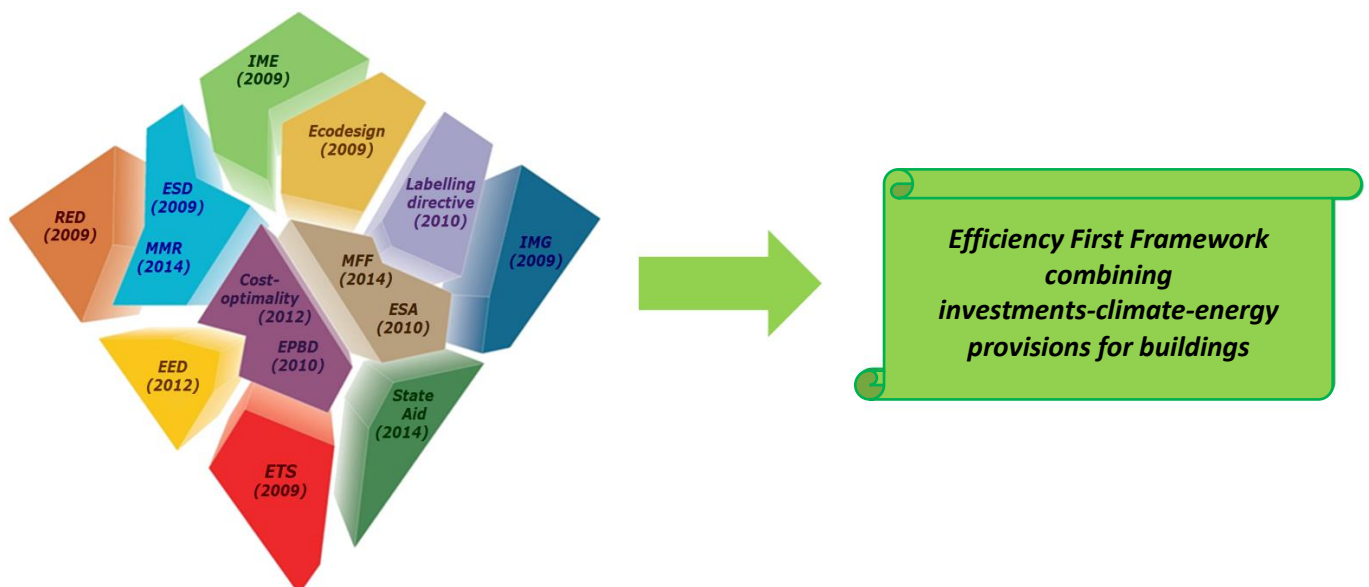




Energy Transition of the EU Building Stock

Unleashing the 4th Industrial Revolution in Europe

Executive summary



Acknowledgements

The publication “[Energy Transition of the EU Building Stock -Unleashing the 4th Industrial Revolution in Europe](#)” is an analytical report prepared by [Yamina SAHEB](#) from [OpenExp](#).

The author is thankful to the experts herein for the useful input they provided:

Shradha ABT, Katalin BODIS, Randall BOWIE, Goran CACIC, Céline CARRE, Bertrand CAZES, Alix CHAMBRIS, Jean-François DALLEMAND, Anibal De ALMEIDA, Stella DIMITRIOU, Bettina DORENDORF, James DRINKWATER, Monika DRUNGILAITÉ, Susanne DYRBOEL, Szymon FIRLAG, Joao FONG, Patty FONG, Anna FRACZYK, Quentin GENARD, Zdravko GENCHEV, Karen GLITMAN, Véronique GUILLAUMIN, Irena HLEDE, Cecilia HUGONY, Jean-Pierre JACOBS, Rod JANSSEN, Nicolas JARRAUD, Scott JOHNSTONE, Adrian JOYCE, Maria KLEIS-WALRAVENS, Stephan KOLB, Rob KOOL, Andriy KOTSYUMBAS, Jens LAUSTSEN, Bianca-Nicole LEPSA, Alex LUPION-ROMERO, Erika MATA, Alan MEIER, Heinz OSSENBRINK, Costas PAPANICOLAS, Jędrzej PASIERSKI, Bruno PEDROTTI, Ladislav PIRSEL, Julian POPOV, Jan ROSENOW, Anna RYBERG HENRIKSSON, Mika RUPONEN, Milla SAIRANEN, Despina SERGHIDES, Niels SCHREUDER, Malgorzata SMOLAK, Ondrej SRAMEK, Dan STANIASZEK, Sandor SZABO, Marta SZABO, Jan TE BOS, Marta TOPOREK, Edouard TOULOUSE, Markus TRILLING, Sharon TURNER, Dragomir TZANEV, Ron VAN ERCK, Tomas WYNS, Francisco ZULOAGA.

