European Commission

Clean energy
for all Europeans

Good practice in energy efficiency

For a sustainable, safer and more competitive Europe

#EnergyUnion #EnergyUnion #EnergyUnion

Energy

GOOD PRACTICE IN ENERGY EFFICIENCY
For a sustainable, safer and more competitive Europe

European Commission
Directorate-General for energy
1049 Brussels
BELGIUM

Europe Direct is a service to help you find answers to your questions about the European Union.

Freephone number (*):
00 800 6 7 8 9 10 11

(*) The information given is free, as are most calls (though some operators, phone boxes or hotels may charge you).

More information on the European Union is available on the internet (http://europa.eu).

Photo on p. 1: © European Union, 2016

Print	ISBN 978-92-79-65332-2	doi:10.2833/865683	MJ-01-17-061-EN-C
PDF	ISBN 978-92-79-65331-5	doi:10.2833/75367	MJ-01-17-061-EN-N

Luxembourg: Publications Office of the European Union, 2017

© European Union, 2017
Reproduction is authorised provided the source is acknowledged.

The views expressed in this study are those of the authors and do not necessarily reflect the views of the European Commission or of its services.

Printed by Bietlot in Belgium

PRINTED ON ELEMENTAL CHLORINE-FREE BLEACHED PAPER (ECF)

The Paris Agreement has now entered into force, and with it, we have accelerated the transition towards a clean, smart and secure energy system. The implementation of our Paris commitments is now our highest priority.

We are building on our 2030 climate and energy goals to reduce green-house gas emissions, to promote the deployment of renewable energy and to achieve significant energy savings.

Turning our commitments into concrete actions will be a considerable challenge: after all, two thirds of greenhouse gas emissions result from energy production and use alone. But if we want to succeed in our endeavour and meet our ambitious climate and energy objectives, we need to take action to reduce energy consumption.

The cheapest energy, the cleanest energy, the most secure energy is the energy that is not used at all. Energy efficiency needs to be considered as a source of energy in its own right. It is one of the most cost effective ways to support the transition to a low carbon economy and to prompt further investment opportunities and to create growth and employment.

That is why the European Commission is promoting ambitious policies that will put energy efficiency first. And that is why the Commission has proposed to increase the ambition level for energy efficiency to the level of 30% binding at EU level.

An ambitious approach to energy efficiency is needed across all the sectors. This is particularly true for the buildings' sector, which represents 40% of energy used in the EU and where is a considerable cost effective energy saving potential.

The construction industry provides 18 million direct jobs in Europe and accounts for 9% of our GDP and SMEs contribute more than 70% of the value added in the EU building sector. Renovating and retrofitting buildings adds almost twice as much value as the construction of new buildings.

Increasing the rate, quality and effectiveness of building renovation will be a great challenge for the coming decades. After all, two thirds of our buildings were built before energy performance standards even existed. And when you put that next to renovation rates of around only 1% per year, you see how big the challenge is.

We want to change this situation. This is why we have proposed an update to our Energy Performance in Buildings Directive and launched a Smart Finance for Smart Buildings Initiative to help finance renovation and retrofitting in our largely inefficient housing stock.

These measures will help us double renovation rates to at least 2% annually, with changes to buildings' energy performance rules and with the support of financing instruments, which will be supported under the Smart Finance for Smart Buildings Initiative.

Moreover, this initiative will build upon the Investment Plan for Europe and the European Structural and Investment Funds, helping us to unlock private financing to renovate and retrofit in our largely inefficient housing stock. Combining private investments with public financing that leverages private investments and addresses market failures is crucial. Sustainable energy renovation in buildings is an area where pooling of projects and public guarantees can make a huge difference.

And it will also lead to a more effective use of public funds, supporting project aggregation and assistance and rolling out de-risking activities to help investors and financiers better understand the true benefits and risks of energy efficiency investments.

The Paris Agreement gives a clear and ambitious direction of travel for investment into low carbon solutions. Being ambitious and putting energy efficiency first will bring down costs for consumers, reduce our import dependency and redirect investments towards the kind of infrastructures that are smart, secure and sustainable.

Miguel Arias Cañete
European Commissioner for Climate Action and Energy

Introduction > 3

#1 Cross-cutting measures to support energy efficiency > 6

#2 Energy efficiency in buildings > 10

#3 Energy efficiency in industry, businesses and services > 20

#4 Energy efficiency of products > 28

#5 Setting the right public policy framework > 32

#6 Unlocking financing for energy efficiency investments > 38

Glossary > 48

N.B. An online version of this brochure including hyperlinks is available on the Europa website.

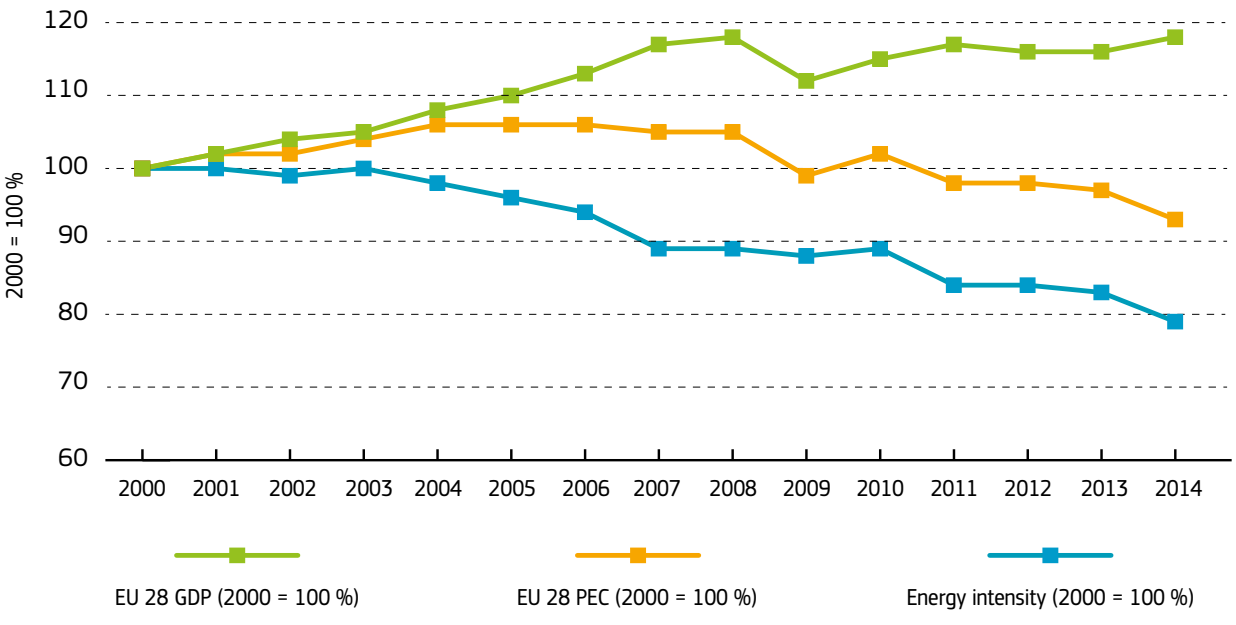
Introduction

Huge improvements in energy efficiency are occurring across the European Union. Energy efficiency policies are delivering in terms of reducing consumption, safeguarding Europe's security of supply, reducing CO_2 emissions, creating jobs and saving money for consumers. All this brings monetary and non-monetary benefits to Europe's industry and consumers, including those experiencing energy poverty. As discussed in a variety of literature on 'sustainable growth', energy efficiency can counter the adverse effects of economic downturn and lead to economic growth. Several Member States' energy efficiency action programmes actively rely on this macro-economic benefit to the economy.

The European Union has successfully managed to decouple energy demand and economic growth. In short, this means reduction in energy use is not linked to a reduction in the economic or industrial activity. The economy can now grow while energy is being saved.

Today we are seeing so-called 'energy intensity' [1] levels fall. This fall is due to several factors, including structural changes to the economy and advances in technology. But it is also a result of new national and European energy efficiency policies that have played a key role in reducing energy consumption across the bloc.

Figure 1: Gross Domestic Product (GDP), Primary Energy Consumption (PEC) and energy intensity in the European Union from 2000 to 2014



Source: Eurostat

(1) Energy intensity is the primary energy consumption divided by GDP.

These policies include the Directive on Energy Performance of Buildings, which sets out mandatory efficiency standards for all new buildings and for deep renovations. It has resulted in significant improvement of energy performance standards for new constructions and renovations.

Energy labelling of household appliances and office equipment has increased consumer awareness of energy consumption and encouraged consumers to buy more energy efficient products. With the Ecodesign Directive, minimum energy efficiency standards have been introduced for product groups as a precondition to them being placed on the European market. Both policies encourage industry to come up with new products complying with or exceeding the minimum standards and led to a clear pull-factor for energy efficient appliances on the European market, as well as saving up to EUR 490 per household per year.

The Energy Efficiency Directive has placed an obligation on Member States to achieve new energy savings each year[2] and has been a key driver for enhanced energy efficiency across different sectors of the economy.

This brochure presents examples of good practice from policy implementation, technology development and investment in energy efficiency across different sectors and throughout all 28 Member States.

The large body of evidence for this document on successful policies and measures was provided among others by: Concerted Actions on the Energy Efficiency Directive and on the Energy Performance of Buildings Directive, the *ODYSEE-MURE* project, which developed databases on energy efficiency measures and policies across the EU and, the *EEW3* project, which produced 10 specific case studies of good policy practice carried out by Member States, providing market feedback from experts, business stakeholders, and local and regional actors.

(2) Corresponding to 1.5 % of the annual energy sales to final consumers.

#1 Cross-cutting measures to support energy efficiency

#1 Cross-cutting measures to support energy efficiency

Energy efficiency obligations

In order to trigger energy savings among consumers, Article 7 of the Energy Efficiency Directive (EED) requires to put in place so-called Energy Efficiency Obligation Schemes (EEOSs). These schemes require energy companies to achieve energy savings at the level of 1.5 % of their annual energy sales to final consumers by implementing energy efficiency measures. Alternatively, countries may introduce other policy measures to stimulate energy savings.

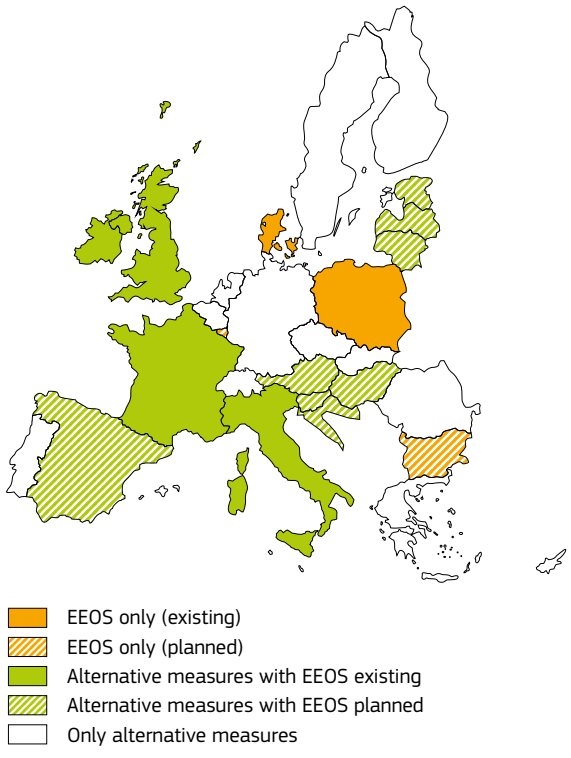
EEOSs target energy suppliers, retailers and distributors as these groups are best placed to identify and carry out energy savings with their customers.

By now, all Member States have submitted their 2020 saving targets. It is estimated that these savings will amount to 230.2 Mtoe, of which EEOSs are expected to deliver 86 Mtoe[3].

In addition, some 480 energy saving measures have been recorded to fulfill Article 7 requirements across the European Union[4]. The cumulative savings expected from these measures are: EEOSs – 34 % of total cumulative savings; financing schemes or fiscal incentives – 19 % or 49 Mtoe; and energy or CO_2 taxes – 14 % or 34 Mtoe[5] (Figures 2 and 3).

A good example of a successful EEOS can be seen in Italy. The country has tradable White Certificates in place that are linked to the provisions on energy manager obligations in industry. Certificates can be generated by energy managers implementing savings measures in industry, thus creating incentives for putting energy management systems in place. More than 14 000 projects were completed and 5 million White Certificates issued, resulting in EUR 600 million in investment during 2013. The industry sector has as a result become active in the EEO system.

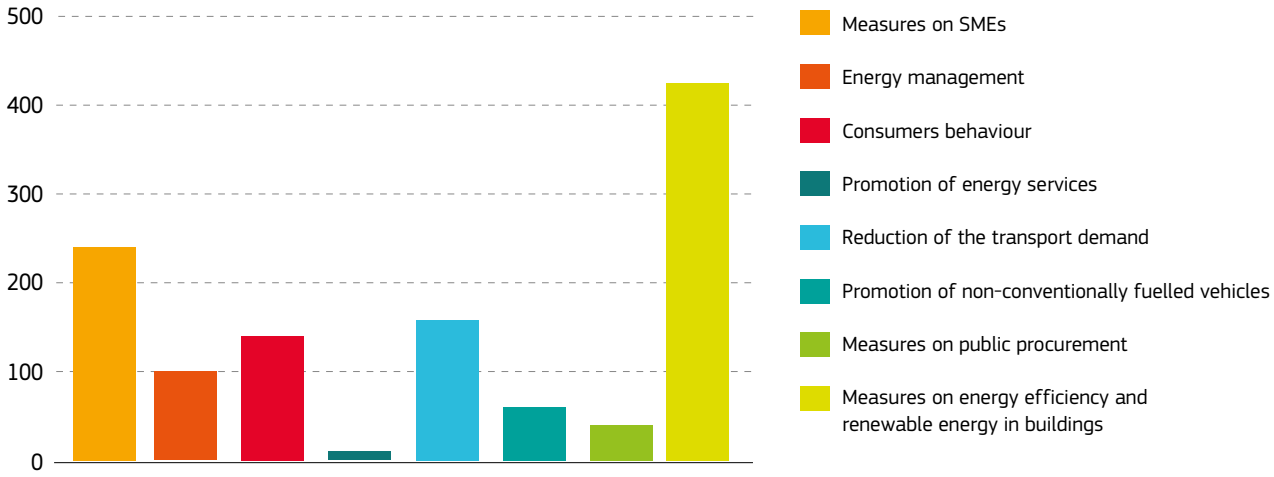
Figure 2: Status of Article 7 EED measures



Source: Ricardo AEA/CE Delft (2016)

(3) On Europa: Obligation schemes and alternative measures.
(4) 361 measures are documented in detail in the Odysee Mure database. Available here.
(5) Ricardo AEA/CE Delft (2016): Study on evaluating the implementation of Article 7 of the EED.

