Industry, EU Regulation, EU Policy, Demand, Energy performance, Tools	Energy poverty, National plan	Italy
Agenzia nazionale efficienza energetica	Bertini, I.	2019	L'efficienza energetica e l'utilizzo delle fonti rinnovabili negli edifici esistenti	Report	Residential buildings	Residents, Renovation, Programmes, Supply, Energy performance	Tax incentives, Tax deductions,	Italy

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile	Costanzo, E. et al.	2019	Osservatorio degli edifici a energia quasi zero (nZEB) in Italia	Report	NZEB, Residential buildings	Programmes	nZEB	Italy
Agora Energiewende	Temperton, I. et al.	2016	Reducing the cost of financing renewables in Europe	Report	Other	EU Policy, Programmes, EU Regulation	Cost of capital, EU intervention	EU27
Asian Development Bank Institute	Retallack, S. et al.	2018	Energy efficiency finance programs: Best practices to leverage private green finance	Report	Financial institutions	Demand	financing energy programs, best practices	Global
Austrian Energy Agency	n.a.	2018	STAND DER UMSETZUNG DES BUNDESENERGIEEFFIZIENZ GESETZES (EEffG) IN ÖSTERREICH im Jahr 2018	Policy Study	Residential buildings, Non-residential buildings, Public buildings	Programmes, Certification, Supply, Industry	Energieeffizienzmaßnahmen, Energieaudits, Energiedienstleistungsmarkt	Austria
Austrian Energy Agency	n.a.	2019	Bericht über den jährlichen Energieverbrauch in erfassten Gebäuden gemäß § 23 Abs. 4 EEffG	Policy Study	Public buildings	Programmes, Supply, Energy performance	Energieeffizienzmaßnahmen in Gebäuden der Zentralregierung, Energieeffizienzmaßnahmen bei denkmalgeschützten Gebäuden	Austria
Austrian Federal Ministry of Science, Research and Economy	n.a.	2017	Second National Energy Efficiency Action Plan of the Republic of Austria 2017 in accordance with the Energy Efficiency Directive 2012/27/EU	Other	Residential buildings, Non-residential buildings, Public buildings	Residents, Supply, Demand, Industry, Programmes, EU Regulation, Certification	Targets, Obligation schemes, Metering and billing	Austria

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Bank Gospodarstwa Krajowego	n.a.	n.a.	Thermal Modernization and Refurbishment Fund - Poland.	Report	Residential buildings	Renovation, Residents	Thermal modernisation	Poland
Bank Underground	Guin, B. & Korhonen, P.	2018	Insulated from risk? The relationship between the energy efficiency of properties and mortgage defaults	Report	Residential buildings	Real estate market, Residents, Programmes	Mortgage	UK
Basel Agency for Sustainable Energy	Magallon, D. et al.	2019	Manual of financing mechanisms and business models for energy efficiency	Report	Residential buildings, Commercial property, Public buildings	Market-based mechanisms, Demand, Programmes	Financing energy efficiency	Global
Bruegel	N.a.	2021	European Union countries' recovery and resilience plans.	other				EU27
Building Performance Institute Europe	Firląg, S. & Staniaszek, D.	n.a.	Supporting renovation of single-family houses in Europe	Report	Residential buildings	Renovation, Residents	Funding scheme	Poland
Buildings Performance Institute Europe	n.a.	2015	Buildings modernisation strategy: Roadmap 2050	Report	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Renovation	Thermal modernisation, Financial mechanisms,	Poland
Buildings Performance Institute Europe	Firląg, S. et al.	2018	Financing renovations of buildings in Poland	Research paper	Residential buildings, Non-residential buildings	EU Regulation, EU Policy, Programmes	Financing	Poland
Buildings Performance Institute Europe	N.a.	2011	Europe's buildings under the microscope: A country-by-country review of the		Residential building			EU27

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
			energy performance of buildings					
Bundesministerium für Nachhaltigkeit und Tourismus	n.a.	2018	Energie in Österreich 2018	Report	Residential buildings, Non-residential buildings	Supply, Industry, Market-based mechanisms	Erneuerbare Energie, Ressourceneffizienz, Versorgungssicherheit, Energiepreise	Austria
Bundesministerium für Nachhaltigkeit und Tourismus	Melmuka, A. et al.	2019	Fortschrittsbericht 2019	Report	Residential buildings, Non-residential buildings	Programmes	Policy development	Austria
Bundesministerium für Nachhaltigkeit und Tourismus	Adensam, H. et al.	2018	Klima- und Energieziele Monitoringreport	Report	Residential buildings, Non-residential buildings	Supply, Industry, EU Policy, EU Regulation	Treibhausgasemissionen, Erneuerbare Energie	Austria
Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit	n.a.	2019	Klimaschutzplan 2050	Policy Study	Residential buildings, Non-residential buildings	EU Regulation, EU Policy, Supply, Demand, Programmes	Klimaschutz, Gebaeudebereich, Mobilitaet	Germany
Bundesregierung	n..a.	2019	Eckpunkte für das Klimaschutzprogramm 2030	Report	Residential buildings, Non-residential buildings	Industry, Supply, Demand	Transport, Construction, Consumption	Germany
Bundesregierung	n.a.	2019	Klimaschutzprogramm 2030 der Bundesregierung zur Umsetzung des Klimaschutzplans 2050	Policy Study	Residential buildings, Non-residential buildings, Public buildings, Financial institutions,	Energy performance, EU Policy, Industry, Supply, Demand, Programmes	CO2-Bepreisung, Entlastung von Bürgern und Wirtschaft, Wissenschaftsplattform Klimaschutz, Finanzpolitik /	Germany

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
					Commercial property		Sustainable Finance	
Business News Daily	Stowers, J.	2019	Small Business Financing Options Without a Traditional Bank	Other	Other	Non-EU, Market-based mechanisms	Start-up, Venture capitals	USA
Camara dei deputati	n.a.	2019	Il recupero e la riqualificazione energetica del patrimonio edilizio: una stima dell'impatto delle misure di incentivazione	Other	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Renovation	Building heritage, Energy upgrading	Italy
CDP	Fryer, D. et al.	2017	Charged or static. Which European electric utilities are prepared for a low carbon transition?	Report	Other	EU Policy, EU Regulation, Supply, Industry	Electric utilities	EU27
Central Statistical Office - Poland	Peryt, S. et al.	2010	Energy Efficiency in Poland in years 1998-2008	Report	Residential buildings	Market-based mechanisms, Industry, Supply, Demand, Energy performance	Transport, Service sector, Energy efficiency indicators	Poland
Centro Euro-Mediterraneo sui Cambiamenti Clamitici	n.a.	2017	Piano Nazionale di Adattamento ai Cambiamenti Climatici	Other	Other	Supply, Industry	Climate change adaptation	Italy
CEPS	Núñez Ferrer, J.	2019	Leveraging funding for energy efficiency in buildings in South East Europe	Research paper	Residential buildings, Non-residential buildings, Public buildings	Energy performance, EU Policy, Supply, Demand, Renovation, Residents, Tools, Market-based mechanisms	Financial instruments, Loan renovation programme, Urban development fund	Other
Chance for Buildings	Trubačík, T.	2020	The Case of The Czech Republic - New Green Savings programme	Presentation	Residential buildings, Non-residential	Renovation	Green Savings programme	Czech Republic