An energy renovation market is emerging in Europe

Energy renovation is playing a strong role as a stabiliser of the building sector and consequently of the European economy in the period since the financial crisis. Estimates of the energy renovation market was of the order of EUR 109 billion in 2015 in the EU 28 and created 882,900 jobs. The French, German and Italian energy renovation markets alone accounted for almost half of the EU energy renovation market. The energy renovation market of residential buildings had the highest share, 65%, out of the total energy renovation market.

Governmental policies, either those related to economic recovery or those related to the implementation of the EU 2020 climate and energy targets, played a major role in the emergence of the energy renovation market. EU funding, when well combined with national funds, allowed considerable support for the implementation of energy efficiency measures in existing buildings. This in turn, has limited the effect of the financial crisis on the residential sector by either sustaining existing jobs or creating new ones. However, austerity measures have hindered the emerging energy renovation market in some Member States.

The building sector, which is currently led by the renovation of existing buildings, is one of the pillars of the European Union's economy. The overall sector had a turnover of EUR 1.241 billion in the EU 28 in 2013, which was equivalent to more than 9% of the EU GDP that year. The sector employed almost 11 million persons in 2013. More than 3 million enterprises, out of which 94% were enterprises with less than 9 persons employed, were active in the building sector the same year. The share of the turnover due to the renovation of existing buildings increased from 47% in 2005 to 57% in 2015. The dominance of the renovation market in the total building market started in 2009, especially in Member States where economic recovery measures have specifically targeted the energy renovation of existing buildings.

The energy renovation market could grow if the EU has the ambition to increase its size

The size of the EU energy renovation market could increase by almost half the current energy renovation market if a 40% energy savings target is adopted for 2030. This would create more than one million additional jobs. A 40% energy savings target could allow for an increase of the renovation rates to almost 3%, while it is around 1% with the current 27% energy savings target. The increase of renovation rates would increase the volume of the renovation activity. This would give more confidence to investors and remove uncertainties about the future of the EU building market.

The building sector is known for its conservatism and lack of attraction of Millennials. Increasing the size of the energy renovation market would move investments towards research, innovation and modernisation of the sector through industrialisation. This would lead to the emergence of an EU energy renovation industry. Which will ensure that existing EU industries (insulation, windows, heating and cooling, automation, lighting, solar thermal, photovoltaics...) involved in energy renovation of the EU building stock will keep their competitive advantage in the global markets.

Energy renovation is a unique opportunity for the industrial renaissance of Europe

Increasing the size of the energy renovation market would unleash the 4th industrial revolution in Europe. It would require industry to move from the current step-by-step component-based energy renovation to an overall and one step energy renovation of each single building. Innovation will occur along the overall value-chain of the building sector. From the development of holistic prefabricated zero energy renovation kits to the transformation of the EU citizens from being passive consumers into being active prosumers. New actors, such as aggregators of small projects, will enter the market. Public funding should be dedicated to this transformation of the overall value-chain.

The industrial renaissance of Europe would require modern methods and methodologies to gather data and analyse them. The roll-out of smart-meters, as now required by the directives on the internal market in electricity and gas and the energy efficiency directive, if well-implemented will play an important role in the renovation of Europe. The roll-out of smart meters needs to be combined with energy models based on Geographical Information Systems (GIS), the use of drones for the inspections of buildings, and well-designed mandatory reporting templates for different provisions to close the data gap. The aim is to gather/generate over time the data needed for a better assessment of the progress towards the EU climate-energy targets and how achieving these targets make Europe meeting its priorities in term of jobs and growth. Overall, the objective is to have real-time data to better target needs and to adjust policies at the right moment.