Figure 3: Energy efficiency measures in place in the EU 28 – distribution per topic and target group (2016)



Source: data from MURE database

Meanwhile, the French Energy Saving Certificates brought the EEOS closer to the consumers by offering incentives such as low interest loans for investments in energy saving measures and rebates. Also, a number of hypermarkets and DIY (Do It Yourself) stores granted rebates to their customers via 'prime énergie' vouchers, which were exchanged against invoices for energy performance works.

From 2011 to 2014, 1 million energy efficient individual boilers, 480 000 wood burning/biomass stoves and collective boilers in 400 000 apartments were installed across France. It is expected that the scheme will trigger some EUR 3 billion worth of investment between 2014 and 2017.

The Concerted Action EED, which provides Member States with best practice so that they can implement the Directive effectively, analysed EEOSs in detail and produced a number of reports and presentations [6].

The *ENSPOL* [7] project, which cross-analysed various EEOSs across the European Union, resulted in three important conclusions, which should be noted when implementing future EEOSs.

The first conclusion is that an effective EEO needs to achieve a balance between rules and procedures that are simple enough for obliged parties to work with, while being complex enough to meet requirements for additionality, flexibility, auditability and transparency.

The second states that policy-makers must avoid setting up barriers by focusing on attainable targets. And the final conclusion recommends that technology and energy service providers should be oriented towards long-term solutions.

Smart metering and billing: increasing consumer awareness

The EED aims at making consumers more aware of their actual energy consumption so that they can change their behaviour to save energy.

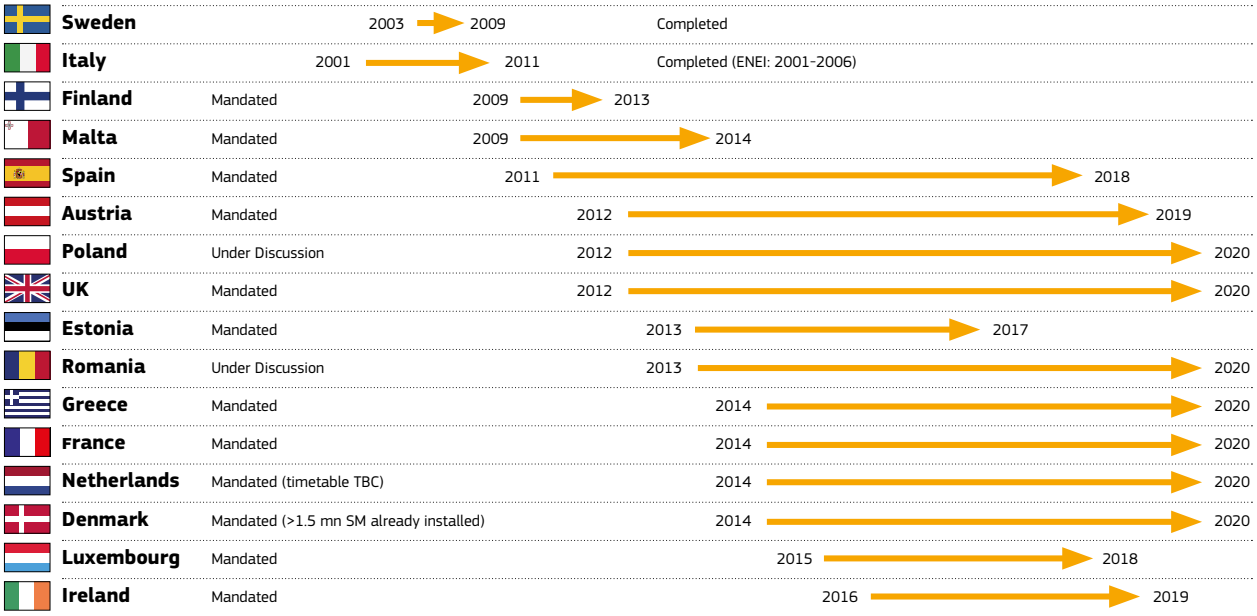
Real time direct feedback on energy consumption is vital to harness the full energy savings potential of smart meters.

Articles 9 to 11 of the EED look at installing smart meters across the European Union and, consequently, most Member States have started large-scale rollout programmes. According to the European Commission, 195 million electricity smart meters will be installed in 16 Member States by 2020.

In addition, 45 million smart gas meters will be installed in seven Member States with more countries being added by 2020 (Figure 4).

(6) CA EED – Core theme 8. http://www.ca-eed.eu/themes/obligation-schemes-and-monitoring-ct8
(7) Project funded under H2020 SC 3: www.enspol.eu

Figure 4: Roll-out timing of smart metering in EU Member States



Source: Odyssee Mure (2015)[8] based on European Commission data (2014)[9]

Several projects from Intelligent Energy Europe and Horizon 2020 – Energy Efficiency are helping consumers to save energy by focusing on innovative billing and smart metering[10].

The *EMPOWERING*[11] project is one such example as it provided consumers with useful information to save both energy and money. The project managed to do this by developing a comprehensive, flexible approach to billing, while creating open source software tools.

Although an outright success, the project showed how difficult it is to engage consumers and that feedback on energy consumption should be tailored to the end user.

Energy consumption data is useful for decision makers wanting to introduce policy measures at national level. For example, in Italy, the *MESHARTILITY*[12] project is developing online tools that will enable energy utility companies and local authorities to share energy data easily. These tools will ultimately help cities across the country and beyond develop Sustainable Energy Action Plans (SEAPs).

Lessons learnt

> Article 7 of the EED has been a key driver for enhanced energy efficiency action that results in tangible energy savings, economic, social and environmental benefits, developing new business models for suppliers and the delivery of cost efficient energy efficiency services at competitive prices.

> The successful implementation of EEOSs depends on channelling measures to a targeted group of end-users and building synergies with other measures or programmes.

> Consumer engagement and acceptance is key to delivering energy savings by behavioural change.

> Energy consumption data can help consumers change their behaviour and become more energy efficient. It is also useful for policy-makers to effectively target, monitor and evaluate their measures and actions.

(8) European Commission, Borchard KD (2014): Benchmarking smart metering deployment in the EU. European Conference on Smart Metering Deployment in the EU, Brussels, 26 June 2014.
(9) Odyssee Mure (2015): Energy Efficiency Trends and Policies in the Household and Tertiary Sectors. An Analysis Based on the ODYSSEE and MURE Databases. Available here.
(10) See for example: SMARTREGIONS which ran until 2013: http://ec.europa.eu/energy/intelligent/projects/en/projects/smartregions#results
(11) http://iee-empowering.eu/
(12) http://www.meshartility.eu/

#2 Energy efficiency in buildings

#2 Energy efficiency in buildings

In 2014, European building stock accounted for 30% of the European Union's greenhouse gas emissions[13]. This equates to approximately 40% of the European Union's total energy consumption[14]. As the number of buildings is continuously rising, energy consumption and CO_2 emissions will also rise if energy performance minimum requirements are not applied.

Residential buildings dating between 1945 and 1980 are the major culprits as they consume the most of energy. As a result of the recent economic crisis, funds have been lacking to renovate these energy-sapping structures. However, to reach the European Union's energy efficiency targets, this situation needs to be addressed quickly.

As 18 million people work in the European Union's construction industry, improving the energy performance of building stock makes sense as it will spur economic growth and create jobs.

The Energy Performance of Buildings Directive (EPBD) combines provisions on minimum energy performance requirements with certifications, providing both a constraint and an incentive for buildings energy performance improvement. There is evidence of around 48.9 Mtoe additional final energy savings in 2014 compared to the 2007 baseline of the EPBD, and these savings have mainly happened within the scope of the Directive.

Targets for all new buildings to achieve nearly zero-energy consumption by 2020 have ensured a 'future-proof' vision for the sector and stakeholders have mobilised accordingly. However, the same level of ambition is needed for existing buildings. Significantly ncreasing the rate, quality and effectiveness of building renovation is the biggest challenge to overcome.

Due to the diversity and disaggregation of the building sector value chain, it is difficult to acquire reliable data on buildings energy use and the financial implications of renovation in terms of cost savings and asset values. This general lack of data has negative consequences on the market's perception of investments. It is the role of sustainable energy policy to help consumers undertake these investments more easily and to create better investment conditions.

More research and innovation is also needed. The Energy-efficient Buildings Contractual Public-Private Partnership initiative (EeB cPPP) is a platform that could play a key role here as it has already helped develop affordable breakthrough technologies and solutions for buildings.

Renovations

Long-term renovation strategies

It is important to have a long-term strategy in place when renovating national buildings stock. While legislation exists for improving energy performance in new constructions, there is currently none for existing buildings.

The *BUILD UPON*[15] initiative is a two-year Horizon 2020 project that aims to empower 1 000 key

(13) GHG emissions in the overall inland GHG emissions for Commercial/Institutional/Residential sectors. Source: Eurostat.
(14) Source: calculations based on Eurostat's data.
(15) www.buildupon.eu

Figure 5: Total Concept pilot building – Finland

Source: Total Concept

stakeholders – from governments and businesses, to NGOs and householders – across 13 countries, to shape the change needed in existing buildings.

By holding over 80 connected events in the capitals and major cities of the project countries throughout 2016 and 2017, *BUILD UPON* is creating a collaborative community to help countries design and implement national renovation strategies.

Key stakeholders from all 28 Member States are actively involved, and an innovative 'Regional Action Network' model is evolving to continue this work after the project is finished.

A Wiki tool called 'RenoWiki' has been developed to provide a quick overview of the diverse renovation initiatives in each country. National experts in each participating country are expected to familiarise themselves with best practice European renovation initiatives, broadening their knowledge that they can then share with others.

Promising stories of deep renovations

A renovation is considered deep if its total cost is higher than 25 % of the value of the building, or if more than 25 % of the surface of the building is being renovated. However, the definition of a deep renovation varies between Member States as there are various ways of interpreting its meaning. To counter any confusion, the *ZEBRA2020*[16] project developed a calculation method to compare national definitions, which has proved useful at European level.

An example of a successful deep renovation is the *Total Concept*[17] project, which has developed smart packages for the deep renovation of non-residential buildings (Figure 5). It did this by combining tailored energy efficiency measures to fulfil the profitability expectations of the investor.

The *Total Concept* method opens up new opportunities for property owners to carry out major energy performance improvement retrofitting in a profitable way. It also creates a market driver for the major refurbishment of existing buildings towards NZEBs.

The *Total Concept* blueprint has to date been used to successfully renovate 20 buildings in Sweden, Norway, Denmark, Finland and Estonia. Estimated energy savings after renovation range from 15 to 56 %.

Another project known as *LEAF* is overcoming the technical, practical and organisational barriers associated with energy efficiency improvements in apartment blocks with mixed ownership.

(16) www.zebra2020.eu
(17) www.totalconcept.info, www.youtube.com/watch?v=0ns1Uo5x6R4

The project developed a toolkit that explains the technical background and provides the means to support the decision-making and procurement process for energy-efficiency renovations in multi-owner buildings.

LEAF has helped improve energy efficiency in 24 case study buildings in six European countries. In Saint-Etienne, France, a building from 1951 was renovated, achieving energy savings of some 72 %[18].

Minimum energy performance requirements

The EPBD states that all Member States must take the necessary measures to ensure that minimum energy performance requirements for buildings or building units achieve cost optimal levels.

This cost-optimal[19] level refers to the energy performance level which leads to the lowest global cost during the estimated economic lifecycle. This means that when assessing cost efficiency of different packages of measures, the whole lifecycle should be considered and not just the up-front investment.

Setting ambitious requirements and showing a clear direction of progressive tightening of energy performance develops markets for the building industry and investors, while stimulating technology development and innovation.

Denmark was one of the first countries in the world to introduce nationwide energy efficiency standards for the energy use of buildings. Today it has one of the most ambitious energy performance standards for new buildings among comparable countries. The energy requirements in the Danish Building Regulation for new buildings have been tightened, using a step-by-step approach, preparing the Danish industry for future requirements almost 10 years in advance and introducing the new requirements as voluntary energy classes before they become mandatory.

France also provides a good practice example of step-by-step tightening of minimum energy performance requirements towards NZEB level and successful NZEB market introduction. NZEBs are called 'Low Consumption Energy Buildings' (BBC[20]) and were originally a quality seal for buildings with very low energy consumption. The aim was to extend this seal to all new constructions through the RT2012 regulation ('Régulation Thermique 2012'). The introduction of the 'BBC' label enabled the follow-up and scaling up of actions and best practices in NZEB before the requirements were extended to all new constructions.

A good example of embracing energy efficiency in buildings can be seen in the Brussels Capital Region, where all new buildings and large renovations must be built following passive house standards[21]. The Region has also introduced numerous initiatives to stimulate demand and enhance building supply.

For example, it launched the so-called 'Exemplary Buildings' call for proposals in order to stimulate new constructions and renovations. The winning projects received funding and expert support and not long after, buildings with extremely high energy and environmental performance started appearing across the Region.

