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THE RENOVATION WAVE

A Make or Break for the European Green Deal

Thibaud VOÏTA

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Executive Summary

Building renovation is central to European Union (EU) policies. It is not only indispensable to improve the building energy performance in order to achieve the EU's climate goals, but it is also crucial to other key sectors and issues: energy security, employment, economic growth, energy poverty, health, and comfort. It is therefore no surprise that building efficiency represents an important feature of the Green Deal, in particular through the upcoming launch of the Renovation Wave by the European Commission (EC). The stakes are high: a success of the initiative can improve the quality of housing and reduce the energy bill of every European; boost the economy and productivity of the Member States (MS) and create jobs; and finally assert EU's position as a global leader in this field.

This makes the challenge every more daunting. First, the task is huge: European buildings are old and too often inefficient: 35% of the stock is over 50-year-old and 75% of the existing buildings are expected to still be in use after 2050, while most of them are inefficient. European buildings also represent 41% of the global final energy use (the largest share) and 39% of energy-related CO_2 emissions. Then, the cost will be very high: studies estimate that the total investment opportunity for renovation represents EUR 243 billion per year until 2050, of which EUR 179 billion per year for residential buildings and EUR 64 billion per year for non-residential ones. However, over the period 2012 – 2016, EUR 760 billion have been invested in building renovation. This represents an average EUR 152 billion per year, behind the EUR 185 need identified by the EC or the EUR 243 billion identified by think tanks.

The progresses are not happening as fast as they should and building renovations are too slow. The EU's overall energy efficiency targets for 2020 are very likely to be missed. Figures show that the European energy consumption is on the rise again since 2014: the EU in 2018 was 5% above the 2020 requirements, with an increase of final energy consumption in 15 of 27 MS compared to 2017. In order to achieve its climate neutrality goal, the EU and its MS need to critically accelerate their efforts, for instance by multiplying by up to 4 the number of deep building renovations every year (the Green Deal calls for the pace to be multiplied by only 2). MS need to accelerate the adoption of policies promoting building renovation, but the progress have been so far disappointing as past policies failed to deliver: for instance, MS were supposed to submit long-term renovation strategies

by March 2020. However, six months after the deadline, submissions by 14 MS were still pending. Several MS are worryingly lagging behind. As an example, France has set the objective of a yearly renovation of 500,000 households per year until 2030, and then of 700,000 per year until 2050, as part of the transcription of the Energy Performance of Buildings Directive (EPBD). In parallel, the government is planning to refurbish 100,000 social houses per year. But the achievements have been so far disappointing: from 2016 to 2018, it is estimated that only between 300,000 and 400,000 households were actually renovated, with only a small number of deep renovations.

Why is the renovation market so difficult to kick-start? The sector is extremely complex, with number of different buildings, regulations and actors, at all levels, from the European to the local one. This means that coordination of the different stakeholders is a major challenge. In addition, building renovation policies may be slowed down by some of the traditional European weaknesses: lengthy processes, different interests of lobbying groups, weak implementation of the regulations, a lack of knowledge or trust from the tenant or home-owners, financing and technology issues, etc.

There are reasons to be cautiously optimistic though. Regulations have accelerated energy efficiency investments in buildings over the past decade, despite the 2008 crisis, and altogether, household energy efficiency has improved of approximately 30% since 2000. Some innovative and promising policies are being implemented in many countries, from Ireland to France and Germany. Some innovative tools are being experimented all over the continent: some just need more coordination, or change of habits. For instance, the set-up of local energy communities or the implementation of the energy sufficiency concept. Other tools require the adoption of new technologies, such as building information technologies, or the electrification of buildings in the context of smart cities. Finally, renovation is also progressing, as it can be seen with the work on passive houses.

The call of Ursula von der Leyen to establish a European Bauhaus points to new creative and efficient ways to promote building renovation across the continent. The construction sector needs clear signals on the future of the building renovation market in order to adapt its training strategies with less emphasis on new building and more on renovation. The Renovation Wave cannot succeed without a sustained effort to ramp up skills and the number of qualified jobs in this sector, with state-of-the art technologies becoming a standard all across the EU, alongside the use of low carbon and ideally, sustainable renovation materials.

To be more successful than previous attempts, the European strategy requires:

- A stronger policy leadership and a better coordination at the European level with the generalization of a "whole-of-government approach", ensuring more coordination between the different departments and sectors that are/should be concerned with building renovation (health, climate change, jobs, etc.). This is crucial in order to better understand the benefits of building renovation and coordinate policies that will touch upon broader areas (such as smart cities, electrification).
- More ambition and proactivity from the MS:
    - A strong acceleration of public buildings renovation;
    - Better data collection and maintenance work, as well as monitoring, reporting and verification on the results of the existing programs;
    - Better dissemination of key technologies such as passive houses, building information modeling, or district energy systems;
    - More research and support policies on innovative approaches and tools such energy sufficiency.
- A more efficient market regulation in order to help consumers better understand and benefit from renovation services, more specifically:
    - The generalization of "Building renovation passports", using the Belgian "Woningpas", French "Passeport Efficacité Energétique" or the German "Individueller Sanierungsfahrplan" as models. These are established based on energy audits and quality criteria, and they provide with long-term renovation roadmaps that can be used to plan deep renovations;[1]
    - Increase the role of local actors, that could play the role of "one-stop-shops" on building renovations: from cities to local energy communities. These would benefit from the creation of local agencies providing the dwellers with more tailored information on building renovation.