The energy renovation market is an opportunity for small and medium enterprises as they are major players in the building sector. Public support is needed to reshape skills and upgrade facilities. The aim is to ensure that small and medium enterprises will benefit from the industrialisation of energy renovation. Solutions based on recyclability and low environmental impacts should be prioritised. These solutions could be co-financed by public funding under the circular economy package.

Moving towards an “Efficiency First” investment-climate-energy framework for buildings

An EU renovation strategy would be best developed through an integrated investment-climate-energy policy framework for buildings based on the “Efficiency First”¹ principle and in light of the Paris Climate Agreement. Such an overarching framework would, as required by the better regulation package, streamline reporting and ensure coherence between the provisions currently included in at least 14 different instruments, Figure ES.1. It would also simplify implementation for Member States, avoid double-counting and facilitate compliance checking.

Provisions to reduce energy consumption and greenhouse gas emissions of the building stock are spread among at least 14 EU-wide policy instruments. Existing provisions include those related to

¹ Efficiency First Principle: is a guiding principle introduced by the Energy Union Strategy Framework (EC, 2015-a) where it says that energy efficiency should be considered as an energy source in its own right. It aims to prioritise investments in energy savings (energy efficiency and demand-response).

More information available at: <https://europeanclimate.org/efficiency-first-a-new-paradigm-for-the-european-energy-system/>

the overall building stock, each building individually and building components and elements. Systems (heating, cooling and lighting) are not well addressed by the current provisions. Important progress on reporting on energy consumption and GHG emissions has been made in recent years as a result of these EU policy instruments. However, Member States are required to report separately to the Commission on the measures considered for each provision/instrument, although, very often, the same measures address different provisions in different instruments at the same time.

Under the Effort Sharing Decision, ESD, there is an implicit binding target to reduce greenhouse gas emissions of the building sector. This target is not supported by an EU requirement to set an energy savings target for buildings. Yet, two-thirds of the Member States have set, on a voluntary basis, an energy savings target for buildings. Member States report on various measures to achieve their ESD binding target and their indicative energy savings target. However, the fragmentation of the energy and climate provisions among different instruments does not allow to effectively assess the contribution of the building sector towards the 2020 climate and energy targets.

The fragmentation of the EU climate and energy policy instruments undermines the design and the implementation of an ambitious and long-term building renovation strategy and hinders the emergence of an EU energy renovation industry. This fragmentation, Figure ES.1, increases the reporting burden on Member States. It also makes the assessment of the effectiveness and the coherence of the overall EU investment, climate and energy policy package for buildings difficult if not impossible. The fragmentation of EU instruments does not encourage synergies between different policy departments at the EU and national levels nor between industries involved in energy renovation. On the contrary, it keeps each group in its own silo.

Figure ES.1 The EU 14 policy instruments aiming to increase investments in the energy transition of the EU building stock



2

Key point: The fragmentation of EU policy instruments leads to challenges and difficulties in implementing EU legislation and hence to missed economic opportunities.

² The full name of EU instruments corresponding to each abbreviation are included in Table ES.1 below

The overarching “Efficiency First” framework for buildings should include a binding long-term carbon and energy savings targets, with milestones. This would give industry confidence to invest in the industrialisation of energy renovation. Which in turn, would lead to the establishment of an energy renovation industry. Existing industries (insulation, windows, heating and cooling, automation, lighting, solar thermal, photovoltaics...) and their value-chains would develop and provide the components needed for the energy renovation kits as they do today for the construction of new buildings. These energy renovation kits would need to be developed for buildings from each construction period, climate zone and building type.