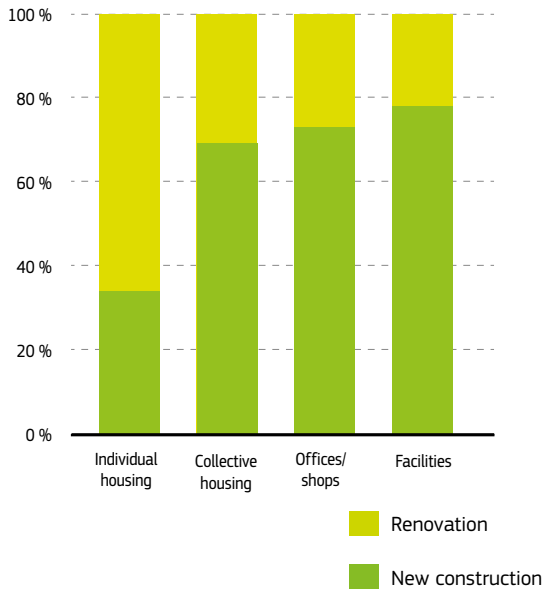
Six 'Exemplary Buildings' calls have resulted in more than 350 000 m² of new passive buildings, and 621 000 m² of newly constructed and renovated surfaces.

As a result of its valiant efforts, the European Commission awarded the Brussels Capital Region with the EU Sustainable Energy Award in 2012 (Figure 6).

(18) www.lowenergyapartments.eu
(19) The cost-optimal level shall lie within the range of performance levels where the cost benefit analysis calculated over the estimated economic lifecycle is positive {EPBD, Article 2 (14)}.
(20) *Bâtiments à Basse Consommation.*
(21) *Région de Bruxelles-Capitale – Brussels Hoofdstedelijk Gewest, Ministerie Van Het Brussels Hoofdstedelijk Gewest* N. 2011 – 2445 [C – 2011/31430], May 5, 2011.

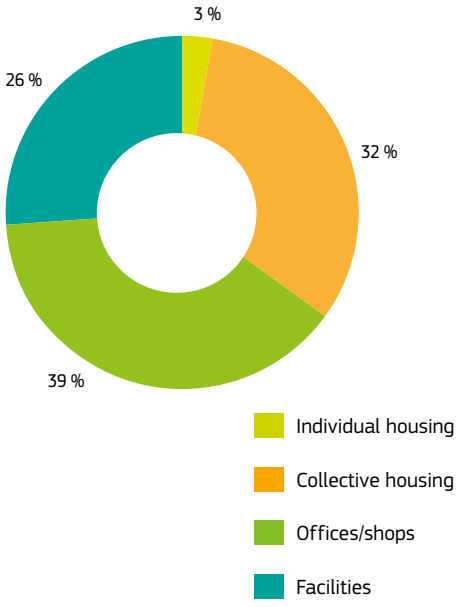
Figure 6: Results of five 'Exemplary Buildings' calls

> Surface area per sector over 6 years according to type of construction



Source: Bruxelles Environnement, Région de Bruxelles-Capitale

> Surface area per sector over 6 years



Source: Bruxelles Environnement, Région de Bruxelles-Capitale

Complying with energy performance requirements

Depending on the country, compliance with energy performance requirements is checked at different stages of the building process. Some Member States even check compliance several times during the building process. However, the compliance rate of new buildings with national NZEBs requirements is low in the European Union (Figure 7).

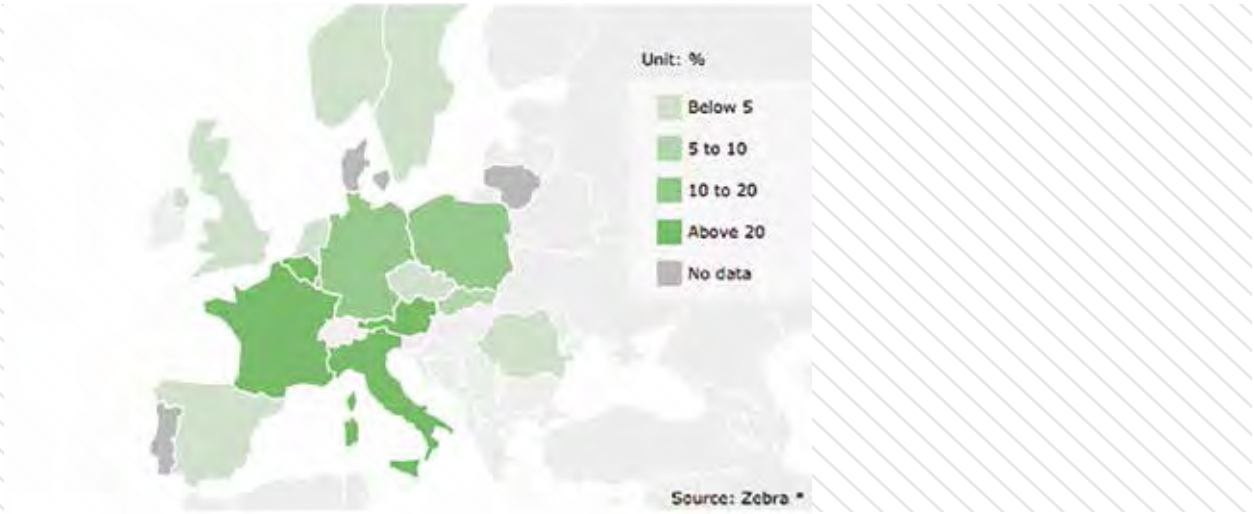
But there are some exceptions. The Flemish region hands out fines for energy performance requirements infringements, which has resulted in a 97 % rate of compliance since 2010.

The EPBD sets out minimum efficiency standards for new-builds or major renovations only. However, Scotland, England and Wales[22] have also introduced minimum standards for energy performance at the point of letting.

In Scotland, for example, housing associations are obliged to reach a 'D class' rating when letting out apartments or they must ensure that improvement work to reach this standard is carried out when a property is sold or leased to new tenants. The Government also wants all social housing in the country to have this rating or better by 2020.

(22) Energy efficiency and energy poverty are devolved matters in the UK.

Figure 7: Share of new dwellings built according to national NZEB definition (or better)



Source: Zebra 2020 project

Raising awareness of NZEBs

Information and communication campaigns aimed at the public are essential for the rapid introduction of NZEBs.

The *AIDA*[23] project is a good example of such a campaign, which promoted the uptake of NZEBs in Europe by targeting municipalities and building professionals. The project was successful in informing and engaging over 3 000 municipality representatives and building professionals by disseminating NZEB case studies and by organising study tours to NZEB buildings.

In addition, more than 1 500 architects and builders were trained in the Integrated Energy Design process via a software tool which was available on the *AIDA* website.

Energy Performance Certificates

Energy Performance Certificates (EPCs) inform prospective owners and tenants about the performance of specific buildings and systems. EPCs also offer recommendations on how to improve energy performance.

Making EPCs more user-friendly

Some Member States have tried to make their EPCs more user friendly. In the United Kingdom, the EPC layout was revamped in 2012 to do just this (Figure 8).

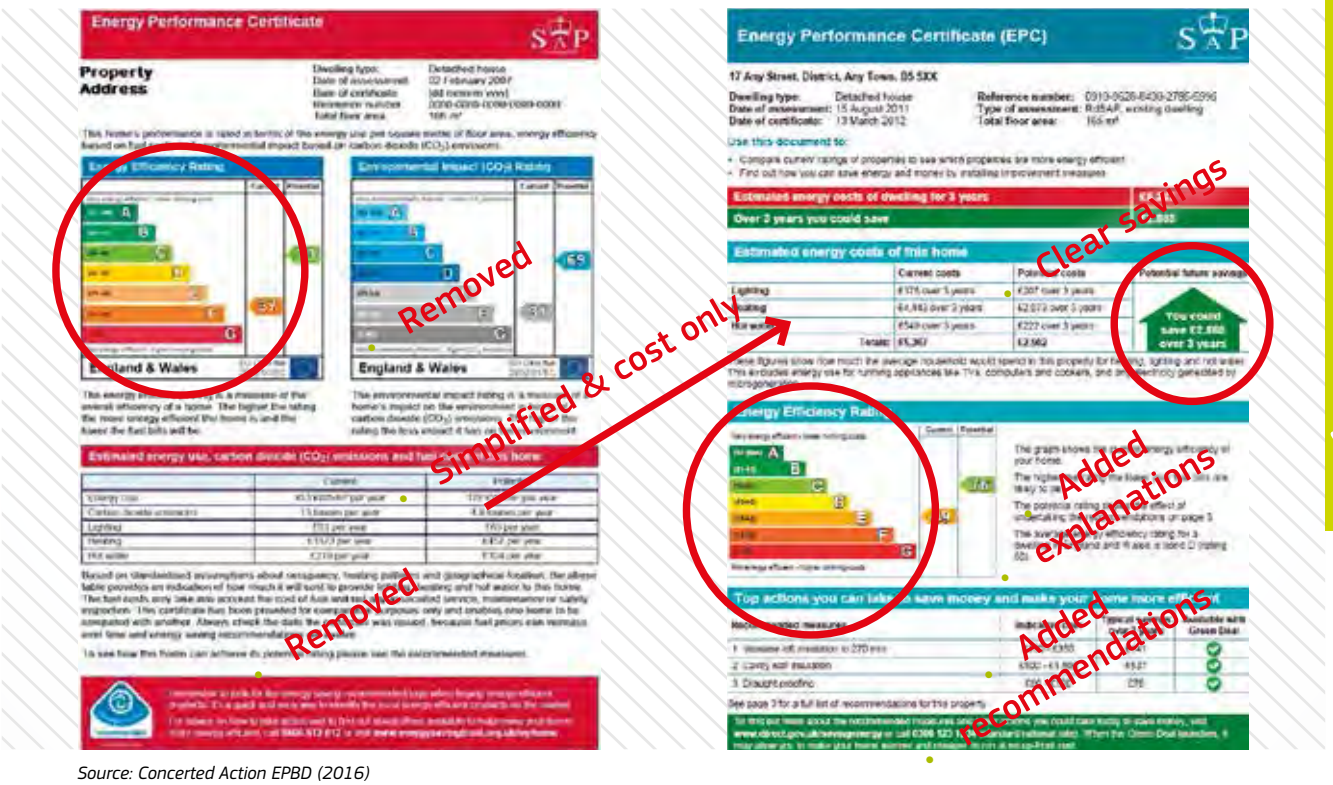
Accessing EPC data via databases

Databases containing information on building certification and systems inspections have the potential to become an excellent source of information on the energy performance of buildings. EPC schemes could be used for mapping and monitoring the national and European building stock. These schemes could also help in assessing real market investment needs and the potential for energy efficiency improvements in the building sector[24].

In fact, Ireland has in the past used information from certificates and reports, which has aided policy interventions. In 2008, the country launched a pilot grant

(23) www.aidaproject.eu
(24) EPCs across the EU, 2014, BPIE.

Figure 8: The old and new Energy Performance Certificates in the United Kingdom



Source: Concerted Action EPBD (2016)

scheme for home energy efficiency upgrades based on before and after EPC data, combined with EPC data modelling and an analysis of sample energy bills. This data was used for developing a full grant scheme.

In Portugal, the EPC database is used to both verify the effectiveness of some energy efficiency policies and to measure the impact of new regulations and energy performance improvements including those on public buildings. It also helps to identify and analyse the financial cost and potential savings from the recommendations stated in the EPC.

Cross-cutting issues

Developing a single energy performance calculation methodology

There are currently 35 different national and regional methodologies to calculate the energy performance of buildings, which is in line with the subsidiarity principle and flexibility allowed by the Energy Performance of Buildings Directive. However, this may prevent national comparisons of building performance, and investments in building renovation. This might also contribute to market fragmentation and limit similar technologies being used in multiple European countries.

An harmonised energy performance calculation method is being called for by construction industry, financiers and real estate market actors and property valuators.

Several Member States have developed exemplary all-in-one calculation method for energy performance of buildings. There is also a general framework for the calculation of the energy performance of buildings developed with the support of the work elaborated by the European Committee for Standardisation, under Mandate M/480 given by the European Commission.

Addressing split incentives

Many potentially cost-effective energy efficiency investments in buildings don't happen due to various market failures, the most significant being the so-called split incentive or owner/tenant dilemma.

Figure 9: *BUILD UP Skills Construye2020* infographic

Source: BUILD UP Skills (Construye2020)

This refers to a situation where the building owner pays for retrofitted energy efficiency upgrades but is unable to recover savings from reduced energy use that accrue to the tenant[25].

As a result, landlords may have little incentive to invest in housing stock improvements, as return on investment may be limited.

The *EURONET 50/50 MAX*[26] project is an example of how this challenge can be successfully addressed. It has helped change the behaviour of public building users and shares savings on the energy bills between municipalities and the buildings' users.

To date, the project has been rolled out in 516 schools and another 45 public buildings. It has involved more than 88 430 pupils, 6 450 teachers and 100 city councils, all working together to save energy. Preliminary figures show that in 2014 most of the participating schools managed to reduce electricity and heat consumption or both.

Tackling fuel/energy poverty

One of the first programmes to tackle energy poverty was the Warm Front programme in the United Kingdom. 2.3 million households received assistance from the scheme. Grants were on offer for improvements such as loft insulation, cavity wall insulation and heating system improvements.

The programme finished in 2013 and its review suggests that every single pound invested in Warm Front resulted in between £1 and £36.3 in monetary benefits over a 20-year period. These figures exclude indirect benefits such as improved health and living conditions[27].

A number of European Union-funded projects, such as *POWER HOUSE*, *POWER HOUSE NZC* and *TRANSITION ZERO* focus on working with social housing associations to boost the energy efficiency of this vulnerable group of consumers' homes.

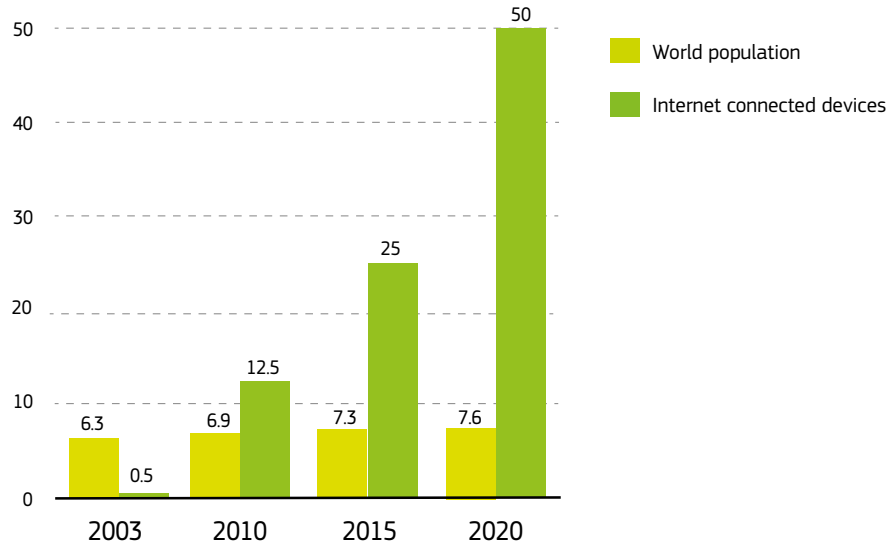
Improving the skills of buildings professionals

Developing skills in the construction sector is crucial to meet NZEB targets and guarantee long-term performance. Consumers should be able to rely on the skills of the building professionals and get value for money.