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
					buildings, Public buildings			
Climate Bonds	n.a.	2019	ASEAN Green Financial Instruments Guide	Report	Financial institutions	Market-based mechanisms, Programmes	Green Financing	Global
Climate Safe Lending Network	Vaccaro, J.	2020	Taking the Carbon Out of Credit. An integrated approach to removing climate emissions from lending.	Report	Financial institutions	Market-based mechanisms	Finance innovation	n.a.
Climate Strategy	Sweatman, P.	2016	Summary Results of the EEFIG Survey for Poland 2015 – Final Report	Presentation	Residential buildings, Public buildings, Non-residential buildings, Commercial property	Tools, Demand, Supply	n.a.	Poland
Committee on Climate Change	n.a.	2019	Net Zero - Technical report	Report	Other	Industry, Supply	Transport, Power and hydrogen production, Aviation and shipping, Waste, Agriculture	UK
Committee on Climate Change	n.a.	2019	Net Zero: The UK's contribution to stopping global warming	Report	Other	Programmes, Supply, Industry	Climate science and international circumstances, Reaching net-zero emissions in the UK, Costs and benefits of a net-zero target for the UK	UK
CONCITO	Madsen, S.	2019	Anbefalinger til implementering af Energiaftalen med fokus på	Report	Residential buildings, Non-residential	Renovation, Residents	Lempelser af afgifter på el, Energiaftalen	Denmark

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
			energieffektivisering og effektiv anvendelse af energi		buildings, Public buildings, Commercial property			
County Administrative Board of Dalarna, Sweden	n.a.	n.a.	Framework program for energy efficiency investment. Best practice from Dalarna, Sweden.	Report		SMEs	SME investments	Sweden
Covenant of Mayors for Climate & Energy	n.a.	2019	Innovative financing schemes	Report	Financial institutions	Market-based mechanisms, EU Policy, EU Regulation	Financing instruments	EU27
Danish Energy Agency	Petersen, M. L.	2018	The Danish Energy Efficiency Obligation (EEO) Scheme	Presentation	Other	EU Policy, Programmes	EEO scheme	Denmark
Danish Energy Agency	n.a.	2019	Denmark's Energy and Climate Outlook 2019	Report	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Demand, Supply, Residents, Industry	Energy consumption, Industry, Transport, Renewables, Greenhouse emissions	Denmark
Danish Ministry of Energy, Utilities and Climate	n.a.	2018	Energy Agreement	Other	Other	Industry, Market-based mechanisms, Supply	Renewable energy, Tax relief, Green transport	Denmark
Danish Ministry of Energy, Utilities and Climate	n.a.	2018	Denmark: energy and climate pioneer. Status of the green transition.	Report	Other	Supply	Green energy, Security of supply, Renewable energy	Denmark
Danish Ministry of Energy, Utilities and Climate	n.a.	2018	Energiaftale	Other	Other	Industry, Supply, Market-based mechanisms	Renewable energy, Tax relief, Green transport	Denmark

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Dansk Byggeri	Damsø Pedersen, C. & Nursen Deveci, N.	2019	Byggeriets Energianalyse 2019	Report	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Renovation	Renewable energy, Energy consumption, Energy labelling	Denmark
Deloitte	n.a.	2016	Energy Efficiency in Europe. The levers to deliver the potential.	Report	Residential buildings, Financial institutions	Energy performance, Certification, EU Policy, Market-based mechanisms, Residents, Renovation	Transportation, Standards and labels, Retail consumers	EU27
Deloitte	n.a.	2019	2020 power and utilities industry outlook	Report	Financial institutions	Supply, Market-based mechanisms	Clean energy transition, Smart cities	n.a.
Department for Business, Energy & Industrial Strategy	Stabler, L. & Foulds, C.	2020	Governing the UK's transition to decarbonised heating: Lessons from a systematic review of past and ongoing heat transitions	Report	Residential buildings, Other	EU Policy, Programmes, Supply, Residents, Industry	Heat decarbonisation policies	Other
Department of Transport, Tourism and Sport & Department of Communications, Climate Action and Environment	n.a.	2019	Low Emission Vehicle Taskforce. Phase 2 Report.	Report	Other	Programmes, Industry	Transport emissions	Ireland
Deutsche Energie-Agentur	Stolte, C. et al.	2020	Perspektiven des Gebäudesektors in der Corona-Krise	Report	Residential buildings, Non-residential buildings, Commercial property, Public buildings	Real estate market, Residents, Industry, Market-based mechanisms	Hersteller und -Bauwirtschaft, Immobilien- und Wohnungswirtschaft, Handwerk, Planer und Energieberater	Germany

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Deutscher Bundestag	n.a.	2020	Entwurf eines Gesetzes zur Vereinheitlichung des Energieeinsparrechts für Gebäude	Other	Residential buildings, Non-residential buildings, Public buildings	EU Regulation, Residents, Renovation	Buildings	Germany
DEXMA	n.a.	2017	Energy Management for SMEs: Best practices from energy experts	Other	Non-residential buildings	EU Policy, SMEs, Demand	Energy management systems, Energy efficiency technologies and materials, Building operation	EU27
Ea Energieanalyse	Dyhr-Mikkelsen, K. & Togeby, M.	2018	Energieffektive og intelligente bygninger i et smart energisystem. Baggrundsrapport 1 – det smarte energisy stem og samspilspunkter mellem forsynings systemer og bygninger.	Report	Residential buildings, Non-residential buildings, Public buildings	Residents, Supply	Det smarte energisystem, Forsyningssystemer	Denmark
EBC & IEA	N.a.	2017	Business and Technical Concepts for Deep Energy Retrofit of Public Buildings	Report				
Ecologic Institute & eclareon	n.a.	2014	Assessment of climate change policies in the context of the European Semester. Country Report: Finland.	Report	Other	Supply, Demand, EU Regulation, EU Policy	Policy development, GHG projections	Finland
EIB		2004	Investment report	Report	Financial institutions	Renovation		EU27
EIB	EIB	2021	Investment report	report				EU27

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
EIB	N.a.	2019	Investment report 2019/2020: Accelerating Europe's transformation	report				
EIB	N.a.	2019	Energy Lending Policy: supporting the energy transformation					
EIB	N.a.	2021	Investment Report 2020/2021: Building a smart and green Europe in the COVID-19 era	Report	Residential building			
EIB	N.a.	2019	Energy Lending Policy: supporting the energy transformation.	Policy Study				EU27
EIB	N.a.	2020						
ELSEVIER	Malinauskaite, J. et al.	2019	Energy efficiency in industry: EU and national policies in Italy and the UK	Research paper	Non-residential buildings	Industry, EU Policy	Energy Efficiency Directive, Energy consumption, Energy efficiency obligation schemes, UK energy efficiency policies, Italy energy efficiency policies	Other
ELSEVIER	Kyprianou, I. et al.	2019	Energy poverty policies and measures in 5 EU countries: A comparative study.	Research paper	Residential buildings	Energy performance, Residents, Demand	Energy poverty, Energy policies, Low-income households, EU countries, Best practices, National measures, Regional measures	Other