The COVID-19 crisis and recovery plan must be a tremendous opportunity to accelerate these changes, and possibly to explore more innovative solutions, such as zero-interest rate loans or mandatory building renovations.[2]

1. M. Fabbri, M. De Groote and O. Rapf, *Building Renovation Passports: Customized Roadmaps towards Deep Renovation and Better Homes*, BPIE, 2016, available at: www.bpie.eu.
2. "Regard sur le Plan de rénovation énergétique des bâtiments", *Connaissance des énergies, op. cit.*

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Introduction

The European Council called for the Green Deal to become a pillar of the sustainable economic recovery, alongside digitalization. A EUR 750 billion recovery program was agreed in July and the multiannual financial framework for 2021-2027 is now being finalized with the European Parliament. As part of the European Green Deal,[3] the EC's renovation wave aims to "at least double the annual rate of building stocks".[4] The EC identified a financing gap of EUR 185 billion per year to achieve renovation, highlighting the scale of the challenge. Part of this money is to be allocated by the European Investment Bank (EIB), EU regional funds, the InvestEU program, and possibly National Energy and Climate Plans (NECPs). The Energy Commissioner, Ms. Kadri Simson, also insisted on the importance of energy efficiency and of the renovation of the building stock. She aims at presenting a Renovation Wave (announced in late 2019, before the Green Deal) in October 2020 that is to address potential regulatory barriers and accelerate the pace of renovation. The first targets of the wave will be hospitals, schools and SMEs, as these sectors are particularly affected by the crisis.

Therefore, the EU is facing a major challenge: it needs to renovate its building stock if it wants to address its ambitious climate and energy goals. Its EPBD aims to have all buildings either low or zero-emission. This is not an easy task: so far, energy efficiency in general is lagging behind in terms of clean energy targets, with the goals of energy-use reduction of -20% set for the end of 2020 compared to 2007 very unlikely to be met. However, an acceleration of the renovation wave – as requested by the EC – can bring a handful of benefits in terms of employment, social issues, health and also energy security, given that it would reduce fossil fuel demand and reduce peak electricity consumption and overall, the costs of electrification. Many reasons can explain why building efficiency is not progressing as fast as it should, and many of these do not have to do with the finance and technology pair – they relate to a lack of leadership from the EC, some

3. "A European Green Deal", webpage of the European Commission available at: https://ec.europa.eu.
4. European Commission, "Communication form the Commission to the European Parliament, the European Council, the European Economic and Social Committee and the Committee of the Regions. Europe's moment: Repair and Prepare for the Next Generation", *European Commission,* May 27, 2020; Number of experts interviewed for this report estimate that 2% is also too weak, and the rate should be pushed to 3 to 4%.

reluctance at the MS level, capacity issues at the company level and finally, reluctance from households.

This study aims to identify the different benefits and challenges coming along with building renovation in Europe and at identifying best practices in MS. It also aims at laying conditions that need to be met in order to achieve the 2030 targets and accelerate with the Renovation Wave. It also delves into two solutions with promising impact: passive houses and energy sufficiency.

European buildings: high CO_2 emissions and inefficiencies

Energy and climate performance of the European buildings

Buildings are a major source of energy use and energy-related CO_2 emissions: according to the Global Alliance for Buildings and Constructions, they represented 36% of the global final energy use (the largest share) and 39% of energy related CO_2 emissions in 2018.[5] In the EU (with 28 members), they represented approximately 41% of the total final energy use and 36% of the EU CO_2 emissions in 2019 (see figure 1).[6] Out of these, building consumption from households takes up about 25% of the total European energy consumption, services representing about 15%. In households, a large share (79% of the total final energy use) is dedicated to heating and hot water.[7]

These European buildings are old and too often inefficient: 35% of the stock is over 50-years-old and 75% of the existing buildings are expected to still be in use after 2050, while between 75 and 97% of them are inefficient – i.e. they do not reach the "A" level in terms of energy performance and must be upgraded to achieve the 2050 target, France and Denmark having the highest share of energy efficient buildings (7% and 6% respectively) and Bulgaria and Spain among the worst ones.[8] This makes building renovation a crucial priority for the EU's climate goals.

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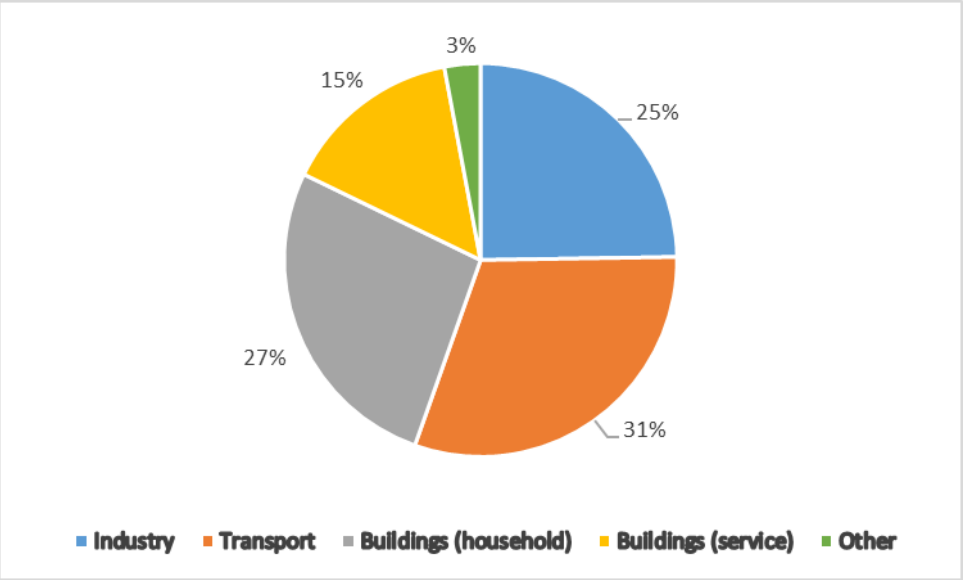
5. Global Alliance for Buildings and Construction, International Energy Agency and the United Nations Environment Programme, *2019 Global Status Report for Buildings and Construction: Towards a Zero-Emission, Efficient and Resilient Buildings and Construction Sector*, 2019.
6. European Commission, "New Rules for Greener and Smarter Buildings Will Increase the Quality of Life for All Europeans", April 15, 2019, available at: https://ec.europa.eu; Build Up, "Overview. EU Support for (Deep) Energy Renovation of Buildings", December 6, 2017, available at: www.buildup.eu.
7. European Court of Auditors (ECA), *"Special Report: Energy Efficiency in Buildings: Greater Focus on Cost-Effectiveness Still Needed"*, 2020, available at: www.eca.europa.eu.
8. BPIE, "97% of Buildings in the EU Need to Be Upgraded", *BPIE Factsheet*, December 2017, available at: www.bpie.eu.