A new governance structure would be needed to support the “Efficiency First” framework

The “Efficiency First” investment-climate-energy framework for buildings would require new governance structure including setting an EU Energy Renovation Facilitator and an EU Risk Sharing Facility. The upcoming legislative proposal on the governance of the Energy Union is a unique opportunity to discuss and set the ground for the institutional arrangements described below:

- **An EU Energy Renovation Facilitator would be needed to organise the demand and the supply.** Such an entity must be independent from existing EU institutions. It requires a multi-level governance structure to align various policy goals and engage stakeholders in the transformation of the EU building stock from being an energy waster to being highly energy efficient and energy producer leading to net zero energy consumption. An important part of the policy alignment is to ensure that policies are aligned across different levels of government. An early and transparent engagement of key stakeholders in setting the target and planning processes, at each level of government, would increase the acceptance of the outcomes as well as stakeholders’ commitments to assist with implementation and increased effectiveness.
- **An EU Risk Sharing Facility would be needed to ensure a more coherent use of public funding and continuous support to investments in energy renovation.** The aim of the Risk Sharing Facility is to mitigate the financial risk of energy renovation investments by providing loan guarantees to aggregators of companies investing in energy renovation projects. The objective is to reduce the perceived risk by investors by allowing for low-interest rates at the local level. Overall, the target is to move to a self-financed energy renovation market. The risk sharing facility should also provide finance for capacity building and knowledge sharing. Existing EU funding could be bundled to establish such a facility.

Local/regional authorities will be one of the major players in the market transformation of the EU building stock. Support to local/regional authorities, especially in Member States with GDP per capita lower than the EU average, would be needed to establish energy renovation facilitators at local/regional levels. Existing one-stop-shops at local/regional levels, which currently provide information, could evolve and play the role of the local/regional energy renovation facilitators. Energy renovation facilitators have to be independent third parties to ensure they will gain the confidence of all actors. Their role at local/regional levels would be to bring together all parties needed in the renovation cycle to ensure a high quality and timely energy renovation is delivered.

Energy renovation is an opportunity to empower EU citizens and address their concerns

The energy transition of the EU building stock, from being an energy waster to being highly energy efficient and energy producer leading to net zero energy consumption, will address the growing concerns raised by fuel poverty. The EU is facing an unprecedented increase of the share of the population unable to keep their homes warm in winter. The energy transition of the EU building stock will ensure all EU citizens have access to energy services without distinction of income. Energy efficient buildings will also make buildings thermally comfortable in summer.

Efficiency improvements of buildings will reduce air pollution resulting from combustion of fossil fuels. Consequently, the health of EU citizens will be improved. Final energy consumption of the EU building stock represented 41% of total final energy consumption of the EU in 2013, with two-thirds of the energy consumed occurring in residential buildings. Almost one-third of the energy consumed in residential buildings was gas, out of which 79% was used for space heating. This results in an increase pollution of air. Reducing heating needs will also have a direct impact on reducing the EU gas dependency as 55% of the gas consumed in the EU is imported.

The identified energy renovation market is partly financed by households' energy taxes. However, energy taxes paid by households are not fully used for energy renovation. Mechanisms to better direct citizens' taxes towards the renovation of their homes would be needed to ensure a fair use of households' taxes. The aim is to shift households' energy expenditures from energy consumption to investments in energy renovation. Energy taxes set by Member States are proportionally higher when the volume of energy consumed is lower. This hinders energy savings and make more vulnerable consumers in risk of ending-up in fuel poverty.

EU citizens will be empowered by making buildings producers of energy savings and renewables. The increased share of energy savings and renewables in buildings will make them play an active role in the EU energy system. Integrating buildings in the EU energy system and allowing for fair competition between capacity generation and energy savings are needed. In the near future, buildings will play a major role in power-supply-system stability. They will provide electricity produced locally, serve as storage capacity and reduce peak demand. The transformation of the EU power system from a centralised to a decentralised one will empower EU citizens and make them "prosumers". Smart appliances will interact with smart grids and allow for more savings. Timers and controls will determine the best time slot to consume and/or to sell energy. Appliances will be automatically turned off at peak load when energy prices are high to allow consumers to sell their energy production at high prices and to increase the share of self-consumption.