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
ELSEVIER	Rodríguez, M. et al.	2019	Sectoral effects of a Green Tax Reform in Portugal	Research paper	Other	Industry, Supply, EU Regulation, EU Policy	Green Tax Reform, Portugal, Computable general equilibrium models	Portugal
ELSEVIER	Boardman	2004	New directions for household energy efficiency: evidence from the UK. Energy Policy, Vol. 32, Issue 17, p.1.	Research paper	Residential buildings	Renovation		UK
ELSEVIER	Holmes, I., Jess, T., Genard	2017	Efficiency first scorecard: is the EU's energy union on track?	Policy Study	Residential building			EU27
ELSEVIER	Economidou, M., Todeschi, V. and Bertoldi, P.	2019	Accelerating energy renovation investments in buildings	Research paper	Residential building			EU27
Elsevier	Trianni, A., Cagno, E.	2012	Dealing with barriers to energy efficiency and SMEs: Some empirical evidences.	Research paper				
Energi-, Forsyinings- og Klimaministeriet	n.a.	2018	Effekter af Energiaftalen	Report	Other	Supply	Effects of the Energy Agreement	Denmark
Energi-, Forsyinings- og Klimaministeriet	n.a.	2018	Energiaftale 2018 - Effecktiv brug af energi	Report	Residential buildings, Non-residential buildings, Commercial property	Market-based mechanisms, Supply	Subsidy, Energy-saving scheme	Denmark
Energi-, Forsyinings- og Klimaministeriet	n.a.	2019	Rekordlave støttesatser til vedvarende energi frigør midler til klimaindsatser	Other	Other	Demand, Supply, Industry	Renewable energy	Denmark

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Energies	Johansson, I. et al.	2019	Designing Policies and Programmes for Improved Energy Efficiency in Industrial SMEs	Research paper	Other	SMEs, Industry	industrial SMEs, energy policy, barriers, drivers	Global
Energies	Astiaso Garcia, D. et al.	2016	Cost-Benefit Analysis for Energy Management in Public Buildings: Four Italian Case Studies	Research paper	Public buildings	Demand, Programmes	cost-benefit analysis, energy efficiency, public buildings, trigeneration plant, thermostatic valves, geothermal plant, building envelope, retrofitting, energy demand savings	Italy
Energistyrelsen	n.a.	2019	9,4 mio. kr. til projekter om energieffective og intelligente bygninger	Other	Other	Residents	n.a.	Denmark
Energistyresen	n.a.	2020	Grants and tax deductions for home renovation	Other	Residential buildings	Renovation	Grants, Tax deduction	Denmark
Energy & Natural Resources Poland	n.a.	2019	My Electricity – new PV programme introduced	Report	Residential buildings	Programmes	My Electricity programme	Poland
Energy Efficiency Infrastructure Group	n.a.	2019	Making energy efficiency a public and private infrastructure investment priority	Report	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Programmes, Supply, Industry, Renovation	National infrastructure programme	UK

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Energy efficient Mortgages Action Plan	n.a.	2018	Creating an Energy Efficient Mortgage for Europe. Building Assessment Briefing: Italy.	Policy Study	Residential buildings	Residents, Energy performance, Certification, Programmes, Renovation	Subsidies, Mortgage	Italy
Energy Journal	Malinauskaite, J. et al.	2019	Energy efficiency in industry: EU and national policies in Italy and the UK, Energy journal	Research paper				
Energy Savings Council	n.a.	n.a.	Anbefalinger fra Energisparerådet vedrørende indsatsen for energibesparelser i bygninger, implementering af Energiaftalen 2018	Other	Other	Demand	Energy savings	Denmark
Energy Sources	Doukas, H.	2018	On the appraisal of "Triple-A" energy efficiency investments	Research paper	Financial institutions	Market-based mechanisms	Decision support, energy efficiency, financing, sustainable development, Triple-A, trust	EU27
Enterprises pour l'environnement	n.a.	2019	ZEN 2050. Imaginer et construire une France neutre en carbone	Report	Residential buildings, Non-residential buildings	Industry, Renovation, Residents, Supply, Demand	Urbanisation, Transport, Consumption patterns, Mobility, Water and waste	France
Environmental Defense Fund	n.a.	2015	United Kingdom. The World's Carbon Markets: A Case Study Guide to Emissions Trading.	Report	Other	EU Policy, EU Regulation	UK ETS	UK
EOS Energy & European Investment Bank	n.a.	2019	New Refurbishment Model	Report	Other	Market-based mechanisms, Renovation, EU Policy, EU Regulation	Market analysis, Commercial strategy, Risk analysis	n.a.

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Erhvervsministeriet	n.a.	2020	Danmarks gronne investeringsfond	Other	Financial institutions	Market-based mechanisms	Investment fund	Denmark
EU	EU		EU action plan: Financing Sustainable Growth	Report	other			
EU	EU High-Level Expert Group on Sustainable Finance	2018	Financing a Sustainable European Economy, Final Report	Policy Study				EU27
EURAI WGEA	N.a.	2018	Energy Efficiency of Public Sector Buildings					
Eurochambers	n.a.	2014	Smart Energy for Growth	Report	Other	EU Policy, Programmes, SMEs	SME initiatives	EU27
European Bank for Reconstruction and Development	n.a.	2019	Joint Report on Multilateral Development Banks' Climate Finance	Report	Financial institutions	Non-EU, Programmes, Market-based mechanisms	Climate finance	Other
European Bank for Reconstruction and Development	Pyrkalo, S.	2015	IEA report calls to boost SME energy efficiency investments	Other	Other	SMEs	Energy efficiency investments	Global
European Commission	n.a.	2014	Financial instruments in ESIF programmes 2014-2020	Report	Other	Programmes, EU Policy, EU Regulation	Financial instruments	EU27
European Commission	n.a.	2014	Financial Instruments supported by the European Structural and Investment (ESI) Funds in 2014-2020	Presentation	Financial institutions	Tools, Programmes, EU Regulation, EU Policy	Financial instruments	EU27
European Commission	n.a.	2016	SME Energy CheckUp, making the most out of energy	Report	Non-residential buildings, Commercial property	EU Policy, Industry	SME energy check-up	EU27

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
European Commission	Bierer, A.	2018	The Smart Finance for Smart Buildings Initiative (SFSB). Financing energy efficiency in Germany, France and Austria.	Presentation	Residential buildings, Non-residential buildings	EU Policy, EU Regulation, Programmes, Supply, Demand	Smart buildings	Other
European Commission	n.a.	2021	The 2012 Energy Efficiency Directive	Report		Renovation		EU27
European Commission		2020	Questions and Answers on the Renovation Wave:	Other	Residential building	EU policy		EU27
European Commission		2020	Questions and answers: Commission presents next steps for EUR672.5 billion Recovery and Resilience Facility in 2021 Annual Sustainable Growth Strategy	Other	Residential building	EU policy		EU27
European Commission	N.a.	2018	Action Plan: Financing Sustainable Growth.	Report				EU27
European Commission	N.a.	2019	Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU, Final report	Report	Residential building			EU27
European Commission	N.a.	2020	Summary Report of the Stakeholder Consultation on the Renewed Sustainable Finance Strategy	Report				
European Commission		2018	Action Plan: Financing Sustainable Growth	Report	Residential building	EU policy		EU27
European Commission	N.a.	2012	The 2012 Energy Efficiency Directive	Other				