Figure 1. Share of energy consumption by sector in the EU (% of total), 2017



Source: European Court of Auditors, 2020.

Different situations in each Member States

The average consumption in the EU reaches around 200 kWh/m², and more specifically 300 kWh/m² for service buildings and 170 kWh/m² for residential ones. The reality also differs from one MS to the other: Finland, the Czech Republic, Poland, Romania and Slovenia were in 2016 the five MS with the highest consumption per m² (around 250 kWh/m²), while Denmark, the Netherlands, Spain, Bulgaria (around 150 kWh/m²) and Portugal (around 100 kWh/m²) had the lowest.[9] Figure 2 highlights the energy efficiency progress in the European household sector and table 1 shows the different primary energy savings (5 best and 5 worst, in terms of percentage). These figure and table should not be seen as a ranking, as performances in different countries vary from one area to the other and depend on number of external factors (climate, initial performance, etc.). However, the Odyssee-Mure database notes some important energy efficiency gains in approximately half countries since the 2008 economic crisis, due to the evolution of related regulations. It also points to a slow-down in a few countries, including Romania, Slovakia, Germany, Austria and Slovenia. In terms of average consumption per dwelling at normal

9. M. Rousselot, "Energy Efficiency Trends for Households in the EU", Odyssee-Mure policy brief, available at: www.odyssee-mure.eu. More information on country's progress and policies can be found on the Concerted Action Energy Performance of Buildings website, available at: https://epbd-ca.eu.

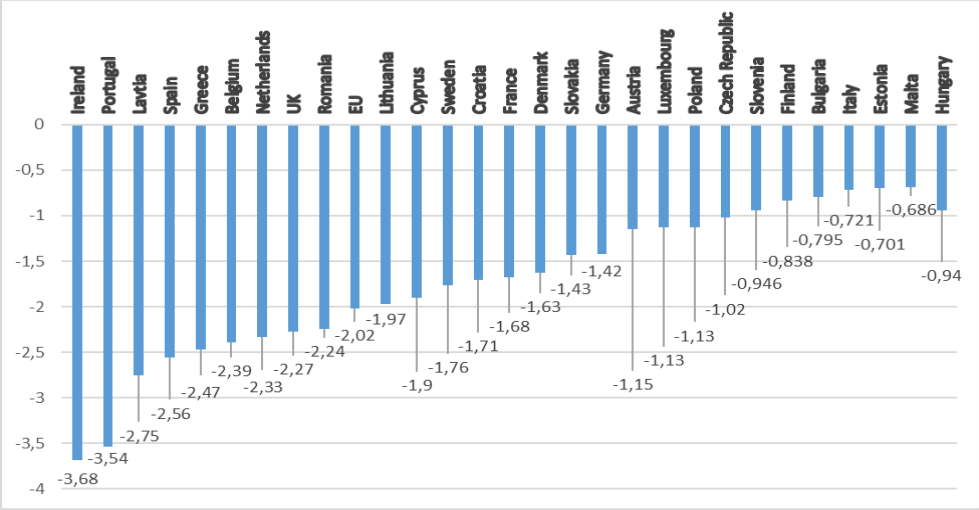
climate, data show that in 2017. Malta had the lowest one (0.557 toe/dwelling) and Luxembourg the highest (2.25) while the average at the EU level is 1.36.[10]

Table 1. Examples of relative primary energy related savings in residential and non-residential buildings (average savings per year for the period 2012-2016)

	Residential			Non-residential		
	Country	Energy related savings	KW/ (m^2.y)	Country	Energy related savings	KW/ (m^2.y)
Highest (%)	UK	11.4%	15	Belgium	21.3%	75
	Austria	11.1%	25	Greece	20.9%	80
	Czech Republic	10.8%	23	Cyprus	20.8%	58
	Greece	10.7%	15	Bulgaria	20.4%	49
	Cyprus	10.5%	16	Portugal	20.0%	16
Lowest (%)	Estonia	7.3%	24	Ireland	12.1%	54
	Netherlands	7.3%	10	Austria	11.6%	50
	Sweden	6.3%	12	Romania	10.4%	22
	Malta	4.9%	8	Luxembourg	8.8%	24
	Finland	4.8%	16	Croatia	8.6%	50

Source: Esser et al.*, 2019.*

Figure 2. Energy efficiency progress in EU countries (%/year, 2008-2017)



Source: odyssee-mure.eu.

10. Odyssey-mure.eu.

Some countries are leading the way in terms of good practices in the residential sector.[11] Ireland and Spain are often seen as the best performing countries in terms of building efficiency, based on their energy intensity, progress and policies. Ireland set up a renovation strategy in 2014 and, in order to accelerate its implementation, has set up a Behavioral Economics Unit that explores motivations and drivers leading to the renovation decision. Spain's policies have been designed through a successful engagement with stakeholders and regions are using concerted neighborhood action to promote new policies and address energy poverty.[12] France also features in the top countries and is prominently featured in the American Council for an Energy Efficient Economy (ACEEE)'s International Scorecard that identifies good practices. They recognize the "excellency" of its energy codes and retrofit categories, as well as its mandatory building rating system. The country's retrofit building policy combining codes requiring energy-efficient upgrades within specific time frames and loans and rebates is considered as the most innovative in the world (Castro-Alvarez *et al.*, 2018).[13] Other European top-performers include Germany, the UK and the Netherlands. Nordic countries should also be mentioned, though they do not necessarily rank high in the lists. They benefit from district energy systems and heat pumps. For instance, in Denmark, district heating plants produce heat and electricity for 64% of the homes, a total 1.7 million households. In Sweden, large heat pumps are responsible for 50% of Stockholm's heating and they have been used for 30 years.[14]

At the bottom stand countries such as Hungary, Poland, Sweden, Lithuania, and Croatia. For instance, Hungary has low electricity prices for end-users that reduce the potential money savings after the renovation, and is missing long-term sustainable energy programs. In addition, some public buildings (schools) are operated by the national government, which reduces the incentive for local authorities to launch renovation projects.[15] In Sweden, different factors may explain the low level of the country in terms of building energy performance; these include the wide availability of

11. Otherwise noted, the following paragraphs are using the Odyssee-Mure EU Energy Efficiency Scorecard as a main reference, available at: www.odyssee-mure.eu.