BUILD UP Skills is an initiative, which aims at uniting forces and increasing the number of qualified workers in Europe's construction workforce. It focuses on the continuing education and training of craftsmen and

(25) JRC report (2014). Overcoming the split incentive barrier in the building sector. Available here.
(26) http://www.euronet50-50max.eu/en/
(27) Sovacool B (2015): Fuel poverty, affordability, and energy justice in England: Policy insights from the Warm Front Program. Energy 93, pp. 361-371.23.

Figure 10: Number of internet-connected devices comparing to the world's population



Source: 'The Internet of Things – How the Next Evolution of the Internet is Changing Everything', Dave Evans, Cisco, April 2011, p.3

other on-site workers in the field of energy efficiency and renewable energy in buildings. It has three main components: establishing national qualification platforms and qualification roadmaps, developing and upgrading qualification and training schemes, and introducing Europe-wide coordinated support activities such as European exchanges.

The results of the project are impressive:

- accreditation of 17 training centres;
- mobilisation of more than EUR 40 million for the training schemes;
- training of more than 120 trainers;
- 2 000 training sessions for some 10 000 workers.

BUILD UP Skills has managed to create national platforms gathering various construction sector actors and stakeholders throughout Europe, including representatives of the construction and energy sectors, training sector, politicians and decision makers.

In addition, the World Economic Forum[28] has highlighted *BUILD UP Skills* as an example of best practice in construction (Figure 9).

The role of ICT in smart buildings

Information and telecommunication technology (ICT) has a crucial role to play in the transition towards a more sustainable future.

ICT can accelerate energy market transformation enabling demand-response, real time energy management and integration of intermittent renewable energy sources. Appropriate ICT solutions will enhance network efficiency and improve overall system operation by matching local supply and demand optimally.

As regards buildings, ICT will ensure an optimised energy management by supporting design, monitoring and control with self-learning capacities. For occupants, ICT will provide user information, enhancing comfort and optimal indoor conditions as well as enabling real time communication and interactions with the grid.

However, the challenge is to keep internet-connected devices' energy consumption in check (Figure 10).

The *PEAKapp*[29] project aims to develop an innovative ICT-based system that connects energy markets and end-users. Although the focus will be on achieving energy savings through behavioural change, the

(28) Shaping the Future of Construction' report, p. 46. Available here.
(29) www.peakapp.eu

solution will also increase the consumption of renewable and low priced electricity from the spot market using a dynamic electricity tariff.

The *PEAKapp* ICT ecosystem will be designed to require smart meters as the only hardware element. Validation in social housing will be carried out in 2 500 households across Austria, Estonia, Sweden and Finland. Users will be connected to social networks and their feedback will participate actively in the Smart Home building energy management systems.

One of the main innovations being developed under the *MORE-CONNECT*[30] project is linking data from existing buildings with manufacturing tools to develop prefabricated, multifunctional renovation elements for the building envelope (façade and roof) and systems. This means that data on building characteristics, potential for energy efficiencies, and end-users demands are linked using so-called Building Information Modelling (BIM) systems to steer industrial process and to enhance quality control.

Lessons learnt

> Building refurbishment has the biggest available energy saving potential in Europe.

> Increasing the energy performance of buildings can have a positive impact, not only in economic terms, but also as regards public health and safety by improving indoor climate.

> Addressing energy efficiency in buildings can help to trigger many co-benefits such as tackling fuel poverty.

> To achieve enhanced energy performance of buildings, there is a need for much improved technical skills. Training and qualification schemes should ensure that worker qualifications keep pace with the technical complexity of buildings and building components.

(30) http://www.more-connect.eu/

#3 Energy efficiency in industry, businesses and services

#3
Energy efficiency in industry, businesses and services

Industry

Over the years, the European Union's final energy consumption by industry has decreased by 15 % – from 327 Mtoe in 2005 to 277 Mtoe in 2013 [31]. In fact, since 2000, European industry has cut its energy intensity twice as fast as the United States. The improvement rate is steeper in energy intensive sectors for a clear reason: energy is an important cost.

In addition, the European Union Emissions Trading Scheme (EU ETS) offers an incentive to use low carbon fuels and to invest in energy efficiency. However, much potential remains and by embracing existing technologies, it would be possible to reduce industry energy costs by between 4 and 10 %.

The successful policies listed in the MURE database [32] contain several initiatives to enhance energy efficiency in industry, including energy audits, developing industrial energy efficiency networks, energy efficiency management, and public-private partnerships for energy efficiency measures.

Energy audits

Article 8 of the EED requires Member States to implement mandatory energy audits for large enterprises and to safeguard the availability of audits for SMEs by the end of 2015.

The Concerted Action EED has put a lot of attention into sharing experience from setting up energy audits and energy management systems. This has resulted in good practice examples coming from Austria, Croatia, the Czech Republic, Finland, Germany, the Netherlands, Slovakia and Sweden.

Good practice examples in this field are also being developed by the European projects.

The *Transferring Energy Save Laid on Agroindustry (TESLA)* [33] project focused on four agro food sectors: olive oil mills, fruit and vegetable processing plants, wineries, and animal feed factories.

Auditors performed 110 energy audits in the above sectors. The project produced a guide on best practices and optimal techniques in energy management, as well as an online self assessment and benchmarking tool for each agro-food sector.

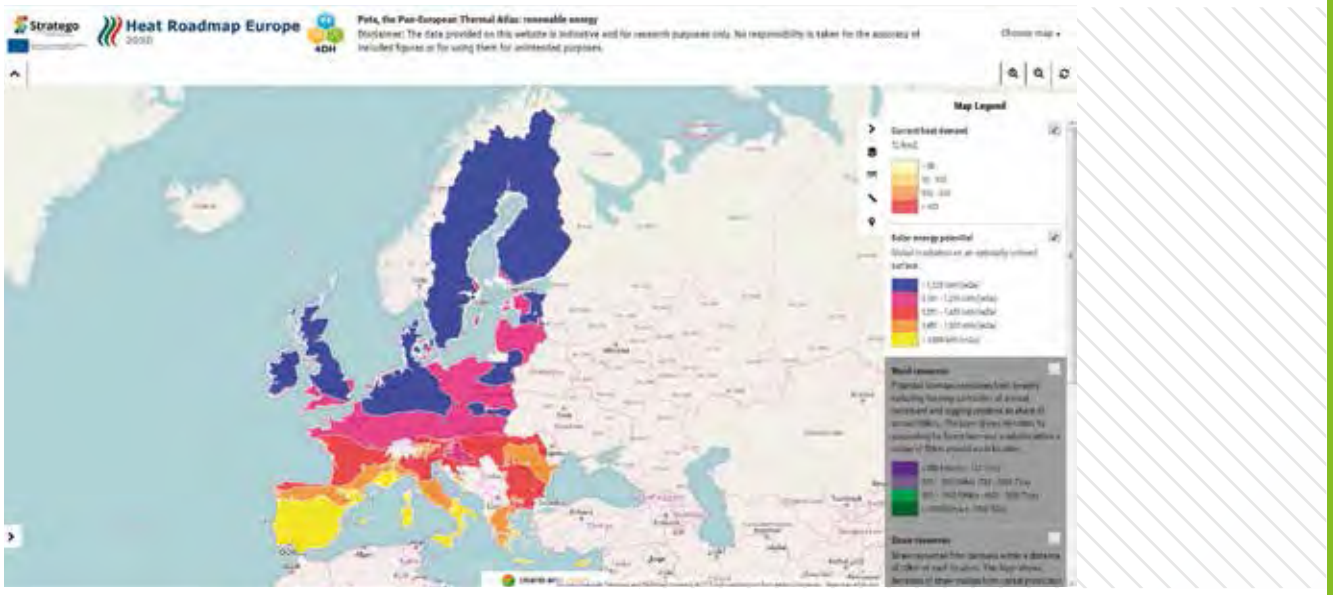
TESLA has triggered energy efficiency investment of some EUR 10 million, achieving primary energy savings of 1 800 toe/year.

Energy efficiency networks, benchmarking, and voluntary agreements

Several Member States including Sweden, Germany, Belgium and Ireland have supported energy efficiency networks in the industry and the service sector.

(31) SWD (2015) 245 final.
(32) http://www.measures-odyssee-mure.eu/
(33) http://ec.europa.eu/energy/intelligent/projects/en/projects/tesla

Figure 11: *STRATEGO*, the Pan-European Thermal Atlas



Source: STRATEGO project [36]

An example of a project developing industrial networks is *EuPlastVoltage* [34], which unites the plastics converter associations of eight European Union countries. The partners have worked together to launch a long-term voluntary agreement [35] on energy efficiency for the European plastics converting industry.

The objective of the project is to improve the energy efficiency of the European plastics converting industry by 20 % between 2007 and 2020. This will be achieved by introducing mandatory energy efficiency measures into the production process, undertaking voluntary measures in the product chain and using renewable energy.

Industrial waste heat recovery

According to a European Commission Communication entitled 'An EU Strategy on Heating and Cooling', industry accounted for a quarter of the European Union's final energy consumption in 2012. Industrial processes generate heat as a by-product, which is often wasted. Much of this heat by-product could be reused in factories or sold for heating nearby buildings.

The *STRATEGO* [37] project (Figure 11) is helping national authorities to prepare heating and cooling plans to assess the potential for developing efficient district heating and cooling infrastructures by:

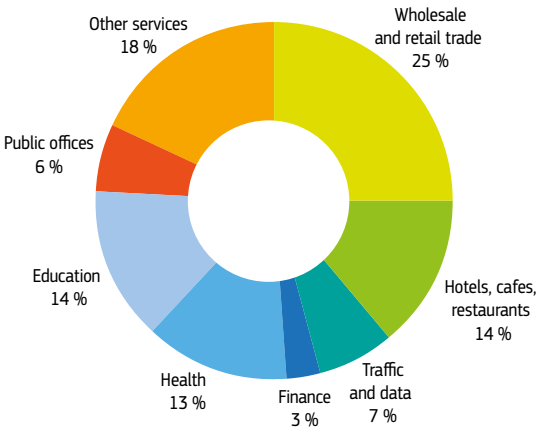
- creating a thermal atlas of the 28 Member States;
- developing an in-depth assessment of the potential of efficient heating and cooling in five countries;
- setting up national advisory groups in eight countries;
- helping 23 cities/regions to map their local heating and cooling demand and supply;
- establishing a coaching scheme.

New technologies or innovative solutions for the recovery of residual heat in large industrial systems are being developed by a number of projects funded under the Horizon 2020 contractual Public Private Partnership on Sustainable Process Industry (SPIRE).

An example is the *I-Therm* [38] project, which developed technologies and processes for the efficient and cost effective heat recovery in industrial facilities. The project also made it possible for these technologies to be integrated within the existing energy system. The recovered heat and generated electricity could also be exported if required.

(34) http://www.euplastvoltage.eu
(35) http://www.euplastvoltage.eu/uploads/downloads/voluntary-agreement.pdf
(36) http://maps.heatroadmap.eu/maps/31157/Renewable-Resources-Map-for-EU28?preview=true#
(37) http://ec.europa.eu/energy/intelligent/projects/en/projects/stratego; www.stratego-project.eu
(38) www.itherm-project.eu

Figure 12: EU-28 heating and cooling consumption in services per sector (2012)



Source: SWD Heating and cooling strategy in SWD (2016) 24

Another project known as *TASIO*[39] is working on solutions to recover the waste heat produced in the cement, glass, steelmaking, and petrochemicals sectors and transform it into energy. These solutions will be developed after an energy evaluation of these four industries and will take the form of Waste Heat Recovery Systems (WHRS) using Organic Rankine Cycle (ORC) technology.

Environmental legislation and energy efficiency

The Industrial Emissions Directive (IED) contributes to energy efficiency as it reduces harmful industrial emissions.

In fact, permits granted under the IED must take into account the entire environmental performance of the plant: emissions to air, water and land, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, and restoration of the site upon closure.

The IED also states that Best Available Techniques (BAT) conclusions are the reference point for setting the permit conditions of the industrial installations it covers. The BATs aim to prevent or reduce emissions and the impact on the environment as a whole. These BAT conclusions are included in the so-called BAT reference documents (BREFs), one of which is specifically dedicated to energy efficiency.

The service sector

The Commission's review of energy efficiency progress from 2015[40] states that the energy intensity of the service sector across all 28 Member States fell by 5% between 2005 and 2013.

The fall is a result of various measures including building codes, renovation plans for the public sector, mandatory audits, third party financing, and rules for outdoor lighting. And they are complemented by eco-design and energy labelling, focusing on equipment, such as computers, food coolers and bakery ovens.