Addressing the loopholes in the EU existing 14 instruments should be a priority for 2016

The opportunity to initiate the move towards the "Efficiency First" investment-climate-energy policy framework for buildings must start with the upcoming review/revision of the existing legislation. In late 2016, the EU will adopt proposals that will shape investment-climate-energy policies for buildings for years to come. This process must not *lock-out* the possibility to quickly evolve to a single, fully coherent, streamlined overarching policy framework for buildings aimed at achieving the necessary goal of energy transition of the EU building stock.

The on-going 2016 review/revision of EU investment-climate-energy instruments is a unique opportunity to strengthen existing provisions and promote ambitious renovation strategies. The existing EU instruments have contributed to raising awareness among market actors about the importance of the transformation of the building stock from being an energy waster to being highly energy efficient and energy producer leading to net zero energy consumption. However, to ensure the energy transition of the EU building stock, existing instruments need to be amended and/or strengthened. Major loopholes identified under each instrument/provision are summarised in table ES.1. For each identified loophole, a recommendation for improvement is suggested. The aim is to set the ground for a pathway to capture the untapped savings potential in light of the EU priorities in terms of jobs, growth, the Energy Union Strategy Framework and the Paris Climate Agreement. Policy discussion on the recommendations in Table ES.1 below is the right first step to take.

Table ES.1 Identified loopholes in EU policy instruments and recommendations to overcome them for further discussion

EU instrument	Identified loopholes	Proposed modifications to consider under the on-going review/revision of EU instruments
EU 2030 climate and energy framework (27% energy saving target)	Renovation rates considered in the PRIMES model (1.48% until 2020 and of 1.84% after 2020 in the case of 27% energy savings target) are too low to boost investor confidence and to give a clear signal to market actors to invest in innovative technological and financing solutions.	-Increase energy renovation rates considered by PRIMES in the on-going review of the decarbonisation scenarios. -Adopt at least 40% energy savings target for 2030 to allow for an increase of energy renovation rates and to give market actors a long term perspective.
Effort Sharing Decision (ESD), Emission Trading Scheme (ETS) and Mechanism for Monitoring and Reporting (MMR)	The sum of Member States projections of their 2030 GHG emissions from buildings are 23% higher than those under the 27% energy savings target.	Require Member States to revise their GHG projections for buildings and ensure coherence between Member States projections of GHG and the EU 2030 climate and energy framework.
	Some Member States will overachieve their emissions reduction under ESD for the period 2013-2020.	Ensure Member States' 2030 projections of GHG emissions are based on accurate baselines.
	ESD allows Member States to over-allocate emission permits from the current period to the next period (2020-2030).	Remove the possibility to over-allocate emission permits for the next period.
	Member States report on the savings from all measures together without distinction between demand-side and supply side measures.	Require breakdown of the reporting on savings from demand-side and those due to renewables to assess coherence with the energy savings target and renewables target.
Internal market directives for gas and electricity (IME) and (IMG)	Internal market regulations allow for competition between supply side options only.	Include provisions to allow for fair competition between supply side options and energy savings (energy efficiency and demand response).
	Internal market regulations require Member States to develop "innovative pricing formulas". Pricing formulas developed by Member States do not motivate consumers to reduce their energy consumption.	Require Member States to consider higher energy taxes for high energy consumption bands and low energy taxes for low energy consumption bands.
Energy Efficiency Directive (EED)	-There is no specific requirement to report on the projected energy savings from the building stock. But some Member States report, on a voluntary basis, their projections of final energy consumption of their building stock under Articles 3, 4, 5 and 7. -There is no requirement to set an energy and/or carbon reduction target for the overall buildings stock. But, 16 Member States, the Flanders region and Gibraltar have reported, on a voluntary basis, an energy and/or carbon reduction target in their energy renovation strategies.	-Require Member States to report on their projected final energy consumption of their building stock for a defined year (2020, 2030) and group this reporting under current Article 3. -Require all Member States to set a long-term energy and/or carbon reduction target for the total building stock by 2050 with 2020 and 2030 milestones.
	Member States are required to report on the measures considered for energy renovation under Articles 4, 5 and 7.	Require Member States to be explicit about the expected savings for each measure or package of measures to assess coherence with the projections of the final energy consumption and group this reporting under one single