12. "A Snapshot of National Renovation Strategies. Examples from Selected EU Member States", *BPIE Briefing,* November 2017, available at: http://bpie.eu.

13 F. Castro-Alvarez, S. Vaidyanathan et H. Batian, *The 2018 International Energy Efficiency Scorecard*, American Council for an Energy Efficient Economy (ACEEE), Report 1801, June 2018.

14. "The Path to Emission-Free District Heating in Denmark", *Foresight Climate & Energy,* April 2019, available at: https://foresightdk.com.

15. North-West Croatia Regional Energy Agency, *Analysis of the Current National and Regional/Local Renovation Strategies*, Interreg Central Europe, April, 2018, available atwww.interreg-central.eu.

district heating mentioned above and the housing crisis that the country is facing is making renovation a politically sensitive issue.[16]

These rankings of energy performance in countries should however by considered with caution. Many countries are suffering from poor data reliability and collection or maintenance issues, for instance in Romania but also in richer countries like Germany. In addition, while Spain ranks as second-best country in terms of the household energy efficiency score in the Odyssee-Mure database, back in 2017, BPIE could not identify any "A" ranked building in the country, as mentioned above.[17]

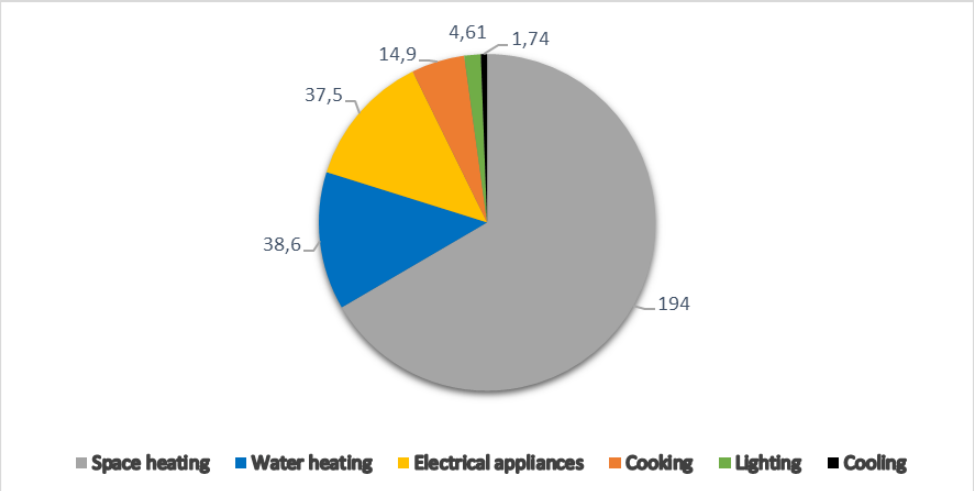
16. D. Polanska, "Inside Sweden's Housing Crisis: When Renovation Means Eviction", *The Conversation,* February 1, 2017, available at: https://theconversation.com.
17. Personal interview. According to "97% of Buildings in the EU Need to Be Upgraded", *BPIE Factsheet*, December 2017, Germany in 2017 did not have comprehensive Energy Performance Certificate data available.

Building renovation: a silver bullet for climate change and economic growth?

Combining climate mitigation and economic growth

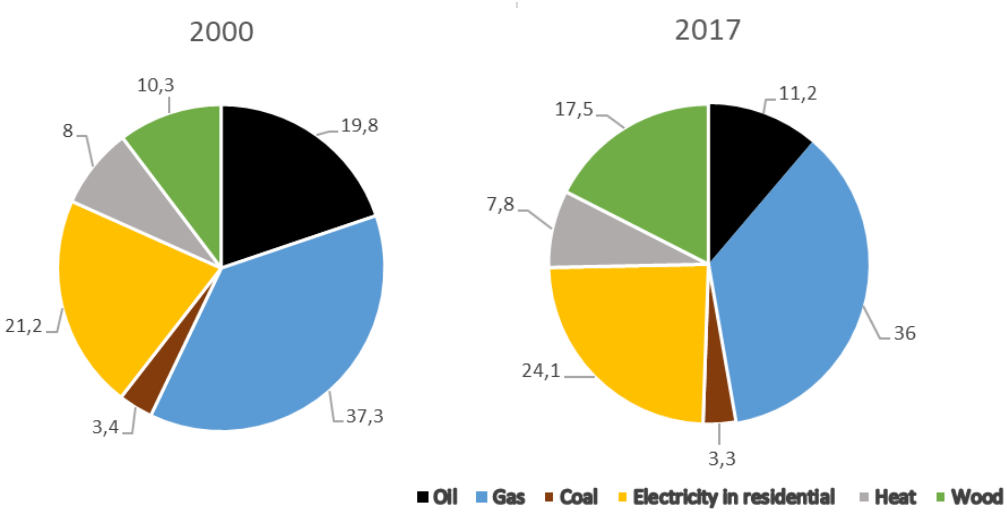
European buildings represent 41% of the global final energy use (the largest share) and 36% of energy related CO_2 emissions. Hence, buildings constitute a key sector in terms of climate action. Most of this energy-use comes from households (see figure 1) and heating and cooling represent a huge part of the energy-use, as shown in figure 3. Figures 4 and 5 show that natural gas is the dominant source of energy for households, while the use of electricity is increasing (from 21% in 2000 to 24% in 2017), as well as the use of wood (from 10 to 18%). Oil is being phased out, but remains important in island countries. This makes many European countries dependent on foreign supplies and can also create energy supply tensions in case of hard winters or other extreme temperature events.