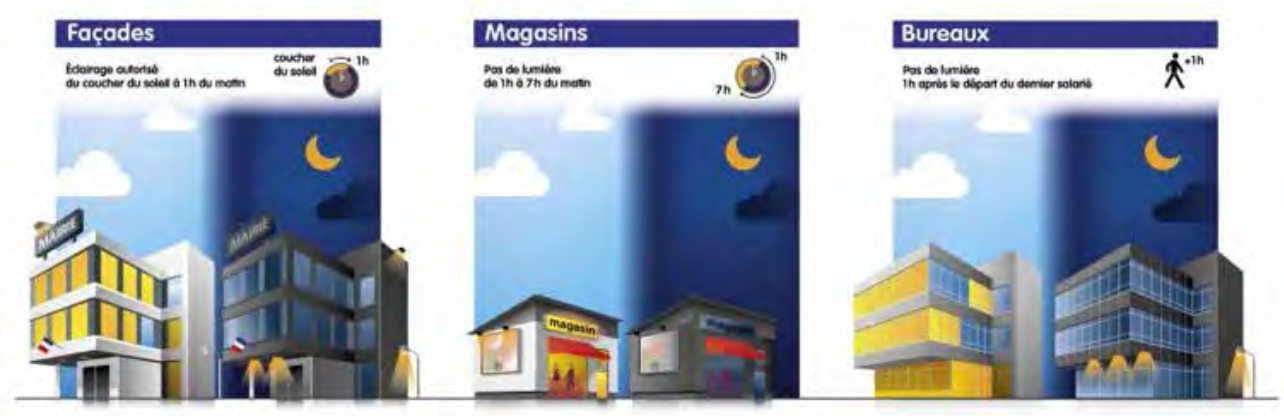
The service sector contributes significantly to the European Union's economic activity. The biggest consumers of energy are the wholesale and retail trade sectors which account for 25% of total heating and cooling energy consumption in the service sector[41] (Figure 12).

The *Night Hawks*[42] project has raised much awareness about energy efficiency in the retail sector. 123 energy checks during off production hours, so called 'night walks', were undertaken in order to identify losses in idle shopping centres, retail parks, and shops.

The project reported significantly higher potential primary energy savings than initially expected – 1 192 toe/year compared to 220 toe/year – as well as potential annual savings on energy bills of EUR 2 220 000 for the participating companies.

(39) http://www.tasio-h2020.eu/
(40) SWD (2015) 245 final.
(41) SWD (2016) 24 final.
(42) https://ec.europa.eu/energy/intelligent/projects/en/projects/night-hawks

Figure 13: Night time switching-off of lighting in non-residential buildings in France



Source: Le Ministère de l'Environnement, de l'Energie et de la Mer

The findings were compiled in a handbook, which was used for training some 1 500 personnel. It contained simple and cost effective energy efficiency measures, including a number of best practice case studies.

Follow-up actions included establishing a Saxony-wide network of energy advisors for the retail sector, as well as providing input to the Latvian Ministry of Economics on criteria for mandatory energy audits in shopping centres.

The *ODYSEE MURE* project has reported on a successful initiative in France relating to light installations.

According to a 2013 regulation, lighting installations of non-residential buildings must be switched off during the night, in order to reduce both energy waste and light pollution. There are various limits in place depending on the type of building and lighting in place (Figure 13).

This measure will result in energy savings comparable to the annual electricity consumption of 750 000 households. It will also lower CO_2 emissions by 250 000 t and save EUR 200 million.

SMEs as a target group

In 2014, some 22.4 million SMEs accounted for 99.8 % of all enterprises in the European Union's non-financial sector. In fact, SMEs in Europe generate EUR 3.7 trillion, employ almost 90 million people and create about 1.1 million new jobs each year.

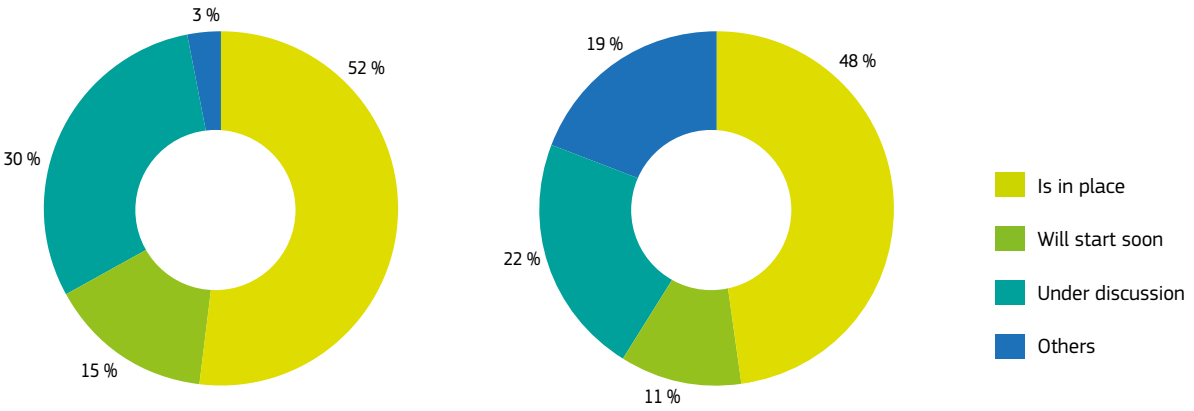
Collectively, SMEs' energy demand is considerable. However, they often have little or no access to resources and finance to make improvements. They may also lack the capacity and rarely view energy efficiency as a priority, especially in their early years[43].

EUROCHAMBRES estimated in 2014 that the short-term energy consumption reduction potential among its 20 million European Union members could range from 10 % to 20 %[44].

By now, all Member States have adopted policies to enhance energy efficiency in SMEs. The MURE database lists a total of 220 active policy measures both in industry and in the tertiary sector and classifies each into two broad categories. The first category focuses on financial measures, while the second looks at information, educational and training measures.

(43) An EU Strategy on Heating and Cooling.
(44) EUROCHAMBRES (Association of European Chambers of Commerce and Industry) (2014), Smart energy for growth: SME actions on energy efficiency powered by Chambers of Commerce and Industry, EUROCHAMBRES, Brussels. Available here.

Figure 14: Schemes to encourage SMEs to undergo energy audits



Source: Forni D/Concerted Action EED (2015)

Many Member States have taken advantage of the EED provision to support SMEs with tailored audit schemes (Figure 14).

Several European projects have developed specific measures for SMEs to achieve energy efficiency in different sectors.

The *neZEH*[45] project aims to provide technical advice to SME hotel owners in order to accelerate the refurbishment rate of existing hotel buildings to nearly zero energy standards.

The project is compiling data on existing case studies, showcasing exemplary energy refurbishments, and delivering pilot demonstration projects as real life examples of Nearly Zero Energy (nZEB) hotels.

The project also boasts an online tool[46] for hotels to identify appropriate nZEB renovation solutions, which is used globally through the UN World Tourism Organisation.

Agriculture and rural areas

Agriculture and fishing account for 25 Mtoe or 2.3 % of the European Union's final energy consumption.

This consumption is especially high in France (4.2 %), Poland (3.6 %), the Netherlands (3.5 %), as well as in Spain and Italy (each 2.8 %)[47], making energy savings in these sectors especially interesting for these countries.

Measures and projects carried out in the agricultural sector aim at the efficient use of local, residual resources and agricultural waste for energy production.

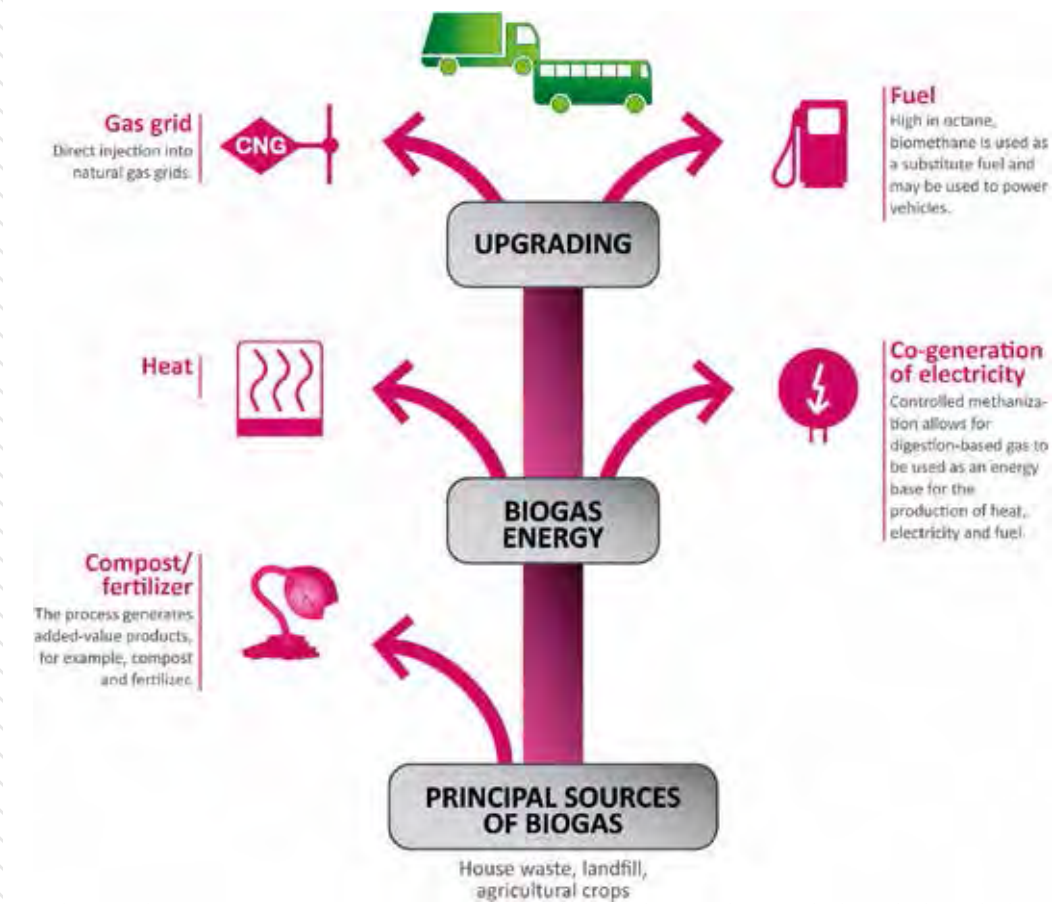
The *BIOMASTER*[48] project has helped Biogazownie Małopolskie to generate heat and power from manure and agricultural waste in Wielopole, Poland, attracting investors for its long term bioenergy ambitions (Fig. 15).

Since March 2016, the site has produced 500 MWh of energy, which has been sold to the region's power network and used for the farms' heating needs. The plant has also produced 300 000 cubic meters of biogas and is exploring opportunities for biomethane and compressed natural gas (CNG) processing for transport fuel.

BIOMASTER provided technical and strategic guidance, including feasibility studies for the farm's goal of producing biofuel for transport, and opportunities to network with potential investors.

(45) http://www.nezeh.eu/home/index.html
(46) http://hotelenergysolutions.net/
(47) DG Energy (2015): Energy in figures. Statistical Pocketbook.
(48) http://biomaster-project.eu/

Figure 15: Biogaz energy



Source: BIOMASTER project

Lessons learnt

> Energy audits provide individual companies with valuable feedback on their energy consumption. Combining this feedback with other incentives to enhance energy management system audits has proven particularly effective.

> Energy efficiency networks are an extremely effective multiplier of best practices. They also engage industries in energy saving efforts.

> Given the broad scope of the service sector, there is a clear need for targeted energy saving solutions that focus on the individual sectors.

> Despite relatively low energy savings per company, the SME sector offers considerable cost-effective savings potential.

#4
Energy efficiency of products

#4
Energy efficiency of products

Ecodesign and energy labelling have triggered more energy efficient products being placed on the market, resulting in energy and cost savings.

Experts predict that both measures will have saved consumers and businesses up to EUR 100 billion per year by 2020[49]. The Ecodesign Directive alone should yield yearly savings of up to 600 TWh of electricity and 600TWh of heat by 2020. However, non-compliance is estimated to reduce these savings by at least 10%.

Many *Intelligent Energy Europe (IEE)* and Horizon 2020 projects have helped in the implementation of the EU's product efficiency legislation. They have, for example, supported Market Surveillance Authorities (MSAs) across the European Union so that they could better enforce the regulations.

The *ECOPLIANT*[50] project is an example of this support. The project developed the means to carry out and coordinate joint market surveillance activities going beyond product testing and adding European value of harmonised policy implementation such as the exchange of information and the development of common methods, protocols, and checklists. The project also came up with various tools to communicate these findings to MSAs across the European Union including:

- a best practice guide;
- common formats and procedures for sharing information;
- a training package for MSA personnel;
- national workshops to disseminate project findings and the best practice guide;
- a database for MSAs to share test data for products.

The *CompliantTV*[51] project is another success story that involved assessing the compliance of televisions with energy labelling and ecodesign regulations.

This training programme improved the capability of laboratories to measure the energy efficiency of televisions. Despite the project finishing, its legacy continues, with its blueprint being followed by laboratories across the European Union.

To effectively manage ecodesign and energy labelling initiatives, all actors in the supply chain must be prepared and aware of their respective roles to increase acceptance and compliance.

LabelPackA+ supports key market players in the implementation of the so-called 'package label' for highly efficient combinations of conventional and renewable heating systems. The project provides a validated, tested and operational set of tools, information, and training to support those in charge of issuing the package label.

(49) COM (2015) 345 final and SWD (2015) 143.
(50) http://www.ecopliant.eu/
(51) http://www.compliantv.eu

Figure16: *LabelPackA+* Pilot Course in Italy

Source: LabelPackA+ project

Overall, the project supports professionals working in the heating market, while at the same time helping the end-consumer to get the most out of energy labelling so that they can make the right choices when buying products (Figure 16).

Communicating to consumers is vital for promoting energy efficiency. *Topten*[52] is an online search tool that presents the best performing appliances in various product categories, helping consumers and large buyers in 16 countries to identify top performing products and to compare costs.

Key criteria are energy efficiency, impact on the environment, health, and quality.

The tool also acts as an instrument to influence manufacturers and retailers to shift the market towards energy efficient products.

The *TOPTENACT* project developed 16 national Topten websites, providing up to date information to 2 million visitors a year, and triggering annual savings of 600 GWh of final energy, and 276 000 tons of CO_2.

Lessons learnt

> The combination of energy labelling and minimum energy performance standards is clearly delivering tangible results in terms of energy savings.

> Additional customised information, e.g. online products databases allowing comparison, targeted at final consumers, allowing them to compare products, would be welcomed.

(52) www.topten.eu

#5 Setting the right public policy framework

#5 Setting the right public policy framework

Energy efficiency targets driving change

Setting measurable targets is key to guiding and coordinating any policy interventions. It also helps to keep track of policy progress.