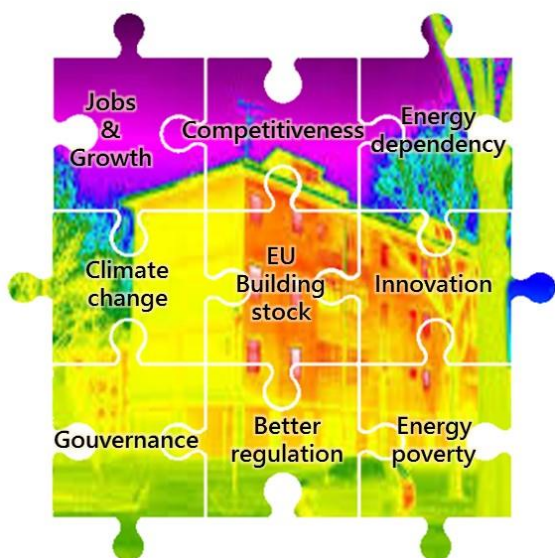
		Article on reporting.
	Renovation concept is defined in 4 different manners.	Replace all existing “renovation concepts” by one concept aiming at transform buildings from being energy waster to being highly energy efficient and energy producer leading to net zero energy consumption.
	Member States are allowed to opt for alternative measures, including behaviour change, for the renovation of public buildings in Article 5.	-Remove the possibility to opt for alternative measures which lower the ambition and lock the savings potential when public buildings are renovated to ensure public authorities lead by example. -Extend the provisions of Article 5 to cover all buildings owned and/or occupied by public authorities at different levels of governance within the Member States.
	The directive dedicates an entire article for split-incentives barrier while 70% of the EU population lives in owned-occupied dwellings and almost 60% of the EU population lives in single family homes.	Include provisions to allow for bundling small projects (single family houses) and address the affordability of energy renovation (high share of owners), especially in Member States with GDP per capita lower than the EU average.
Energy Performance of Buildings Directive (EPBD) and the cost-optimum methodology	Residential buildings often do not comply with the requirements when buildings undergo major renovation, especially when it comes to building elements.	-Remove the concept of major renovation. Each time a building is renovated, it has to be renovated to net zero energy consumption level. Minimum energy performance requirements for building elements and systems have to be met each time a building is renovated, especially if it involves the use of public funding. The net zero energy consumption requirement, combined with smart meters, will make compliance checking and enforcement easier to implement.
	Lighting systems are not considered as one of the systems for which minimum energy performance requirements have to be set.	Include lighting when setting requirements for technical building systems (Article 8 of the EPBD).
	End-uses included in Annex I are unclear as to whether lighting has to be included or not. But, Member States report to Eurostat on final energy consumption of all end-uses	Clarify Annex I and include all end-uses to allow for assessment of progress as the final energy consumption reported under Eurostat includes all end-uses and smart meters will measure the overall consumption.
	Energy Performance Certificates are not required to be based on operational or metered energy consumption.	Require the inclusion of design (asset rating) as well as operational rated energy consumption, the latter based on utility bills, when preparing Energy Performance Certificates.
Renewable Energy Directive (RED)	There is no reporting requirement on the increased share of renewables in buildings.	Require reporting on the increased share of renewables in buildings.
Implementing measures resulting from the combined Ecodesign and Labelling directives	Minimum energy performance requirements are set at the least-life cycle cost at the time the preparatory study is undertaken. As a result, by the time of the implementation, the market has already moved.	Set minimum energy performance requirements at the efficiency level of the best available technologies to ensure Ecodesign drives innovation.
	Energy performance requirements are component-based and do not reflect real usage conditions, especially when these components are part of energy	Require standardisation to take into account the system approach and real usage conditions when defining test conditions and estimating and/or