Figure 3. European household energy consumption (2017, Mtoe)



Source: odyssee-mure.eu.

Figures 4 and 5. Household energy consumption in the EU (2000 and 2017, %)



Source: odyssee-mure.eu.

Accelerating buildings' energy performance also benefits the European economy, especially at a time when countries are facing a severe recession. The International Energy Agency (IEA) shows that general energy efficiency actions can support economic stimulus programs. Among others, it promotes economic activities, improves competitiveness, frees up money to be spent in other parts of the economy, etc.[18]

Building renovation policies also support the job market. Recent studies confirm that building new renewable generation capacity or improving energy efficiency create more jobs than investing in an equivalent level of fossil fuel-fired generation. It is said that the magnitude of the difference is of about 1 job per annual GWh produced.[19] According to the IEA, the buildings and construction sector is the one with the largest impact, as it has the potential to activate local value chains. This sector involves number of jobs in areas such as insulation and building fabric, heating, cooling, hot water and lighting systems, rooftop solar PV and battery storage (IEA, 2020). In Europe, the construction industry represents approximately 9% of the GDP, and directly accounts for 18 million jobs. Unlike for many other businesses, these jobs are local ones. The European construction sector also strongly benefits small and medium-sized enterprises, which contribute to more than 70% of the

18. IEA, "Energy Efficiency and Economic Stimulus"', April 8, 2020, available at: www.iea.org.
19. W. Blyth W., R. Gross, J. Speirs *et al.*, "Low Carbon Jobs: The Evidence for Net Job Creation from Policy Support for Energy Efficiency and Renewable Energy", UK Energy Research Centre Technology & Policy Assessment Function, March 2020.

value-added in the building sector.[20] Investing in energy efficiency could also help protect the 6 million construction jobs at risk because of the economic impacts of the virus.[21] After the 2008 economic crisis, Ireland used building efficiency to promote job creation. Its Home Energy Saving Scheme supported the upgrades of 88,000 homes in 2009 – 2011 with an investment of EUR 250 million that supported the creation of up to 5,000 jobs each year.[22]

Tackling energy poverty, improving health

Addressing these energy efficiency potentials can also have important social benefits, primarily in terms of energy poverty. Defined as "a situation where a household or an individual is unable to afford basic energy services (heating, cooling, lighting, mobility and power) to guarantee a decent standard of living due to a combination of low income, high energy expenditure and low energy efficiency of their homes",[23] energy poverty concerns millions of people in Europe: for instance, 57 million people do not have the means to keep their homes warm during winter (i.e. 7.4% of the total population), and 52 million are facing delays paying their energy bills (6.6% of the total population). This number varies from one country to another; in Romania, in 2018, 9.6% of the population was unable to keep their home warm and 14.4% had problems paying their bills, against for instance 5.1% and 6.3% in Poland, or 2.1% and 3.6% in Luxembourg.[24]

Improving the energy performance of the buildings has a direct effect on the energy costs of a dwelling. Deep renovation of homes can ensure that warm increases, that energy bills are lowered down, and that the overall quality of dwellings is improved. Renovation programs promoting renovation in homes with low-income families have shown results (BPIE, 2017). These renovation programs need however to be supported by government policies, as dwellers suffering from energy poverty normally do not have the means to pay for renovation works. European countries have put in place some programs and projects to address this.

20. European Commission, "Energy Performance of Buildings Directive", available at: https://ec.europa.eu.
21. Interviews with an expert from the sector.
22. F. Meijer *et al.*, "Jobs Creations through Energy Renovation of the Housing Stock", NEUJOBS Working Paper D14.2, December 2012.
23. European Commission, *Citizens' Energy Forum 2016*.
24. EU Energy Poverty Observatory, *Member State Reports on Energy Poverty 2019,* European Union, 2020, available at: www.energypoverty.eu.

For instance, between 2009 and 2014, the city of Porto (Portugal) spent EUR 17.3 million to renovate 5,000 m^3 of heated area in the Rainha Dona Leonor neighborhood. This effort consisted mostly in the installation of hot water systems based on solar thermal energy, the improvement of building envelope and enhanced control of infiltrations. As a result, the annual energy needs decreased by almost 50 kW/m^2, and solar energy allowed for an increased uptake of renewable energy of almost 10 kWh/m^2 per year. The energy costs for the residents were reduced by no less than 70%, though these renovations also resulted in a rise of the rents.[25] Concerned by this issue of energy poverty, the EU also established an EU Energy Poverty Observatory, which has teamed up with another EC-funded initiative, the Covenant of Mayors for Climate Energy, to alleviate energy poverty.[26]

Energy renovation can also significantly contribute to better health. This component has been added in the EPBD during its 2nd review (article 7), with the requirements that renovation strategies minimize health risks to workers, building inhabitants and general public. Renovation can bring better ventilation, and address indoor pollutants such as dust, spores, molds, or products linked to human activities like cooking or cleaning. These can generate asthma, allergies, irritations, or chronic pulmonic diseases. In 2017, 2.2 million Europeans were said to have asthma because of poor living conditions. The level of temperature in the home is also important. This issue is correlated to energy poverty, as 45% of Europeans are keeping their temperature down in order to reduce their energy bills.[27] In addition, building renovation can also help removing from buildings substances that are harmful to health, such as asbestos.[28] Finally, the building renovation announced in the Green Deal shall also be started with hospitals and schools, which in 2017, represented 21% of the total building electricity consumption.[29] These types of buildings, along with public ones, are often targeted first by renovation policies: it is easier for the State to launch a renovation wave in its own buildings, than to convince non-state building owners to implement one.

25. Energy Cities, "Fighting Energy Poverty through Deep Renovation of Buildings", *Best Practices,* 2016, available at: http://energy-cities.eu.
26. Covenant of Mayors for Climate and Energy, "Alleviating Energy Poverty", available at: www.eumayors.eu.
27. "Protecting Health by Improved Building Efficiency", Build Up, April 9, 2018, available at: www.buildup.eu.
28. "Workers' Health Should Not Be Jeopardized in Order to Make Buildings Energy Efficient", European Economic and Social Committee, April 28, 2019.
29. Odyssee-mure.eu.