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European Commission & European Investment Bank	n.a.	2015	Financial Instrument products. Loans, guarantees, equity and quasi-equity.	Report	Financial institutions	EU Policy, Tools, EU Regulation, Programmes	Financial instruments	EU27
European Commission & European Investment Bank	n.a.	2015	The European Regional Development Fund. Financial instruments.	Report	Financial institutions	EU Policy, EU Regulation, Tools, Programmes	Financial instruments	EU27
European Commission & European Investment Bank	n.a.	2015	The European Social Fund. Financial instruments.	Report	Financial institutions	EU Regulation, EU Policy, Programmes, Tools	Financial instruments	EU27
European Commission & European Investment Bank	n.a.	2016	JEREMIE in Extremadura, Spain. Case study.	Report	Financial institutions, Other	EU Policy, EU Regulation, SMEs, Industry	Financial products, Investment strategy	Spain
European Commission & European Investment Bank	n.a.	2019	Financing rural, agricultural and forestry infrastructure	Policy Study	Non-residential buildings	Market-based mechanisms, EU Policy, EU Regulation, Programmes	Financial instruments	EU27
European Construction Sector Observatory	n.a.	2018	Denmark. Better Homes Scheme.	Policy Study	Residential buildings	Renovation, Residents	Energy efficient building renovation	Denmark
European Council for an Energy Efficient Economy	Hampton, S. & Fawcett, T.	2017	Challenges of designing and delivering effective SME energy policy	Research paper	Non-residential buildings	SMEs, Demand, EU Policy, Non-EU	Policies and measures	Other
European Council for an Energy Efficient Economy	Schäfer-Sparenberg, C. et al.	2017	The future of EU energy efficiency policies – a comprehensive analysis of gaps, shortcomings, and potential remedies	Research paper	Non-residential buildings	EU Regulation, EU Policy	Evaluation, Policy packages, Policy-mix	EU27

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
European Energy Award	n.a.	2016	Luxembourg	Report	Other	EU Policy, EU Regulation	Municipalities	Luxembourg
European Energy Efficiency Fund	n.a.	2019	Advancing Sustainable Energy for Europe. Quarterly Fact Sheet as of 31/03/2019.	Report	Other	EU Policy, Market-based mechanisms	Investments, Energy savings	EU27
European Environment Agency	n.a.	2016	More from less — material resource efficiency in Europe. Country profile: Estonia.	Report	Other	EU Policy, Tools	Material resource efficiency	Estonia
European Environment Agency	EEA	2021	EEA greenhouse gas - data viewer	other				EU27
European Investment Bank	Tapia, I. & Bender, L.	2017	Energy efficiency in buildings: how to accelerate investments?	Presentation	Residential buildings, NZEB	Industry, Supply, Residents, Demand	Emissions, Investments, Transport	EU27
European Investment Bank	Topaloğlu, B.	2017	Financing Energy Efficiency. Support by the EIB.	Presentation	Residential buildings, Non-residential buildings	SMEs, Industry, EU Policy, EU Regulation	Financing	EU27
European Investment Bank	n.a.	2017	Urban renewal and regeneration of Lisbon	Report	Residential buildings, Non-residential buildings, Commercial property	Renovation, Programmes, EU Policy	Urban development, Smart city	Portugal
European Investment Bank	n.a.	2019	EIB energy lending policy. Supporting the energy transformation.	Policy Study	Residential buildings, Financial institutions	Supply, EU Policy, EU Regulation, Renovation	Energy transformation, Investing, Climate policy	EU27
European Investment Bank	Kalantzis, F. & Revoltella, D.	2019	How energy audits promote SMEs' energy efficiency investment	Report	Financial institutions	SMEs	Energy audits, propensity score matching, energy	EU27

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
							efficiency, European investment bank survey	
European Investment Bank	Rodrigues, D.	2019	Financing EPC for the public sector	Presentation	Financial institutions	Programmes	Financing EPC	n.a.
European Investment Bank	n.a.	n.a.	EU Finance for Innovators	Report	Financial institutions	EU Policy, EU Regulation, Programmes, Tools	Financial instruments	EU27
European Investment Fund	n.a.	2017	ENSI: EIF and NPIs Securitisation Initiative	Report	Financial institutions	SMEs, EU Policy	Investment, Securitisation	EU27
European Investment Fund	n.a.	2018	EIF in 2018	Other	Financial institutions	EU Policy, SMEs	Finance, Transactions	EU27
European Investment Fund & Zagrebačka banka d.d	n.a.	2018	Guarantee scheme - InnovFin SME Guarantee Facility of the European Investment Fund (EIF)	Presentation	Financial institutions	SMEs, EU Policy	Financing conditions	Croatia
European Parliamen		2017	DG Internal Policies (2017). Research for REGI Committee – Financial instruments for energy efficiency and renewable energy					
European Parliament	N.a.	2021	Revision of the Energy Efficiency Directive / Before 2021	Other				
European Parliament - Policy Department for Structural and Cohesion Policies	Wishlade, F. et al.	2017	Research for REGI Committee - Financial instruments for energy efficiency and renewable energy	Report	Other	EU Regulation, EU Policy, Energy performance, Market-based mechanisms	ESIF financial instruments, Renewables, Cohesion policy	EU27
European Union	Zangheri, P., Armani, R., Kakoulaki,	2020	Building energy renovation for decarbonisation and Covid-19 recovery, EUR 30433 EN,	Report	Residential building	EU policy		EU27

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
	G., Bavetta, M., Martirano, G., Pignatelli, F. and Baranzelli, C							
European Union	Moles-Grueso, S., Bertoldi, P. and Boza-Kiss	2020	Energy Performance Contracting in the Public Sector of the EU	report				
Eurpace	N.a.	2018	A Guide to THE IMPLEMENTATION OF THE AMENDED ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE (EPBD) 2018	other		Energy Performance		EU27
EU-Startups	Loritz, M.	2019	10 European cleantech startups innovating for a more sustainable future	Other	Other	EU Policy, Programmes	Start-ups	EU27
EU-Startups	Neuburger, H.	2019	10 smart energy startups to keep you warm this winter (and help you save money)	Other	Other	EU Policy, Demand	Smart energy, Start-ups	EU27
Evaluation Into Practice to Achieve Targets for Energy Efficiency	Gynther, L. & Suomi, U.	2017	FINLAND Energy Efficiency Agreement for Industries	Report	Other	EU Policy, EU Regulation, Tools, Programmes	Policy instrument	Finland
Evaluation Into Practice to Achieve Targets for Energy Efficiency	Di Santo, D. & Biele, E.	2017	The Italian white certificates scheme	Report	Other	EU Policy, Market-based mechanisms, EU Regulation, Programmes	Energy efficiency obligation	Italy