All Member States have set out 2020 national energy efficiency targets [53]. In addition, many regional and local authorities have adopted ambitious energy efficiency and sustainable energy strategies [54].

In many instances, this was achieved through voluntary commitments in the context of the Covenant of Mayors, an initiative launched by the European Commission in 2008, and which became in 2015 the Covenant of Mayors for Climate and Energy, to endorse and support the efforts made by local authorities in the implementation of sustainable energy and climate policies (Figure 17). As of today, this successful initiative counts over 6 600 local authorities, and 5 500 Sustainable Energy Action Plans submitted – all have been monitored following a robust scientific methodology. These regional and local strategies or targets are in some cases more ambitious than their national equivalents.

The projects funded under both IEE and Horizon 2020 Energy Efficiency show how effective energy efficiency targets can be for local and regional authorities and private actors. These projects have helped spur local targets and strategies into action.

Zagreb, for example, was one of the first European capital cities to join the Covenant of Mayors initiative. The city committed to reducing CO_2 emissions by at least 21 % by 2020 through energy efficiency measures and renewable energy sources. The *ZagEE* project [55] main focus is on building refurbishment, as building energy consumption represents around 65 % of Zagreb's total energy consumption [56]. It aims at providing technical assistance to prepare a large-scale investment in renovating 87 public buildings and retrofitting public lighting, which will result in energy savings of 49 % in retrofitted buildings and 72 % in public lighting. To date, approximately 40 buildings have been renovated, representing an investment of EUR 15 million.

In Italy, the Emilia-Romagna Region joined the Under2MOU international initiative in November 2015 and committed to achieving an 80-95 % greenhouse gas emission reduction by 2050 against the 1990 baseline. 294 out of 340 municipalities of the region, representing 95 % of the regional population, have already put in place Sustainable Energy Action Plans (SEAP).

The *LEMON* [57] project is developing a sustainable energy investment pilot scheme for the Emilia-Romagna Region Social Housing Programme. The project has already been pledged EUR 15.29 million in energy investments in 622 private and public social housing.

(53) See the overview on indicative national targets available here.
(54) Holtfrerich/BDEW (2014): German national energy transition.
(55) https://ec.europa.eu/energy/intelligent/projects/en/projects/zagee
(56) ZagEE (2013): About ZagEE. Available at: http://zagee.hr/?page_id=520&lang=en
(57) http://cordis.europa.eu/project/rcn/200000_en.html

Figure 17: Covenant of Mayors signing ceremony on 15 October 2015, in the European Parliament, Brussels

Source: Covenant of Mayors

The Province of Limburg in Belgium, which is also a Covenant of Mayors Territorial Coordinator, aims at becoming climate neutral by 2020. The *ESCOLIM-BURG2020* project is helping the province to reach this target by strengthening an existing ESCO-offer.

This helps relieve the local authorities from complex investment processes. The project will accelerate a large scale retrofitting of the public building stock of the 44 municipalities and the province itself, allowing for the implementation of energy efficiency and renewable energy measures in the stock. Since the start of the project in April 2013, it has delivered the following cumulative results: 28.9 GWh of energy savings, 7.0 Kt CO_2 reduction and triggered investments in the amount of EUR 5.8 million.

London is one of the European Capital Cities with the highest emission reduction targets. The city joined the Covenant of Mayors initiative and set ambitious targets for climate change mitigation and energy transition: 60 % CO_2 reduction and 25 % decentralised energy targets by 2025.

Low temperature district heating recovering waste energy from urban infrastructure is an integral part of the London Energy Plan – scenarios to 2050 explore how much energy London would need in the future.

Figure 18: London & Islington Borough, extension of district heating system

Source: CELSIUS project

Through the *CELSIUS*[58] project (Figure 18), Islington Council and Transport for London are developing an innovative waste heat recovery from the London underground ventilation system. The challenge of cooling down the tube will turn into an opportunity to reuse available waste heat and supply it to Islington Council's Bunhill Heat and Power Heat Network. New heat sources will be integrated into the district's energy system and an additional 500 homes will be connected to the network.

Coordinating energy efficiency efforts – multi-level governance

Effective European and national energy efficiency measures are implemented regionally and locally. This means that to work properly, an operational energy efficiency governance needs to be put in place to: coordinate energy efficiency efforts between the different layers of government, exchange good practices between regional and local entities, and provide feedback to policymakers when measures fall short of delivering energy savings.

The *COOPENERGY*[59] project, funded by the IEE Programme, has supported the development of collaborative work between regional and local public authorities to develop and deliver Sustainable Energy Action Plans (SEAPs) in partnership, thus avoiding duplication and maximising positive energy planning outcomes.

Overall, the *Intelligent Energy Europe* (IEE) programme has funded 34 projects focusing on developing sustainable energy communities across the European Union, building institutional capacity at local and regional levels.

Setting up local projects on energy efficiency and sustainable energy usually involves a considerable amount of human and financial resources in the pre-project phase. Project Development Assistance (PDA) facilities provided under IEE and H2020 have been set up to support public authorities and to develop effective sustainable energy projects.

(58) http://celsiuscity.eu
(59) http://www.coopenergy.eu/

Capitalising on the multiple benefits of energy efficiency

Energy savings triggered by energy efficiency policies are just one of their many benefits. Other positive impacts include lower consumer bills, decreased public spending, CO_2 reduction and health benefits from improved thermal insulation of buildings.

The International Energy Agency (IEA) says that these so-called 'co-benefits' can also translate into economic gains on both macro- and microeconomic levels.

And in a study from Copenhagen Economics [60], health benefits are associated with several other benefits, which have a positive impact of the public budget. In fact, the overall annual improvement of public budget ranges from EUR 30 to 40 billion, according to the report.

To date, many projects, programmes and measures have actively encouraged co-benefits by creating synergies and combining energy efficiency policies with other areas of policy [61].

As an example, the *REACH* project addresses energy poverty by training teachers and students in vocational schools to become energy advisors. In cooperation with social actors who help to identify energy poor households, energy advisors will carry out 1 600 home visits and provide tailor-made advice, energy saving device kits, guidebooks and post-visit support to fuel poor households. It is expected that *REACH* will achieve energy savings of nearly 300 toe/year that will be translated into monetised benefits in terms of lower energy bills.

The exemplary role of the public sector

The EED states explicitly that public bodies should fulfill an exemplary role as regards energy efficiency. The requirements fall into two categories: renovating central government building stocks at an annual rate of 3 % and integrating energy efficiency in public procurement.

Overall, *ODYSEE-MURE* listed some 80 measures on the exemplary role of the public sector, comprising the refurbishment of public buildings and public procurement. The French 'Grenelle de l'Environnement' laws include a goal of reducing primary energy by 40 % by 2020 in all buildings owned by the central government. Several countries such as Germany, Denmark, Italy or the United Kingdom use prominent or highly frequented public buildings like schools, kindergartens or town halls as demonstration projects.

More than 250 000 public authorities in the European Union represent a spending power of around EUR 2 trillion per year [62]. This significant purchasing power allows them to push for a greater adoption of sustainable measures, for instance, by including energy criteria in all public procurement procedures.

Many projects have helped public authorities across the European Union in taking up energy efficiency in public procurement, often by analysing and replicating examples from countries deemed best performers [63].

The project *SPP Regions* [64] has assembled seven European regions to coordinate the publication of 42 tenders in the areas of energy use in public buildings, vehicles and transport, as well as foods and catering services, which would lead to 54,3 GWh/year of primary energy savings and 45 GWh/year of renewable energy production.

(60) Copenhagen Economics (2012): Multiple benefits of investing in energy efficient renovation of buildings: impact on public finances.
(61) Ürge-Vorsatz et al. (2015): Literature review on Multiple Impact quantification methodologies. COMBI project. Available here.
(62) PWC, London Economics, Ecorys (2011): Public procurement in Europe: Cost and Effectiveness; Dimitri N et al. (2006): Handbook of procurement. Cambridge University Press, Cambridge.
(63) Adelphi (2010): Strategic Use of Public Procurement in Europe Final Report to the European Commission. MARKT/2010/02/C. Available here.
(64) http://www.sppregions.eu/home/

Figure 19: GPP2020 project results

Source: GPP2020 project

The project also transformed the *Procura+* Campaign, launched in 2004, into a wider, permanent European Network[65], to foster direct peer-to-peer exchange between at least 100 public authorities, and to provide a platform for policymakers for expert consultation on SPP.

GPP 2020[66] is another example. The project aimed at mainstreaming low-carbon procurement across Europe in support of the European Union's goals to achieve a 20% reduction in greenhouse gas emissions, a 20% in the share of renewable energy, and a 20% increase in energy efficiency by 2020.

To this end, *GPP 2020* ran more than 100 low-carbon tenders, which directly resulted in substantial CO_2 savings. Moreover, *GPP 2020* managed a capacity-building programme that included trainings and exchange (Figure 19).

Most PDA projects include the procurement of energy efficiency works and/or services by local and regional authorities, mainly in the field of building renovation, street lighting and district heating. Regarding Energy Performance Contracting (EnPC), there is a clear lack of skills in procurement departments as the logic is very different between the traditional procurement of design on the one hand and works on the other.

Lessons learnt

> Setting an energy efficiency target is a strong incentive and impetus for triggering additional energy efficiency measures and following up on their delivery.

> There is a need for a structured dialogue between national, regional and local actors to systematically deal with all aspects of energy efficiency.

> Energy efficiency policies should capitalise on synergies and positive externalities with existing measures and correlated policy fields. Analysis of co-benefits such as improved health and reduced public spending related to energy efficiency can strengthen the case for building refurbishment.

> The exemplary role of the public sector can mobilise a substantive amount of energy savings, especially if extended to regional and local authorities.

(65) http://www.procuraplus.org/
(66) http://www.gpp2020.eu/

#6 Unlocking financing for energy efficiency investments

#6 Unlocking financing for energy efficiency investments

Deploying energy efficiency measures is capital intensive. It requires up-front investments in the form of savings from households, equity from businesses, or debt financing from lending institutions, in order to benefit from reduced energy bills in the future.

In order to reach the European Union's 2030 climate and energy targets, approximately EUR 379 billion in investments are needed annually over the 2020-2030 period, mostly in energy efficiency, renewable energy sources and infrastructure. Financing the energy transition will, therefore, need to combine private investments with public financing that leverages private investments and addresses market failures.

The current economic context, with a low cost of capital, is favourable to unlock private investment at a larger scale and channel capital expenditure into clean energy, energy efficient solutions and sustainable assets. This is an opportunity for citizens, companies, pubic authorities and investors to get a higher return on capital than from savings.

In line with the objectives of the Investment Plan for Europe, the European Union's financial instruments are already making a significant contribution to support the clean energy transition, including investments in energy efficiency. For instance, the vast majority of energy projects approved for financing under the European Fund for Strategic Investments (EFSI) (accounting for 22 % of EUR 154 billion worth of overall investment) concerns energy efficiency and the renewable energy sector.

Over the 2014-2020 period, the European Structural and Investment Funds (ESIF) will also invest EUR 17 billion in energy efficiency in public and residential buildings and in enterprises, with a focus on SMEs. This is three times more than in the previous period, and it confirms the commitment and the importance Member States and regions attach to energy efficiency. It has the potential to leverage a much larger amount of national public and private co-financing, reaching an estimated total of around EUR 27 billion.

Building on these key financing strands, the European Commission has launched the 'Smart Financing for Smart Buildings' initiative as part of the Clean Energy for all Europeans package. This initiative includes specific measures to further unlock private financing and enable market actors to realise their projects through attractive and appropriate financing solutions.

In practice, it will encourage the more effective use of public funds, in particular through financial instruments and investment platforms. It will also help project developers bring good project ideas into maturity with more project development assistance and aggregation mechanisms. Finally, the initiative promises to make energy efficiency investments more trusted and attractive for project promoters, financiers and investors by providing them guidance to evaluate the real risks and benefits of such investments, and disclosing market evidence and performance track record throughout the De-risking Energy Efficiency Platform (DEEP)[67].

(67) https://deep.eefig.eu/

Using public funds to mobilise energy efficiency investments

Public funds can be used in many different ways to support energy efficiency investments.

Whereas grants or subsidies are effective to address specific market failures or help the most vulnerable consumers, public funds can also be used in the form of financial instruments as an efficient way to trigger private financing.

In general, financial instruments have four major advantages as compared to traditional grants, when supporting financially viable projects [68]:

- More investment can be triggered with the same budget.
- Economic viability of the investment is increased due to private actor involvement.
- Repayments can be used to finance future operations.
- Support is provided in the form best suited for the investment.

Experience has shown that financing schemes need to be customised to regional or local socio-economic, legal and banking conditions. One of the key challenges is the proximity of financing schemes to their final users and the usage of usual financing distribution channels that are known and trusted by borrowers.

Loan schemes co-financed by public funds

The residential building modernisation programme in Lithuania [69] is a good example of how public funds can be used to support the renovation of multifamily buildings in the form of loan schemes. Implemented by VIPA, the Public Investment Development Agency, this programme offers attractive financing conditions to the final beneficiaries, with for example, a fixed interest rate of 3%, maturity up to 20 years, or the possibility to write off part of the loan when energy savings attained a certain energy class.

This programme became extremely successful when the following measures were introduced by the Lithuanian government:

- Municipalities were involved by drawing a list of the worst-performing buildings and mandating them to appoint renovation administrators, who could do off balance borrowing on behalf and in favour of apartment owners.
- To implement a modernisation project, it is sufficient that 50 +1 of apartment owners vote in favour.
- Compensation of monthly loan installments can be allocated to indigent apartment owners.
- Technical and financial support are paid from national funds to all related parties for preparation and implementation of projects.

Other good examples are the programmes to improve the energy efficiency of residential buildings in Germany. Managed by KfW, the German state-owned Bank for Reconstruction, these programmes target both the construction of new buildings and the refurbishment of existing ones. They offer a choice of upfront grants or soft loans, which may have a grant component. The amount of grant depends on the energy efficiency level achieved: the higher the energy efficiency, the better the financing arrangement [70].

To be eligible, it is a precondition that the efficiency standards achieved by the project are better than the minimum requirements as set out in the German Energy Savings Ordinance. Eligibility is based on two key parameters: (1) the annual primary energy demand compared to the demand of a new building (the so-called 'reference building') and (2) the structural heat insulation (specific transmission heat loss) compared to the reference building.