Does the EU really have the means of its ambitions to address its building renovation targets?

Setting targets

There are a number of European regulations covering building efficiency and renovation, which makes the whole system quite complex and may also impact its ability to deliver.

First, building efficiency is a key element of the overall EU energy efficiency strategy, with two pillar directives: the 2010 EPBD and the 2012 Energy Efficiency Directive (EED), and important elements in the Renewable Energy Directive (RED) and the Governance Regulation (see table 2). The targets it set up aim for an energy-use reduction of 32.5% for the period 2021-2030 (the original 27% target for 2030 was revised upward in 2018). These complement other related targets: a 40% cut in greenhouse gas emissions for 2030, as compared to 1990 levels and at least 32% of renewables in the energy mix.[30] The energy-use reduction target uses 2007 projection as a baseline and aims at a 368 Mtoe reduction. More specifically, the EPBD includes measures on:

- Energy Performance Certificates to be made available when the building is on sale or rent;
- The development of inspection schemes for heating and air-conditioning systems in each member states;
- New constructions to be nearly zero energy after 31 December 2020 (31 December 2018 for public buildings);
- Minimum energy performance requirements;
- The development by all member states of financial measures and instruments for building energy efficiency.

30. European Commission, "2030 Climate and Energy Framework", available at: https://ec.europa.eu.

In September 2020, the EC announced that the EPBD would be revised again in 2021 (Von der Leyen, 2020).

Energy efficiency can be seen as being the weak link of the EU energy and climate targets. First, the target has not been made mandatory. This was not the case for the 2020 target, and still not the case for the 2030 target.

Table 2. Main European-level regulations for building renovations

Regulation	Main measures
EPBD	Long-term renovation strategies, investment mobilization, advisory tools, smart readiness indicators
EED	2030 energy efficiency target, energy savings obligations
RED	2030 renewable energy target, renewable energy in buildings
Governance	National and climate energy plans, long-term strategies, multilevel climate and energy dialogues

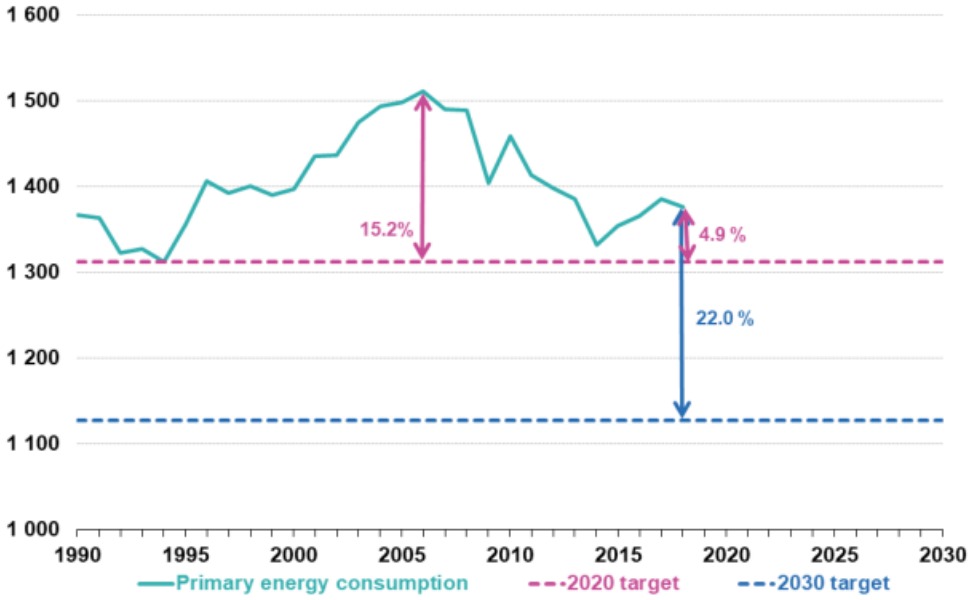
Source: BPIE, 2019.

Missing targets

The EU's overall energy efficiency targets for 2020 are very likely to be missed. Figures show that the European energy consumption is on the rise again since 2014: Eurostat data stresses that the EU in 2018 was 5% above the 2020 requirements, with an increase of final energy consumption in 15 of 27 MS compared to 2017 (see figure 6). The biggest increases were recorded in Poland (+13.7%) and Spain (+7.5%).[31] Building energy-use tends to slow down, but too slowly: it decreased by only - 0.6% per year from 2008 to 2016, after a 0.7% increase per year between 2000 and 2008. Some experts still see weather as an important explanation of the yearly chance in energy use (i.e. harsh winters mean more heat used to warm up dwellings).[32] In addition, the growing use of air conditioning could in the future bring a significant increase of energy use: according to Odyssee-Mure data, it jumped from 0.442 to 1.74 Mtoe from 2000 to 2017.

31. Eurostat, "Energy Consumption in 2018. Primary and Final Energy Consumption still 5% and 3% Away from 2020 Targets", Newsrelease, 26/2020, February 4, 2020.
32. "EU at Risk of Missing 2020 Energy Efficiency Targets: Lessons for 2030", *Euractiv,* January 19, 2019, available at: www.euractiv.com.

Figure 6. Primary energy consumption in the EU, 1990-2018 (in millon tons of oil equivalent – Mtoe)



Source: Eurostat (2020).

It may seem that missing the 2020 targets would not have important consequences. First, the two other targets (on greenhouse gas emissions and renewable energy) will be met. One could argue that one of the main objectives of reducing energy consumption is to fight climate change – therefore, the mandatory emission target is more important, and it will be met. Then, the 2030 target uses 2021 as a baseline. It means that missing the 2020 will not entail a more important effort to meet over the 2030's (as it would have been the case if both targets has had the same baseline).[33] However, one can wonder how the 32.5% decrease in 10 years will be achieved, when MS turned out to be unable to meet a target almost 1/3 lower over the past decade. In addition, not improving energy performance leaves number of the benefits listed above (fight against energy poverty, enhanced indoor air quality, etc.) unaddressed.