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Executive Agency for Small and Medium-sized Enterprises (EASME) and Ministry of Energy of Poland	n.a.	2019	Second roundtable on financing energy efficiency in Poland	Report	Residential buildings, Commercial property	Residents, Programmes	Support policies	Poland
Federal Ministry for Economic Affairs and Energy	n.a.	2020	Langfristige Renovierungsstrategie der Bundesregierung	Policy Study	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Renovation, Residents, EU Regulation	Heizungslabel, Energiausweise	Germany
Federal Ministry for Economic Affairs and Energy	n.a.	2020	Integrierter Nationaler Energie- und Klimaplan	Policy Study	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Market-based mechanisms, EU Policy, EU Regulation, Programmes, Industry, Supply, Demand, Energy performance	Dekarbonisierung, Erneuerbare Energie, Energiearmut	Germany
Federal Ministry for Economic Affairs and Energy	n.a.	2019	Energieeffizienzstrategie 2050	Policy Study	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Programmes, EU Regulation, EU Policy	Gabaeude, Insudtrie, Verkehr	Germany
fzfinanz	n.a.	2020	Energiforbruget faldt i 2019	Other	Other	Demand	Energy consumption	Denmark
G20 Energy Efficiency Finance Task Group	n.a.	2017	G20 Energy Efficiency Investment Toolkit	Tool	Financial institutions	Market-based mechanisms, Programmes	Energy efficiency investments	Global

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Global Environment Facility	Krushelnytska, O.	2017	Introduction to Green Finance	Presentation	Financial institutions	Market-based mechanisms	Financial products and services	Global
Goldman Sachs	n.a.	2019	Big Oils and Utilities' diverging strategies for energy convergence	Report	Financial institutions	Industry, Market-based mechanisms, Supply	Energy convergence	Global
Government of Ireland	n.a.	2019	Annual Transition Statement 2019	Other	Residential buildings, Non-residential buildings, Public buildings	Industry, Supply, EU Policy, EU Regulation, Programmes	Electricity generation, Transport, Agriculture, Forestry and Land Use	Ireland
Government of Ireland	n.a.	2019	Climate Action Plan 2019. To Tackle Climate Breakdown. Annex of Actions.	Other	Residential buildings, Non-residential buildings, Public buildings	Residents, Demand, Supply, Industry	Emissions targets, Carbon pricing, Built environment, Transport, Circular economy	Ireland
Government of Ireland	n.a.	2019	Climate Action Plan 2019. To Tackle Climate Breakdown.	Other	Residential buildings, Non-residential buildings, Public buildings	Industry, Supply, Demand, Programmes, Residents	Emissions targets, Carbon pricing, Built environment, Transport, Circular economy	Ireland
Government of Ireland	n.a.	2019	Climate Action Plan 2019. To Tackle Climate Breakdown. Infographic.	Other	Residential buildings, Non-residential buildings, Public buildings	Residents, Industry, Supply, Demand	Emissions targets, Carbon pricing, Built environment, Transport, Circular economy	Ireland
Government of Ireland	n.a.	2019	Electricity & Gas Networks Sector. Climate Change Adaptation Plan.	Other	Residential buildings, Non-residential buildings,	Residents, Industry, Supply	Renewable energy, Climate change adaptation.,	Ireland

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
					Commercial property			
Greater London Authority	n.a.	2019	The cost of London's infrastructure requirements to 2041 and the funding gap	Report	Residential buildings, Non-residential buildings	Residents, Renovation, Programmes, Supply, Demand, Industry	Transport, Affordable housing, Energy, Water, Green infrastructure	UK
Greater London Authority	The London Sustainable Development Commission, in association with UK100.	2020	Financing for a future London. How to finance a fair transition to a resilient, circular, zero carbon London.	Report	Other	Programmes	Climate change adaptation, Financing	UK
Green Building Council Italia	n.a.	2019	Energy Efficiency of Buildings in Italy	Report	Residential buildings, Non-residential buildings	Energy performance, Renovation, Residents, Programmes, Certification	Design energy efficiency verification	Italy
Green Finance Institute	n.a.	2020	Financing energy efficient buildings: the path to retrofit at scale	Report	Residential buildings	Residents, Programmes	Home decarbonisation	UK
Green Finance Taskforce	n.a.	2018	Accelerating Green Finance	Report	Financial institutions	Programmes, Market-based mechanisms	Green finance, Climate risk management, Green lending, Green bonds	UK
Group of Development Finance Institutions	n.a.	2019	DFI Working Group on Blended Concessional Finance for Private Sector Projects	Report	Financial institutions	Market-based mechanisms	Development finance institutions	Other
Grupo Interministerial	n.a.	2007	Estrategia Española de Desarrollo Sostenible	Other	Other	Demand, Supply, Industry	Sostenibilidad ambiental, Sostenibilidad	Spain

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
							social, Sosteniblidad global	
Harvard Business review	Aldy, J.E., Gianfrate, G.	2019	Future-Proof Your Climate Strategy. Harvard Business Review					
House of Commons - Business, Energy and Industrial Strategy Committee	n.a.	2019	Energy efficiency: building towards net zero	Report	NZEB, Residential buildings, Non-residential buildings, Commercial property	Renovation, Residents, Programmes, Demand, Supply, Industry, Energy performance	Net zero, EPC targets, Fuel poverty policy	UK
Housing Europe	Lakatos, E.	2017	EU funding for energy efficient renovation of multi-apartment buildings	Presentation	Other	EU Policy, EU Regulation	EU Funds	EU27
IEA	IEA	2020	World Energy Outlook 2020	Report	Other	Energy performance, Market-based mechanisms	Energy	Global
IEA	IEA/OECD	2015	Policy Pathway-Accelerating Energy Efficiency in Small and Medium-Sized Enterprises	Policy Study				Global
IEA	N.a.	2019	Transforming industry through CCUS	Report	Non-residental buildings			
IEA	IEA	2015	Capturing the multiple benefits of energy efficiency	report				Global
IEA	IEA	2020	World Energy Investment	report				Global
IEA	N.a.	2020	Energy efficiency in 2019	Report	Residential building			Global
InnovFin - EU Finance for Innovators	n.a.	2014	InnovFin SME Gurantee	Other	Other	SMEs, EU Policy, Market-based mechanisms, Tools	SME Gurantee	EU27

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Institut für Energieeffizienz, Stuttgart	N.a.	2021	Energieeffizienz-Index Winter 2020/21	other				
Institute for Government	n.a.	2020	UK net zero target	Report	Other	Industry, Supply, Demand	Greenhouse gas emissions	UK
Institute for Public Policy Research	Webb, J. et al.	2020	All hands to the pump. A home improvement plan for England.	Report	Residential buildings, Public buildings	Renovation, Residents, Programmes	Energy security, COVID crisis, Household improvements	UK
Institute of Environmental Economics	n.a.	2012	ESCO market in Poland	Report	Residential buildings, Commercial property, Public buildings	Industry, Programmes, Residents	Energy Service Companies	Poland
Institute of Environmental Economics	n.a.	2017	Technical condition of single-family houses in Poland. Renovation needs.	Report	Residential buildings	Renovation, Residents	Modernization needs, Financing	Poland
Institute of Environmental Economics	n.a.	2018	Energy Efficiency in Poland. 2017 Review. Single-family houses.	Report	Residential buildings	Residents, Energy performance, Renovation	Building mordernisation, Financing	Poland
Instituto para la Diversificacion y Ahorro de Energia	n.a.	2011	Plan de Energías Renovables (PER) 2011-2020	Other	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Residents, Industry, Supply, Demand, Programmes	Renewable energy	Spain
Interministerial group	n.a.	2007	Spanish sustainable development strategy	Other	Other	Supply, Demand, Industry	Environmental sustainability, Social sustainability, Global sustainability	Spain