Based on monitoring reports [71], final programme energy savings for the period between 2009 and 2013 amounted to more than 28000 GWh by the end of 2013. Additional employment effects are estimated to be 79000 people per year due to total investments of

(68) https://www.fi-compass.eu/sites/default/files/fi-compass%20article_1.pdf
(69) Source: VIPA presentation *'Financial instruments in Lithuania for energy efficiency and public infrastructure development'* available at: http://www.betalt.lt/wp-content/uploads/2014/01/Financing-VIPA-20151210.pdf
(70) EEW Case Study http://www.energy-efficiency-watch.org/index.php?id=213
(71) Diefenbach et al. 2010, 2011, 2012, 2013, 2014.

EUR 6.5 billion, of which EUR 1 billion directly returns to the state in the form of VAT.

In terms of key success factors, KfW makes use of established structures (local commercial bank offices) to facilitate loans. A benefit for the investor is that the system is transparent with all information available online.

Risk-sharing instruments

Several examples of a risk-sharing instruments have been created under the 'Third industrial revolution' (rev3), which is a master plan launched in partnership with the private sector, local authorities, schools, universities and the citizens of the Hauts-de-France region. With all the possibilities offered by digital technologies, the energy transition and a new mobility, the region wanted to move towards a society and economy that are more responsible, sustainable, collaborative and better connected.

Among the financial tools specific to rev3, the most important is the CAP 3RI fund, intended to finance business investment.

CAP 3RI is a 'layered' fund which invests risk capital in enterprises developing 3RI projects: the region participates, using the European Regional Development Fund (ERDF), providing equity financing alongside public and private investors. The EIB, supported by the EFSI, provides mezzanine debt to the fund and commercial banks provide senior debt at project level[72]. In addition to financing, the region also offers technical assistance thanks to a grant of up to EUR 2.5 million drawn from ERDF resources.

The investment projects eligible to CAP 3RI financing are in the field of renewable energies, energy efficiency, energy management and smart grids, smart transport and the circular economy (Figure 20).

Another interesting risk-sharing scheme is the Private Finance for Energy Efficiency (PF4EE)[73]. This European Union Financial Instrument developed by the European Commission and the European Investment Bank (EIB) provides risk-protected debt financing via local commercial banks, enabling the banks to provide better financing conditions for energy efficiency projects in buildings and SMEs. It also provides specific expert support, enabling local banks to develop and market new energy efficiency financing products tailored to customer needs (Figure 21).

PF4EE has a budget of EUR 80 million for the risk-sharing and expert support facility for the 2014-2017 period.

Grant and tax schemes

Various grant and tax schemes are also in place to support the deployment of energy efficiency measures across Europe.

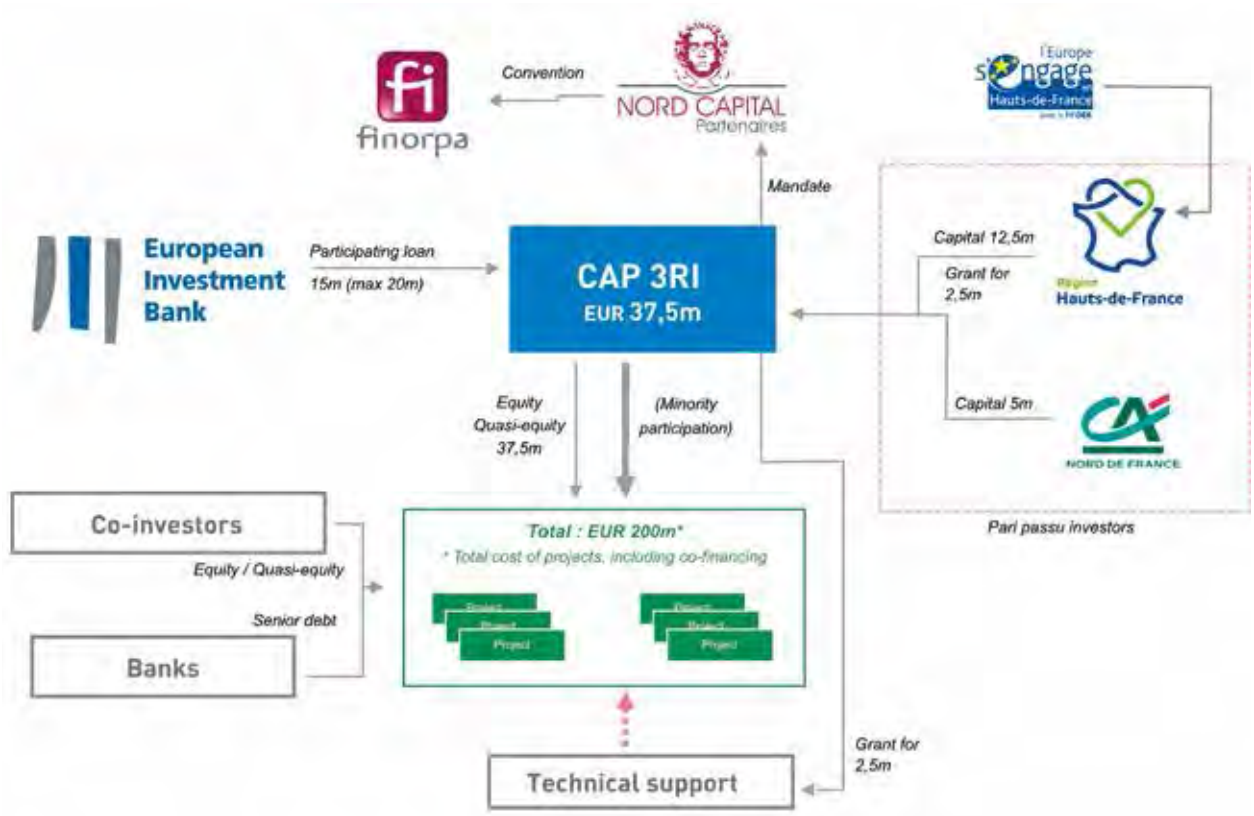
One example is the Sustainable Construction Programme in Andalucía, Spain known as PICSA. This scheme has been pivotal in supporting the energy renovation of buildings in Andalucía and the rehabilitation of urban areas.

It contributed to boost the competitiveness of the construction sector and the creation of skilled employment, while reducing energy poverty for low income families. Co-financed with EUR 133 million from the ERDF, the project has led to an estimated reduction in CO_2 emissions of 62 000 tonnes and energy savings of about 26 000 toe/year. Around 14 000 jobs have been created. Vulnerable groups have benefited greatly, with improved housing quality for more than 7 000 low-income families. Moving forward, measures contained in the development plan are expected to generate 80 000 new jobs over the next five years.

An interesting example of a tax-based scheme is the Sustainable Development Tax Credit (CIDD) in France. This scheme takes the form of a tax credit for the purchase of the most efficient materials and equipment in terms of energy consumption and greenhouse gas emissions. Cost of labour is only covered in the special case of the installation of opaque external wall

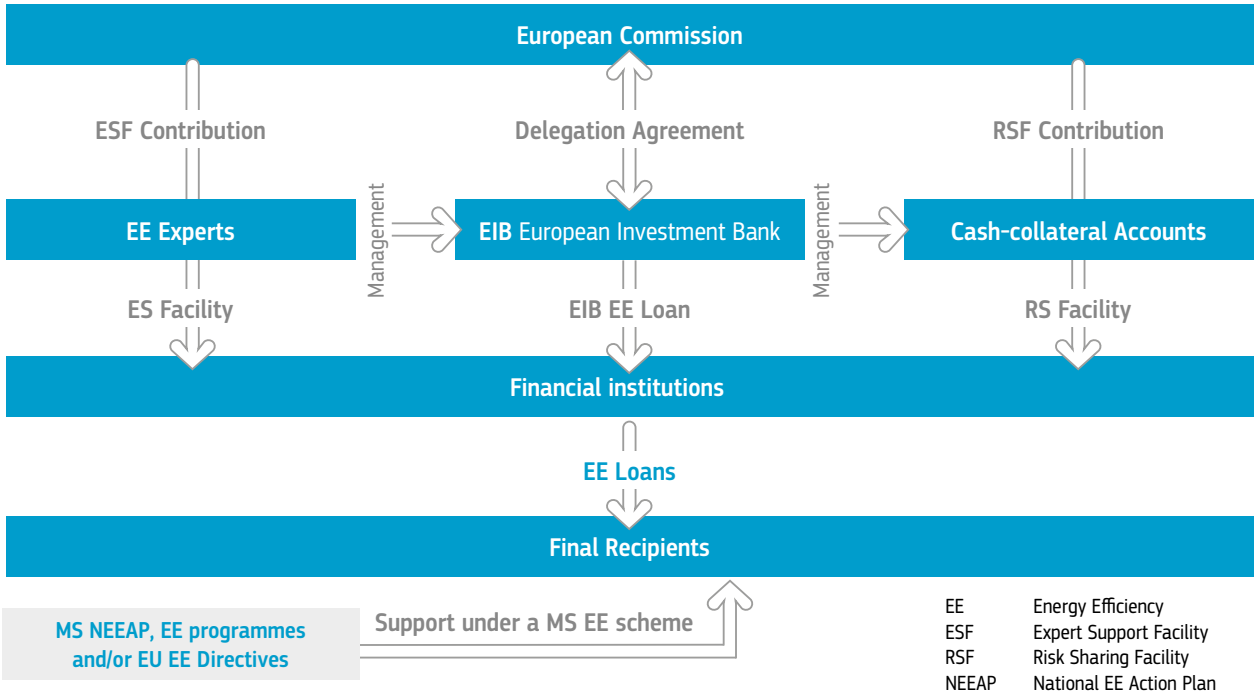
(72) http://europa.eu/rapid/press-release_MEMO-16-1967_en.htm
(73) http://www.eib.org/products/blending/pf4ee/index.htm

Figure 20: CAP 3RI funding scheme



Source: Région Hauts-de-France

Figure 21: PF4EE scheme



Source: European Investment Bank

insulation and ground source heat pumps. This scheme was launched in 2005 and about 8 million households have used the facility. CIDD is available for homeowners and tenants (also occupants who do not pay rent). Only renovation work in existing buildings is eligible, except in the case of renewable energies, which may be financed for both new and existing buildings. A range of improvements are accepted: insulation of floor, roof, window and front door; insulation of heat or water distribution systems; installation of heating regulation equipment; domestic hot water equipment; energy producing equipment using renewable energy; and connection to a district heating fed by renewables or cogeneration system.

Aggregation and assistance

Many cities, individuals or businesses lack the necessary technical, organisational, legal or financial capacity to set up, implement, aggregate and finance energy efficiency projects. As a result, a large number of project promoters are not transforming their ideas into concrete investments. These project promoters need help and this is the purpose of Project Development Assistance (PDA), which aims to create a large-scale pipeline of bankable projects.

Project Development Assistance can be provided via different instruments such as dedicated PDA facilities, investment platforms[74], local 'one-stop-shops' or dedicated services. A large variety of market actors can be involved in PDA activities including local and regional authorities, ESCOs, banks, energy agencies[75] or utilities, usually with a local or regional scope. It can also encompass a wide array of activities including: consumer information, energy audits, proposal for packaged solutions, financing advice, tendering procedures, quality assurance and monitoring.

In addition to triggering action, PDA facilities are essential for developing mechanisms for the aggregation of small scale and fragmented energy efficiency transactions. This is key to increase the size of energy efficiency investments, generate economies of scale, reduce transaction costs and make projects more appealing to investors.

At European level, the Intelligent Energy Europe and Horizon 2020 programmes have been funding different Project Development Assistance facilities, notably the European Local Energy Assistance (ELENA) facility and the PDA call. These facilities have so far provided about EUR 130 million to about 127 projects, resulting in more than EUR 6 billion of expected investment. The minimum required leverage factor (that is, each EUR provided in assistance is required to trigger at least EUR 15 to 20 in investment) has been overachieved, confirming the positive effects of empowerment of project promoters by knowledge[76]. The ELENA Facility is being reinforced through additional capacity provided under the European Investment Advisory Hub[77], created to provide investment support to project promoters under the Investment Plan for Europe.

At the national, regional and local level, an integrated approach is required to create demand for energy efficiency investments, trust in contactors, and to increase the capacity of those along the value chain. Furthermore, an integrated solution would tie-in various sources of financing, ultimately connecting the attractive supply of finance with demand. Such solutions could include, for instance, one-stop-shop approaches that cover the whole customer journey from information, technical assistance, structuring and provision of financial support, either through specific public-private vehicles or by the private sector, to the monitoring of savings.

(74) Investment Platforms definition according to the EFSI Regulation: *'special purpose vehicles, managed accounts, contract-based co-financing or risk-sharing arrangements or arrangements established by any other means by which entities channel a financial contribution in order to finance a number of investment projects...'*
(75) 400 local and regional energy agencies exist across the European Union that can provide the needed technical and economic capacity and expertise.
(76) PDA evaluation report.
(77) http://www.eib.org/eiah/about/index.htm

To achieve this complete and seamless offer, one-stop-shops have to provide support to both the supply or demand (customer) side and they generally include the following interventions: communication and information campaigns, training and building skills in the supply chain, financing mechanisms, and energy performance tracking (before and after). Figure 22 explains the main services provided under a one-stop-shop for building renovation.

PDA to support the implementation of Energy Performance Contracts

Energy Performance Contracts (EnPC) are interesting contractual arrangements as they allow facility owners and managers to upgrade ageing and inefficient assets while recovering the necessary capital directly from the energy savings guaranteed by the EnPC providers. However, these projects are often complex to set up and project promoters often lack the necessary expertise to go through that process.

Different experiences have shown that a local EnPC market can be developed with the support of a 'market facilitator', i.e. an entity which not only helps clients to prepare, procure and manage an EnPC, but also structures the market by training ESCOs, providing template contracts, and informing all market actors[78]. Based on the successful example of Berlin's Energy Savings Partnership, several regions in Europe have implemented market facilitation services with success, often in the framework of European Union-funded projects. For instance, the *EESI 2020* project[79] supported the development of the EnPC market by providing direct training to 800 potential facilitators, and by establishing a guide on the typical tasks and responsibilities of EPC project facilitators. In addition, it demonstrated the importance of this local assistance by implementing 27 EnPC pilot projects which triggered almost EUR 27 million of total investments in energy efficiency.