Accelerating the efforts?

Campaigns and policies have been set up or revised in order to further promote energy efficiency:

33. On a side note, one could also question the appropriateness of the target itself: energy efficiency is usually measured through energy intensity, as its strict definition does not necessarily include a reduction of energy use. That is to say that an increase of energy use does not necessarily mean a decrease of energy efficiency.

- The "energy efficiency first" principle which appeared in 2016, and states that energy efficiency should be treated as an energy source of its own right, and that it should be taken into account when setting new rules for the supply side and other policy areas.[34]
- The Clean Energy for All Europeans Package published in 2016 addresses broader clean energy issues and includes the revision of the 2030 target mentioned above. This should also be reflected in the EU's revised Nationally Determined Contribution (NDC).
- As part of the Clean Energy for All Europeans Package, the EBPD was revised in 2018, in order to include measures aiming at accelerating the rate of renovation including:
    - A path toward a low and zero-emission buildings stock by 2050;
    - The use of information and communication technology (ICT) and smart technologies in buildings;
    - The roll-out of e-mobility infrastructure in each building;
    - The development of a "smart readiness indicator" that measures the capacity of the buildings to use ICTs;
    - The integration and strengthening of the long-term building renovation strategies, each member being asked to submit theirs by March 2020;
    - The mobilization of public and private financing and investments;
    - The fight against energy poverty.[35]

Lastly, the Green Deal calls for a Renovation Wave to be implemented and which is to be guided by a strategy to be presented in October 2020. However, many obstacles need to be overcome for these ambitious plans to be deployed and objectives to be met.

34. European Commission, DG Energy, "Energy Efficiency First Principle", presentation given at the 5th Plenary Meeting Concerted Action for the EED, Zagreb, 2019.
35. "Commission Welcomes Council Adoption of New Energy Performance in Buildings Directive", European Commission, May 14, 2018, available at: https://ec.europa.eu.

Building renovation in France's economic recovery plan – more support needed

France's building energy consumption occupies a larger share in the national energy consumption (45%) than the European average. Buildings are also responsible for 25 to 28% of the national GHG emissions, and Paris has set ambitious objectives for 2050: by then, all buildings shall be low-energy use (*bâtiment basse consommation*) with the objective of a yearly renovation of 500,000 households per year until 2030, and then of 700,000 per year until 2050, as part of the transcription of the EPBD. In parallel, the government is planning to refurbish 100,000 social houses per year. According to the French environment agency (ADEME), the renovation sector represented in 2016 about 200,000 jobs and a market of EUR 29 billion.[36] However, The objective is very ambitious and will be difficult to reach: from 2016 to 2018, it is estimated that only between 300,000 and 400,000 households were actually renovated. This clean energy sector is the one lagging the most behind, with disappointing energy-use reduction of - 2% from 2012 and 2018, against the objective of – 18% between 2012 and 2023.[37] Many reasons can explain these problems, the most important ones being the cost of thermal renovation (estimated to reach EUR 25,900 for a private household), the slow return on investments, the lack of information or confusion about the different support schemes in place.[38]

In order to address this potential and to accelerate the efforts, the French government has put building renovation forward in its economic recovery plan – though many questions remain on whether the plan is ambitious enough to address the renovation gap. Renovation stands as the first sector mentioned in the plan that was released in early September, with the announcement of EUR 2 billion to support renovation work from households, EUR 4 billion for public buildings and EUR 500 million for works in social housing.[39] In parallel, the government established a Building Renovation Observatory in order to mobilize investments.[40] Some industry associations however point that the financial support brought in by the government is still not sufficient. In addition, they worry about the the lack of qualified workforce in the sector, stressing the lack of workers with the environmental RGE label ("Reconnu garant de l'Environnement"). They are also worried about the quality of the renovations, and the lack fo support to the construction job market. Finally, companies are

36. A. Rüdinger, "La rénovation énergétique dans le plan de relance français : une opportunité à saisir et des pièges à éviter", IDDRI's blog, June 21, 2020, available at: www.iddri.org.
37. A. Rüdinger *et al.*, "Évaluation de l'état d'avancement de la transition bas-carbone en France", *Étude de l'IDDRI*, October 12, 2018.
38. « À ce rythme, le plan rénovation énergétique de la France n'atteindra pas ses objectifs", *The Conversation,* November 19, 2019.
39. French Government, *France Relance*, September 3, 2020, available at: www.economie.gouv.fr.
40. "L'observatoire national de la rénovation énergétique des bâtiments est sur les rails", *Le Moniteur,* February 12, 2020.

asking for the support plan to be extended, two years being too short to complete the renovations needed. [41]

These issues may call for more ambitious and innovative implementation measures. For instance, the financial support to renovation could be completed with 0-interest rate, as suggested by the NGO NegaWatt, and building renovations could be made mandatory.[42]

41. "Plan de relance: le compte y est-il pour la rénovation énergétique des logements ?", *Challenges,* September 14, 2020, "Plan de relance : la Fédération du bâtiment dans la Vienne salue « une très bonne chose »", *France Bleu,* September 4, 2020, available at: www.francebleu.fr.
42. « Regard sur le Plan de rénovation énergétique des bâtiments », *Connaissance des énergies,* February, 19, 2018.