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
International Energy Agency	n.a.	2019	World Energy Investment 2019	Report	Financial institutions	Supply, Energy performance, Market-based mechanisms, Programmes	Energy efficiency investment, Power investment, Fuel supply	n.a.
International Energy Agency	Glicker, J. & Gaffney, K.	2019	Global ESCO market updates: Webinar	Presentation	Financial institutions	Energy performance, Tools, Market-based mechanisms	ESCO market, Investments	Global
International Energy Agency	n.a.	2019	Energy Efficiency 2019	Report	Financial institutions	Market-based mechanisms, Demand, Tools	Demand and energy intensity, Policy drivers of efficiency, Digitalisation	n.a.
International Energy Agency	IEA	2012	Net Zero by 2050 A Roadmap for the Global Energy Sector	report				Global
International Finance Corporation	n.a.	2019	Green buildings. A finance and policy blueprint for emerging markets.	Report	Residential buildings, Non-residential buildings	Renovation, Real estate market, Tools, Market-based mechanisms, Energy performance	Green building	Other
Interreg Europe	n.a.	2019	Funding Energy Efficiency through Financial Instruments. A Policy Brief from the Policy Learning Platform on Low-carbon economy.	Report	Financial institutions	Market-based mechanisms	Financial instruments	EU27
Interreg Europe	n.a.	2019	Supporting energy renovation of private households through One-Stop-Shops	Policy Study	Residential buildings	Residents, Renovation, Energy performance	One-Stop-Shops	n.a.
Interreg Europe	n.a.	2019	Improving policy instruments to increase the energy efficiency in industrial SMEs	Other	Other	SMEs, Industry, EU Policy	SMEPlus	EU27

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Interreg Europe	n.a.	2020	Finermap Tool	Tool	Other	Tools	Financial instrument, Investment, Energy saving	Other
Interreg Europe	N.a.	2019	Funding Energy Efficiency through Financial Instruments: a policy brief from the policy learning platform on low-carbon economy.	report				
iNudgeyou	n.a.	2020	Adfærdsindsigter inden for energimærkningsordningen	Report	Other	Programmes, Tools	Behavioral approach, Interactive energy label,	Denmark
IOSCO	N.a.	2020	Sustainable Finance and the Role of Securities Regulators and IOSCO, Final Report	report				
IREES/adelphi		2017	adelphi (2017). Analyse der Entwicklung des Marktes und Zielerreichungskontrolle für gesetzlich verpflichtende Energieaudits.					
IRENA	IRENA	2019	Global Energy transformation: a roadmap to 2050	report				Global
Istituto di Economia e Politica dell'Energia e dell'Ambiente	Croci, E. et al.	2016	Promuovere l'efficienza energetica negli edifici. Guida pratica per gli amministratori comunali.	Report	Residential buildings, Public buildings, Non-residential buildings	Real estate market	Public real estate assets, Financing measures	Italy

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Istituto di ricerca economica della Camera di commercio di Bolzano	Klammsteiner, U. & Untertrifaller, E.	2016	Analisi costi - benefici di un intervento di riqualificazione energetica sull'esempio della scuola elementare "Josef Gasser" di Novacella, Varna	Report	Public buildings	Demand, Energy performance, Programmes	Cost-benefit analysis	Italy
Joule Assets Europe Gorup	n.a.	2017	The White Paper on Opportunities and Challenges in the Italian Energy Efficiency Market	Report	Non-residential buildings	Residents, Energy performance, Supply, Demand, Programmes	Tax reductions, eQuad market, Financing	Italy
Journal of Energy Resources Technology	Cagno, E. & Trianni, A.	2012	Analysis of the Most Effective Energy Efficiency Opportunities in Manufacturing Primary Metals, Plastics, and Textiles Small- and Medium-Sized Enterprises	Research paper	Other	SMEs, Industry, Demand, EU Policy, EU Regulation	energy efficiency opportunities, manufacturing, small medium enterprises	EU27
KPMG	n.a.	2017	European Power & Utilities Report	Report	Financial institutions	EU Policy, EU Regulation, Market-based mechanisms	Electricity prices, Capital markets, M&A, Energy utilities	EU27
KPMG	n.a.	2018	European Power & Utilities Report. Q2 2018.	Report	Other, Financial institutions	EU Policy, EU Regulation, Market-based mechanisms	Regulatory system, Capital markets	EU27
KPMG	n.a.	2019	European Power & Utilities Report. Q3 2018.	Report	Other, Financial institutions	EU Policy, Market-based mechanisms, EU Regulation	Regulatory systems, Capital markets	EU27
Market Research Reports	n.a.	2019	Energy & utilities market research reports, analysis & trends	Other	Financial institutions	Market-based mechanisms	Energy and utilities	Global
MarketWatch	n.a.	2019	Blockchain in Energy Utilities Market: Industry	Other	Other	Market-based mechanisms	Blockchain	Global

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
			Outlook, Size & Forecast 2018-2024					
Microsoft	DiCaprio, T.	2013	The Microsoft carbon fee: theory & practice. Microsoft Corporation.					
Middlesex University	Vickers, I., Vaze, P. et al.	2009	Final Report for BERR Enterprise Directorate: SMEs in a Low Carbon Economy					
Milken Innovation Center	n.a.	2016	Financing Green Building in Residential Development	Report	Residential buildings	Renovation, Residents, Programmes, Market-based mechanisms	Green buildings, Financing	Other
Ministerio de Agricultura y Pesca, Alimentacion y Medio Ambiente	n.a.	2016	Estrategia de adaptación al cambio climático de la costa española	Other	Other	Industry	Climate change adaptation	Spain
Ministerio de Agricultura y Pesca, Alimentacion y Medio Ambiente	n.a.	2017	Plan Nacional de Calidad del AIRE 2017-2019 (Plan Aire II)	Other	Residential buildings, Non-residential buildings	Industry	Air quality, Transport	Spain
Ministerio de Agricultura, Alimentacion y Medio Ambiente	n.a.	2014	PIMA Transporte	Other	Other	Programmes	Transport	Spain
Ministerio de Agricultura, Alimentacion y Medio Ambiente	n.a.	2015	Plan Estatal Marco de Gestión de Residuos (PEMAR)	Other	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Residents, Programmes	Waste policy	Spain

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Ministerio de agricultura, alimentación y medio ambiente	n.a.	2015	Plan de Impulso al Medio Ambiente en el sector de la empresa «PIMA Empresa»	Other	Other	Industry, Supply	Carbon credits	Spain
Ministerio de Economia, Industria y Competitividad	n.a.	2017	Plan estatal de investigación científica y técnica y de innovación 2017-2020	Other	Other	Programmes	Climate change, Bioeconomy	Spain
Ministerio de Energia, Turismo y Agenda Digital	n.a.	2017	Plan nacional de acción de eficiencia energética 2017-2020	Policy Study	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Industry, Residents, Programmes	Energy savings	Spain
Ministerio de Fomento	n.a.	2018	Plan Estatal de Vivienda 2018-2021	Other	Residential buildings	Renovation, Residents, Programmes	Sustainable residential buildings, Urban and rural renovation	Spain
Ministerio de Fomento & Ministerio de Medio Ambiente y Medio Rural y Marino	n.a.	2009	Estrategia española de movilidad sostenible	Other	Other	Demand, Supply	Transport, Sustainable mobility	Spain
Ministerio de Hacienda y Administraciones Publicas	n.a.	2014	Programa Operativo de Crecimiento Sostenible 2014-2020	Other	Other	Industry, Supply, Demand	Sustainable transport, Water quality, Sustainable urban development, Low carbon economy	Spain