	systems (lighting, cooling, heating and ventilation)	measuring energy consumption.
	Lack of consolidated market data, misuse of allowed verification tolerances for market surveillance and general lack of market surveillance.	<ul style="list-style-type: none"> -Assess the possibility to integrate efficiency data in PRODCOM database. -Organise round robin testing for accredited laboratories to assess the relevance of the allowed verification tolerances. -Assess the possibility to consider market surveillance of energy consumption as part of the spot tests conducted under the CE marking procedure. -Shaming and publicly blaming manufacturers reporting wrong information. -Organise annual EU wide random testing campaigns.
Multi-Annual Financial Framework and Structural funds	Ex-ante conditionality is not always a pre-requisite for the use of the EU funds.	Include an ex-ante conditionality aiming to net zero energy consumption level for any use of EU funds.
	Grants do not allow for ambitious energy renovation of buildings but these are the preferred instruments used by Member States.	Provide support to Member States to move from grants and subsidies to the use of tailored financial instruments.
State Aid Rules	State Aid rules limit the use of EU funds for energy renovation.	Revise State Aid rules to ensure EU funds can be used for energy renovation.
Accounting rules	Guidance document for governmental accounting rules make it difficult to finance renovation of public buildings.	<ul style="list-style-type: none"> -Revise current accounting rules to consider energy renovation investments as an asset investment recognising the cash savings resulting from energy renovation investments. -Energy renovation investments should be considered as a productive debt and classified off balance sheet.
EU/EIB funds	High interest rates are considered for energy renovation investments as a result of the perceived risk by investors.	Consider an EU and/or EU/EIB guarantee to lower interest rates at local level, limit the perceived risk by investors and gain their confidence.

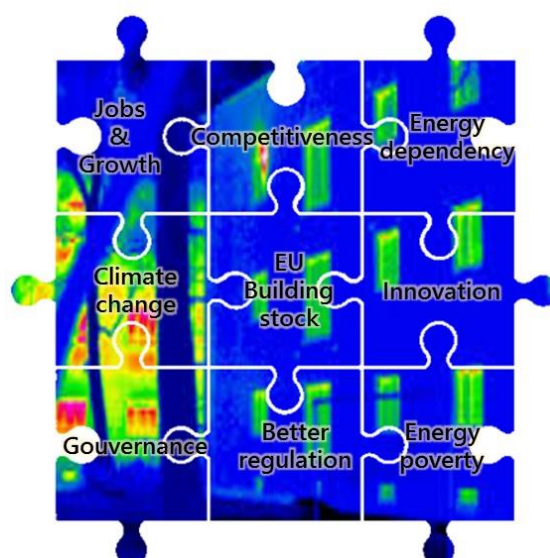
Key point: The review/revision of most of the EU instruments targeting energy renovation in 2016 is a unique opportunity to prepare the ground for the market transformation of the EU building stock from being an energy waster to being highly efficient and energy producer leading to net zero energy consumption.

Energy Transition of the EU Building Stock Unleashing the 4th Industrial Revolution in Europe

EU Building Stock Today!



EU Building Stock Tomorrow?



An emerging EU energy renovation market of €109 billion and 882,000 jobs.

More than 40% of total EU final energy consumption and 46% of EU gas imports.

More than 40% of end-use sectors' direct CO₂ emissions.

Unhealthy, leaky, polluting and high running costs buildings leading to fuel poverty.

Component-based energy renovation financed by grants.

Fragmented provisions for buildings' energy/carbon savings among 14 EU policy instruments.

Fragmented EU institutions with unclear responsibilities.

Fragmented stakeholders with unclear target and sub-optimum collaborations.

An EU energy renovation industry leading the global transformation of buildings.

Net Zero (fossil) Energy Consumption buildings.

Net Zero Carbon Emission buildings.

Healthy, highly energy efficient buildings producing energy and empowering EU citizens.

Industrialised energy renovation and self-financed energy renovation market.

Efficiency First Framework combining investments-energy-climate provisions for buildings.

EU Energy Renovation Facilitator and EU Risk Sharing Facility.

Aligned stakeholders around the clear target of Net Zero (fossil) Energy Consumption and Net Zero Carbon Emission buildings.