PDA to support aggregation mechanisms

PDA is useful for aggregating small projects at city or regional level. For instance, thanks to the support from IEE, the province of Teramo (Italy) has mobilised 32 municipalities in order to procure jointly energy performance contracts (EnPC) on their street lighting facilities. The municipalities get lower bills with a guaranteed level of savings, and retrofitted street lights. Street lighting management contracts are currently being awarded in three lots, representing a total of around EUR 150 million for up to 24 years, of which EUR 20 million will be invested in energy efficiency and renewables.

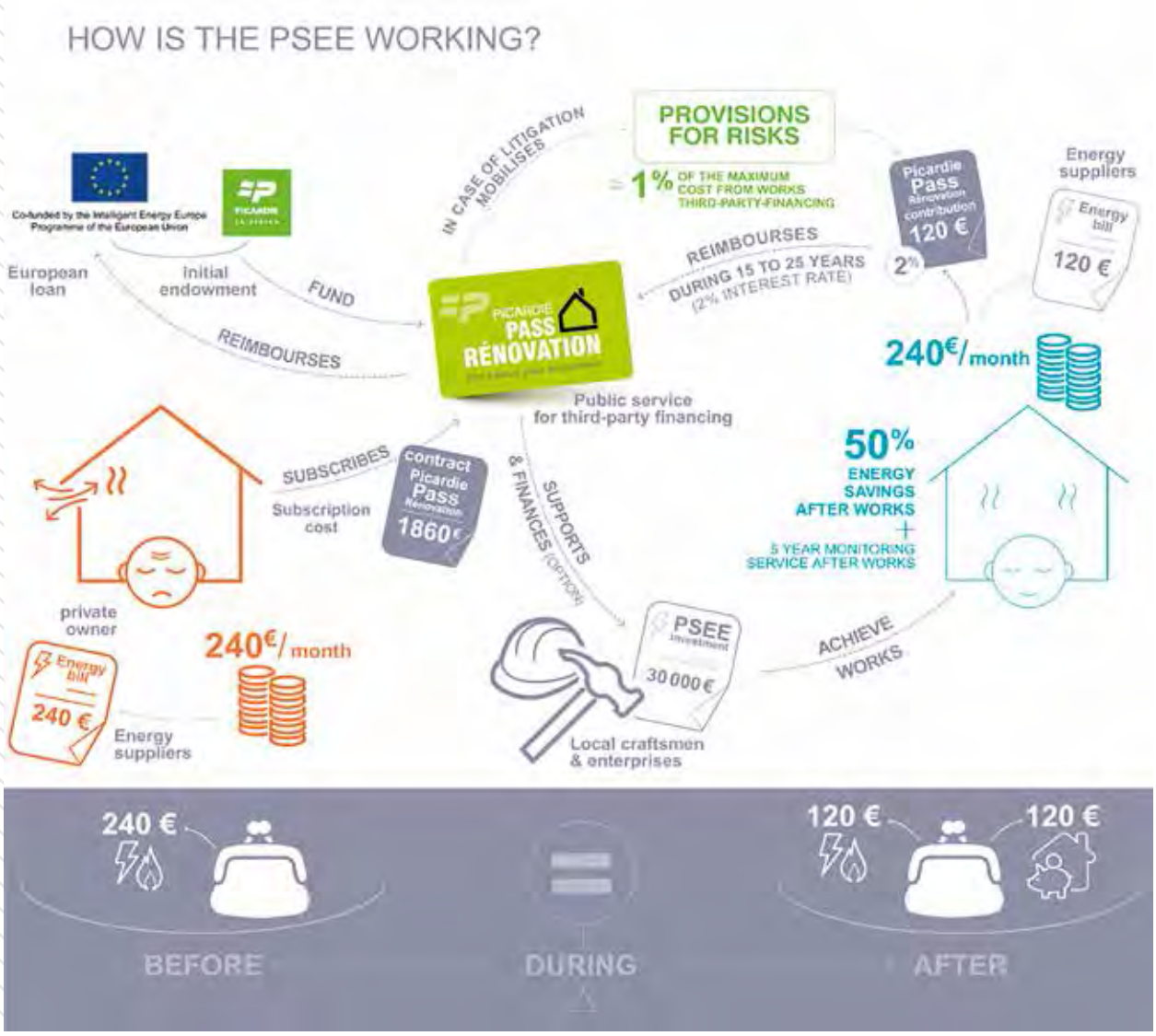
Another example of aggregation mechanism is the *RE:FIT* project in London. Supported under ELENA, this project developed a framework contract to simplify EnPC procurement by providing pre-negotiated, European Union regulation-compliant contracts that can be used with a group of pre-qualified ESCOs for the design and implementation of energy conservation measures. The *RE:FIT* London programme has already achieved significant results: 619 buildings have been refurbished representing a total investment value of GBP 93 million, GBP 6.9 million of cost savings (each year from lower fuel bills) and 119 kt of CO_2 saved.

PDA to support building renovation

Better Home is a new scheme started in 2014 by the Danish Energy Agency. Its aim is to facilitate energy related renovation for homeowners. Denmark wants to create a 'one-stop-shop' for energy renovation for private home owners, where the owner only has to contact one certified building contractor to get counselling on energy renovation of the entire building. The Agency educates, trains and approves professionals such as architects, engineers, craftsmen, energy consultants and building designers and advisors on energy renovation in private homes. A better home advisor can manage the process and can follow the project all the way from plan to completed renovation. The advisors can give homeowners the reassurance

(78) The facilitator concept is detailed at length in Bleyl et al., IEA DSM Task XVI, 'ESCo market development: A role for Facilitators to play', ECEEE 2013.
(79) http://eesi2020.eu

Figure 22: Picardie Pass' Rénovation



Source: Picardie Region

they lack today to engage in a major renovation project. There are better educated home advisers all over the country, but not yet in every municipality.

In France, the Picardie region has launched a Public Service for Energy Efficiency (PSEE) called 'Picardie Pass Rénovation' programme, which aims to implement large-scale deep renovation of detached housing, the predominant building type in the region. Supported under the IEE programme, this regional entity assists homeowners in the implementation of energy efficiency measures by acting as a 'one-stop-shop' from the start with initial advice, further on an energy audit, defining the optimal set of energy efficiency measures, contracting and overseeing the works, providing long-term funding and monitoring the results of the project during five years (Figure 22).

The project is based on a multi-stakeholder partnership approach, which involves local governments and construction companies. The proposed third-party funding mechanism provides an alternative to the traditional banking system. The programme can lend money to the homeowner based on the future energy cost savings, which banks normally refuse to take as a collateral.

Their main objective is to renovate 2 000 private housing units in the test phase and 10 000 per year as of mid-2018. The average loan includes EUR 30 000 for energy efficiency measures and the average monthly reimbursement for householders is around EUR 150/month during 25 years. In order to generate mass demand for energy renovation in individual housing in Picardie and take up one of the challenges in climate

Figure 23: DEEP – the De-risking Energy Efficiency Platforms

Source: De-risking Energy Efficiency Platform (DEEP)

change, the Picardie Pass renovation received a framework loan amounting to EUR 23.5 million from the European Fund for Strategic Investments, which should mobilise EUR 58 million.

Supporting capacity building and stakeholder dialogue

As well as projects and financing schemes, an essential part of increasing energy efficiency investment is to build the capacity of stakeholders across the value chain. With this in mind, an increasing number of initiatives are taking place across Europe to enhance skills.

In the *Infinite Solutions* project[80], for example, nine cities across the European Union are creating home renovation loans and so-called intracting[81] schemes. A complete set of training materials has been prepared, with trainers currently being educated in order to roll out the results of the project across Europe.

De-risking energy efficiency – creating the market

As called for by financial institutions, investors and financiers need to better understand the real risks and benefits of sustainable energy building investments based on market evidence and performance track record. Fundamentals such as the lower probability of default in the case of energy saving loans or an increased value of assets due to higher energy performance need to be progressively recognised by banks and reflected in the pricing of their financing products.

Increasing investors' confidence in energy efficiency

Together with the Energy Efficiency Financial Institutions Group (EEFIG)[82], the European Commission has launched in 2016 the De-risking Energy Efficiency Platform (DEEP)[83] (Figure 23), which is the largest pan-European open-source database containing detailed information and analysis of over 7 800 industrial and buildings

(80) http://www.energy-cities.eu/spip.php?page=infinitesolutions_en
(81) 'Intracting' is like an internal EnPC, where all operations are done with the city administration and with operational accounts.
(82) http://eefig.eu
(83) https://deep.eefig.eu/

related energy efficiency projects. By disclosing thousands of data points showing the real technical and financial data from a large number of implemented energy efficiency projects across the economy, the DEEP platform is a new source of operational risk management information, which aims at helping project developers, financiers, and investors better assess the risks and benefits of energy efficiency investments across Europe.

In collaboration with industry stakeholders and with support from Horizon 2020, the *Investor Confidence Project Europe*[84] has developed its ICP Europe Protocols to define European best practices for predicting energy savings, optimising performance, and monitoring the results of energy efficiency investments. The protocols don't create new standards but list the technical standards which need to be applied to ensure that a project is of good quality.

The concept of ICP was initially developed in the US, where it is progressively becoming a reference for investors, and a series of state or regional programmes are adopting it. The ICP protocols enable the acceleration of energy efficiency investments and the emergence of a robust and thriving commercial renovation sector by increasing confidence in the engineering fundamentals and financial returns of projects. The ICP Europe's Investor Network brings together investors with over EUR 1 billion available for energy efficiency retrofit projects, and comprises a wide range of energy efficiency financiers who recognise the value of standardised, investor-ready projects to increase deal flow and drive demand in the marketplace.

Another good practice is the green mortgages introduced by ASN Bank (the Netherlands) in 2002. This product included an Energy Performance Assessment, paid for by the ASN Bank, worth EUR 200, and a 0.2 % reduction in interest rate after implementation of one single energy audit recommended measure (0.3 % reduction interest fee after implementation of all recommended measures).

Making energy efficiency attractive for institutional investors

A secondary (re-financing) market for energy efficiency investments needs to be created in order to allow investors/lenders to refinance their assets and invest their money into new projects. Appetite for green investments is growing in the finance sector, as policies are being put in place that will progressively discourage investments which do not contribute to the fight against climate change.

More clear guidelines on what is green are therefore essential for investors and for the market.

The *SEI Metrics* project is developing a framework to assess the climate performance of institutional investors' portfolios. This means their alignment with investments that are required to keep global warming under 2°C. This will allow investors to benchmark themselves, and to set targets for the reallocation of assets to low(er) carbon investments. Demand from the financial sector is proving much higher than expected, which reflects the dynamics launched around COP 21 in the financial sector. *SEI Metrics* now has 70 investors testing the 2°C portfolio methodology and is in discussions with index providers to include it in the selection of projects.

(84) http://europe.eeperformance.org

Refinancing energy efficiency assets

Refinancing is a key mechanism in the financial sector. It allows a financial institution to transfer to another entity the claim they have on a client or on a project, in order to free their balance sheet and be able to finance further projects.

The most common procedure for energy efficiency projects is 'forfeiting' on energy performance contracts, whereby the future energy savings are assigned by the ESCO to a financial institutions. In Latvia, the *SUNSHINE* project[85] is currently exploring options to create a similar forfeiting fund, which would refinance ESCOs working on multifamily buildings.

In the US, the PACE scheme (Property Assessed Clean Energy) has been central to structure re-financing mechanisms for energy efficiency and renewable investments in buildings based on bonds. The first PACE bond was issued in 2013 and, since then, the number and size of PACE bonds has been increasing steadily. On 6 June 2016, Renovate America issued their 7th PACE bond[86], which is the biggest to date at USD 300 million. PACE is interesting for investors as it allows attaching a debt to a property so that the debt service is collected through the property tax bill, thus reducing the payment default risk.

Lessons learnt

- The energy efficiency market is dynamic as it is heavily influenced by macro-economic activity, energy prices and regulatory signals.
- Energy efficiency cannot be financed purely from public funds as benefits are predominantly private and there will never be sufficient public funds to do so.
- Most project promoters lack experience in developing large energy efficiency projects and need assistance. Project Development Assistance (PDA) is therefore the key to create a large-scale pipeline of bankable projects.
- The energy efficiency investment cycle needs to be standardised so that both the supply and demand side of finance know what to expect.

(85) http://www.sharex.lv/en/project-overview
(86) www.prnewswire.com/news-releases/largest-pace-bond-securitization-completed-300280343.html

Glossary

BPIE	Buildings Performance Institute Europe
EED	Energy Efficiency Directive (Directive 2012/27/EU)
EEO	Energy Efficiency Obligation
EEOSs	Energy Efficiency Obligation Schemes
EPBD	Energy Performance of Buildings Directive (Directive 2010/30/EU)
EPC	Energy Performance Certificate
EnPC	Energy Performance Contracting
ESIF	European Structural and Investment Funds
EFSI	European Fund for Strategic Investment
ERDF	European Regional Development Fund (part of ESIF)
H2020	Horizon 2020
IEE	Intelligent Energy Europe
MS	Member State
PDA	Project Development Assistance
SEAPs	Sustainable Energy Action Plans
SPP	Sustainable Public Procurement
SWD	European Commission Staff Working Document

HOW TO OBTAIN EU PUBLICATIONS

Free publications:

- one copy:
  via EU Bookshop (http://bookshop.europa.eu);
- more than one copy or posters/maps:
  from the European Union's representations (http://ec.europa.eu/represent_en.htm);
  from the delegations in non-EU countries (http://eeas.europa.eu/delegations/index_en.htm);
  by contacting the Europe Direct service (http://europa.eu/europedirect/index_en.htm) or
  calling 00 800 6 7 8 9 10 11 (freephone number from anywhere in the EU) (*).

  (*) The information given is free, as are most calls (though some operators, phone boxes or hotels may charge you).

Priced publications:

- via EU Bookshop (http://bookshop.europa.eu).