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Ministerio de Industria, Comercio y Turismo	n.a.	n.a.	Proyecto GEO Mincotur. Plan Anual de Objetivos de la Subsecretaria - 2019.	Presentation	Other		None	Spain
Ministerio de Industria, Energia y Turismo	n.a.	2015	Estrategia de Impulso del vehículo con energías alternativas (VEA) en España	Presentation	Other	Industry	Vehiculos con energias alternativas	Spain
Ministerio de Industria, Turismo y Comercio & Instituto para la Diversificacion y Ahorro de la Energia	n.a.	2015	Resumen del Plan de Energías Renovables 2011-2020	Other	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Residents, Programmes, Supply, Industry, Demand	Renewable energy	Spain
Ministerio de la Presidencia	n.a.	2013	Plan de Impulso al Medio Ambiente en el sector hotelero PIMA Sol	Other	Commercial property	Renovation, Programmes, Industry	Tourism buildings renovation	Spain
Ministerio de la presidencia, relaciones con las cortes e igualdad	n.a.	2019	Plan de Contratación Pública Ecológica de la Administración General del Estado, sus organismos autónomos y las entidades gestoras de la Seguridad Social (2018-2025)	Other	Public buildings	Industry, Supply	Public procurement	Spain
Ministerio de Medio Ambiente	n.a.	2007	Estrategia española de cambio climático y energía limpia horizonte 2007- 2012 -2020	Other	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Residents, Industry, Supply, Programmes	Climate change, Clean energy,	Spain

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Ministerio para la Transicion Ecologica	n.a.	2018	Tendencias y Políticas de Eficiencia Energética en España	Report	Residential buildings, Non-residential buildings	Residents, Industry	Transport, Energy consumption	Spain
Ministerio para la Transicion Ecologica	n.a.	2018	Plan PIMA FRÍO	Other	Commercial property	Industry, Programmes	Commercial property cooling	Spain
Ministerio para la transición ecológica y el reto demográfico	n.a.	2020	Obligaciones de aportacion al Fondo Nacional de Eficiencia Energetica 2020	Other	Other	Supply, Industry	Energy savings	Spain
Ministerio para la Transición Ecológica y el Reto Demográfico	n.a.	2020	Borrador actualizado del plan nacional integrado de energía y clima 2021-2030	Other	Residential buildings, Public buildings, Non-residential buildings	Demand, Supply, Residents, Programmes, EU Policy, EU Regulation	Climate change adaptation, Decarbonisation	Spain
Ministero dell'ambiente e della tutela del territorio e del mare	n.a.	2014	Strategia Nazionale di Adattamento ai Cambiamenti Climatici	Other	Residential buildings, Non-residential buildings	Industry, Programmes	Urban planning, Transport	Italy
Ministero dello sviluppo economico	Mallone, M.	2017	Finanziare la riqualificazione energetica degli edifici in Italia, Croazia and Slovenia	Presentation	Residential buildings	Market-based mechanisms, EU Policy	Financing of the energy requalification	Other
Ministero dello Sviluppo Economico and Ministero dell'ambiente e della tutela del territorio e del mare	n.a.	2017	Strategia Energetica Nazionale	Other	Residential buildings, Non-residential buildings	Residents, Industry	Renewable energy, Transport, Energy security, Coal phase out	Italy
Ministerstvo životního prostředí	Hrbek, J.	2020	Aktuální stav administrace	Presentation	Other		n.a.	Czech Republic

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Ministerstvo životního prostředí	n.a.	n.a.	Finanční bilance zdrojů a závazků programu Nová zelená úsporám	Presentation	Other		n.a.	Czech Republic
Ministry of Economic Development, Ministry of the Environment and Protection of Natural Resources and the Sea and Ministry of Infrastructure and Transport	n.a.	2019	Integrated national energy and climate plan	Other	Other	Supply	Renewable energy, Greenhouse emissions, Energy security	Italy
Ministry of Economy, Trade and Industry	n.a.	2015	Promoting Energy Efficiency in Small and Medium Sized Enterprises (SMEs) and Waste Heat Recovery Measures in India	Report	Financial institutions	SMEs, Demand, Supply, Industry	Waste heat recovery, Energy efficiency in SME	Other
National Agency for Energy Efficiency	n.a.	2018	Energy Efficiency trends and policies in ITALY	Policy Study	Residential buildings	Industry, Programmes	Buildings, Transport, Agriculture	Italy
Observatório da Energia	n.a.	2020	Energia em Números - Edição 2020	Report	Residential buildings, Non-residential buildings	Industry, Demand, Supply, Residents	Transport, Consumption, Services, Energy prices, Energy balances	Portugal
Odysse-mure	n.a.		Odyssee-Mure Energy Efficiency Trends in Buildings	other				Global
OECD	N.a.	2015	Infrastructure Financing Instruments and Incentives.	Report				Global

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
Oficina Española de Cambio Climático & Centro Nacional de Educacion Ambiental	n.a.	n.a.	The Spanish National Climate Change Adaptation Plan	Report	Residential buildings	Programmes	Climate change adaptation	Spain
PAE	n.a.	2017	Italian Energy Efficiency Action Plan	Other	Residential buildings, Public buildings, NZEB	Industry, Supply, Residents, Programmes	Energy audits, Heating and cooling, Transport	Italy
Polish Bank Association	Meluch, B.	n.a.	SR7 – Launch and facilitate the implementation of a new EEFIG working group on "Monitoring and communication of the evolution of financing practices for energy efficiency in buildings and in industry"	Other	Residential buildings, Non-residential buildings	Industry, Residents	Financing practices	Poland
Prognos AG, Fraunhofer ISI, ifeu & Dr.. Marc Ringel GbR	Weinert, K. et al.	2018	Grundsatzstudie Energieeffizienz	Policy Study	Residential buildings, Non-residential buildings, Commercial property, Public buildings	Industry, Renovation, Residents, Energy performance	NAPE	Germany
PwC	n.a.	2019	2017 Power and Utilities Trends	Report	Other	Demand	Industry	Global
QualitEE	Keegan, N.	2018	Country report on the energy efficiency services market and quality	Report	Residential buildings, Non-residential buildings, Public buildings, Commercial property	Energy performance, Supply, Programmes	Energy efficiency services, Energy performance contracting, Energy supply contracting	UK

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
REENAG Holdings	Braumann, W.	2020	A short comment for studies on the EE potential for buildings and industry in Austria	Other	Residential buildings, Non-residential buildings, Public buildings	Programmes, Industry	Energy audits, Energy efficiency measures	Austria
Research gate	Zuoza, A. & Pilinkienė,	2018	Barriers of industrial energy efficiency	Policy Study				Lithuania
Research gate	L. G. Hein and K. Blok	1995	Transaction costs of energy efficiency improvement," in The energy efficiency challenge for Europe.	Research paper				
Romanian Energy Regulatory Authority	n.a.	2015	Energy efficiency legislative framework in Romania	Report	Other	EU Policy, EU Regulation	Legislative framework	Romania
Scottish Government	n.a.	2019	Energy Efficient Scotland	Report	Residential buildings	Certification, Residents, Market-based mechanisms	Energy Performance Certificate ratings, Exemptions to the standards, Minimum standards	Other
Springer	Sequeira, M. & Joanaz de Melo, J.	2020	Energy saving potential in the small business service sector: case study Telheiras neighborhood, Portugal.	Research paper	Commercial property	Demand, Programmes	Service and commerce sector, Small and medium enterprises, Local case study, Drivers and barriers	Portugal
Springer Science	Catarino, J. et al.	2015	Portuguese SME toward energy efficiency improvement	Research paper	Non-residential buildings	Industry, SMEs, Demand	Industrial energy efficiency, Barriers, Energy	Portugal

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
							management practices	
Start2Act	n.a.	n.a.	Fund your project: Green finance for startups	Other	Other	Industry	Start-up, Green financing, Energy efficiency equipment	EU27
State of Green	n.a.	2018	Energy Renovation of Buildings	Report	Residential buildings	Real estate market, Residents, Programmes, Certification, Energy performance, Tools	Energy labelling of buildings, Energy renovation, Non-profit housing	Other
State of Green	n.a.	2018	From policy to action - Implementation of the European Energy Union	Report	Residential buildings, Public buildings, Non-residential buildings	Market-based mechanisms, Supply, EU Regulation, EU Policy	EU Energy system integration, Clean energy, Sustainable heating and cooling, Sustainable transportation	EU27
STUNNING	Marchi, F. et al.	2018	Deliverable 5.1. Report on the scenario identified.	Other	Residential buildings, NZEB	Programmes, EU Policy, EU Regulation, Market-based mechanisms, Renovation, Residents	One-Stop-Shop, ESCO, Product Service System	EU27
SWECO	Iversen, J. et al.	2018	Den energieffektive og intelligente bygning i det smarte energisystem. Baggrundsrapport 2 – Analyse af potentiale for samspil mellem bygninger og forsyningssystem	Report	Residential buildings, Non-residential buildings, Public buildings	Residents, Supply	Det smarte energisystem, Forsyningssystemer	Denmark
SWECO & Ea Energianalyse	n.a.	2018	Energieffektive og intelligente bygninger i et	Report	Residential buildings, Non-	Residents, Supply	Fleksibelt energisystem	Denmark

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
			smart energisystem. Baggrundsrapport 3 – bygningers mulige bi drag til et fleksibelt energisystem.		residential buildings, Public buildings			
The European Business Review	n.a.	2019	3 European startups fight against climate change	Other	Other	Industry	Start-up	EU27
The European Energy Efficiency Fund	n.a.	2017	Advancing Sustainable Energy for Europe. Annual Report 2017.	Report	Other	Programmes, EU Policy	Financial arrangements, Low-carbon agenda	EU27
The Polish National Energy Conservation Agency	n.a.	2012	Energy Efficiency Policies and Measures in Poland	Report	Residential buildings	Industry, Supply, Demand, Programmes	Transport, Services, Energy efficiency measures	Poland
The Regulatory Assistance Project	Sunderland, L.	2019	Learning from the Czech Republic on using EU ETS revenues for residential renovations	Report	Residential buildings	Renovation, Residents, EU Policy, EU Regulation	Carbon revenue recycling, EU ETS	Czech Republic
The Research and Statistical Education Centre	n.a.	2018	Development of methodology and realisation of a survey of a scale of thermo-modernization activity in multi-dwelling residential buildings in order to improve their energy consumption and estimation of needs and plans in this area	Report	Residential buildings	Residents	Thermo-modernization	Poland
Tracxn	n.a.	2018	Tracxn sector report. Energy efficiency.	Presentation	Other	Industry, Market-based mechanisms	Investments	Global
TrustEE	n.a.	2019	Financing and realising energy efficiency and renewables in industry	Presentation	Financial institutions	SMEs, Industry, EU Policy, EU Regulation	Renewable energy, Financing	EU27

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
University	Hill, D.	2019	Energy Efficiency Financing: A review of risks and uncertainties.	Research paper	Financial institutions	Market-based mechanisms	Energy efficiency financing, Investment risks, Market barriers	Global
University	Di Foggia, G.	2016	Effectiveness of Energy Efficiency Certificates as Drivers for Industrial Energy Efficiency Projects	Research paper	Other	Energy performance, Certification	Energy Efficiency Certificates, Energy Efficiency, Energy Policy, Payback Time, Energy Performance Contract	Global
University	Robins, N. et al.	2020	Financing climate action with positive social impact. How banking can support a just transition in the UK.	Policy Study	Financial institutions	Programmes, Market-based mechanisms	Just transition, Banking	UK
Watt-IS	n.a.	n.a.	Energy Efficiency Services to SMEs, "The neglected middle"	Other	Other	SMEs, Demand	Energy efficiency services	n.a.
WBG, the MDBs and IMF	n.a.	2015	Catalogue of the MDBs and the IMF Financing Solutions	Report	Financial institutions	Market-based mechanisms, Non-EU, Programmes	Development financial solutions	Other
Wilson Sonsini Goodrich & Rosati	Kim, C.	2014	Innovations and Opportunities in Energy Efficiency Finance	Report	Financial institutions	Non-EU, Programmes, Market-based mechanisms	Energy Efficiency Finance Structures, Energy or Efficiency Services Agreements, Managed Energy Service Agreement, Property Assessed Clean Energy	USA

Org.	Auth.	Year	Title	Type	Sector	Pre-defined Keywords	Keywords	Geographical Coverage
World Bank	n.a.	2015	Financing renewable energy. Options for Developing Financing Instruments Using Public Funds.	Report	Financial institutions	Market-based mechanisms	Financial instruments	Global
World Bank	Taylor, R. et al.	2008	Financing energy efficiency. Lessons from Brazil, China, India and beyond.	Report	Financial institutions	Non-EU, Market-based mechanisms	Energy efficiency financing	Other
World Bank & Energy Sector Management Assistance Program	n.a.	2016	Energy Efficiency Financing Option Papers for Georgia	Report	Financial institutions	Non-EU, Programmes, Tools, Market-based mechanisms	Energy efficiency plans, ESCO	Other
WWF	Duwe, M. & Stockhaus, H.	2019	Klimaschutzgesetze in Europa	Policy Study	Other	EU Policy, EU Regulation	Klimaschutzgesetze	EU27
WWF	Schäfer, M.	n.a.	Stellungnahme des WWF Deutschland zum Gesetzentwurf der Fraktionen der CDU/CSU zum Entwurf eines "Gesetzes zur Einführung eines Bundes-Klimaschutzgesetzes und zur Änderung weiterer Vorschriften"	Other	Other	EU Policy, EU Regulation	Klimaschutzgesetze	Germany

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