Challenges ahead, and options to address them

Lack of leadership and coordination

Some governments are dragging their feet to abide to the EU rules. This can be seen in the delays in terms of adoption of the European directives or draft of national policies. For instance, almost half of the countries failed to submit their National Energy and Climate Plans (NECPs) by the end of 2019, as required by the Energy Efficiency Directive.[43] Delays have also been experienced for transposing the updated EPBD, that includes the requirement to Member countries to present long-term renovation strategy by March 2020 (under article 2A). These are to include information on the current building stock and related policies, as well as a roadmap with measures and progress indicators; milestones for 2030, 2040 and 2050; estimates of energy savings and of the contribution to the EU's targets. As of October 2020, 14 strategies (excl. the UK's) were still missing.[44] More generally, directives are not always transposed properly, there is a lack of details about the assessment of the measures and compliance mechanisms, and policies include numerous exceptions.[45]

The EC is now expected to step in to accelerate the process, but some question their capacity to do so. At the EC level, coordination problems reportedly exist. Energy efficiency in building is a broad topic that concerns many different sectors and therefore directorates: energy, construction, climate change, environment, health, and others. Those were, by the past, mostly not talking to each other. Some even complain that, within the Energy Directorate, units working on Renewable Energy barely talk to the ones dedicated to energy efficiency.[46] Language also remains an issue, even today. Too often, materials are not produced in English, which makes it difficult for others to learn about policies and best practices in the MS. As an example, out of the 13 long-term renovation strategies submitted, only

43. National Energy and Climate Plans (NECPs) webpage, available at: https://ec.europa.eu.
44. The missing ones were those of Bulgaria, Croatia, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, and the UK. See "Long-Term Renovation Strategies", European Commission, available at: https://ec.europa.eu.
45. "EU Countries Dragging Their Feet on Building Renovation Plans", *Euractiv,* April 9, 2020, available at: www.euractiv.com.
46. Personal interviews.

6 have been translated in English.[47] France and Belgium have not translated their NECPs either.[48]

However, the EC has set up different tools in order to improve not only the coordination between its directorates, but also the exchanges between MS. Concerted Action EBPD is one of these.[49] This initiative facilitates the exchange of information between the MS and Norway. It consists in regular meetings, every 6 to 8 months, between representatives from the relevant ministries of the MS and from the EC. Discussions happening there allow country representatives to talk about the policy challenges they are facing and to discuss ways to address these. As the meetings are under Chatham House rules, a benefit is for the EC to be informed of the progress, without being allowed to hold the information against a MS that would recognize not being able to comply with the EU regulations. A total of approximately 30 meetings have been organized over the past 15 years.[50] In addition, under the leadership of Ursula von der Leyen, the EU seem to be trying to promote more discussions between the different directorates and thus to be breaking silos.[51]

Do local companies have the capacity to implement the plans?

Once policies are put in place, important challenges remain.

Critics of the Green Deal's energy efficiency part focus mostly on the lack of implementation and spending details of the plan, and more specifically the absence of a dedicated fund for renovation, a gap that may jeopardize the results of the plan[52]. Funding may indeed be an issue. BPIE[53] (2020) estimates that the total investment opportunity for renovation represents EUR 243 billion per year until 2050, of which EUR 179 billion per year for residential buildings and EUR 64 billion per year for non-residential ones. Studies estimate that over the period 2012-2016, EUR 760 billion have been invested in building renovation.[54] This

47. Austria, Belgium, Cyprus, Finland, France, the Netherlands and Sweden translated their documents in English, while the Czech Republic, Denmark, Estonia, Germany, Luxembourg and Sweden did not. See: https://ec.europa.eu.
48. National Energy and Climate Plans (NECPs) webpage, available at: https://ec.europa.eu.
49. Concerted Action. Energy Performance in Buildings, available at: https://epbd-ca.eu.
50. Personal interviews.
51. Personal interviews.
52. "Green Building Advocates 'Underwhelmed' by EU Recovery Plan", *Euractiv,* June 9, 2020, available at: www.euractiv.com.
53. BPIE, "COVID-19 Recovery: Investment Opportunities in Deep Renovation in Europe", May 2020.
54. A. Esser *et al.*, *Comprehensive Study of Building Energy Renovation Activities and the Uptake of Nearly Zero-Energy Buildings in the EU*, European Commission, November 2019, available at: https://ec.europa.eu.

represents an average EUR 152 billion per year, far behind the EUR 243 billion identified by BPIE. It calls for the creation of a EUR 90 billion per year fund, mostly to support deep renovation; provide advisory services for owners or investors, technical assistance to MS, and support innovation in serial renovation solutions. As a matter of comparison, and according to the European Court of Auditors (ECA, 2020), around EUR 14 billion from Cohesion policy operational programs have been allocated to building efficiency between 2014 and 2020. This was completed by EUR 5.4 billion of co-financing from national budgets.

Then, a large number of barriers need to be overcome in terms of implementation at the company level. The building renovation market is extremely fragmented, with a wide range of companies involved. According to the European Construction Sector Observatory (ECSO),[55] the construction sector represents 9% of EU's GDP, with 18 million employees. In a country like Germany alone, back in 2014, there were more than 650,000 companies active in the field, with a growth rate of 10.4% for the 2010-2016 period. This poses number of challenges. First, not everyone is aware of the EU and/or national building requirements, and not every stakeholder has the capacity to implement the measures: different experts insist on the fact that there is still a strong need for capacity building in every country, on a variety of topics such as building design or data collection.[56] Then, work on building efficiency requires important coordination efforts, as they involve different jobs and can be seen as a bundle of small projects: electricians, architects, insulation companies, etc. These usually do not work together, and most of the time, the landlord is the only person who can ensure that different workers coordinate their efforts. In addition, the people involved in the renovation need to be informed of the latest European regulations in the field, and it can often happen that some architects would not know about the NZEB (*nearly zero energy buildings*) requirements, or that electricians would not be aware of the type of cables or metering boards needed for smart metering.[57]

Some initiatives exist to improve the skills of the workers. The EU's Executive Agency for SMEs (EASME) BUILD UP Skills initiative was launched in 2011 and aims at improving the skills of the workers in the field, in the building fabric, services, management and energy sources. The phase II of the project was assessed in 2018: altogether, the project allowed to train 8,570 people in 21 countries and is said to have save

55. ECSO, "Stimulating Favourable Invesment Conditions", European Commission, November 2018.
56. Personal interviews.
57. Personal interviews.

572,766 toe/year of energy.[58] These figure seem however very modest when put in context with the 18 million employees working on the sector. The "European Bauhaus" suggested by Ursula von der Leyen during her State of the European Union Speech in September 2020 could also support the development of these skills at the European level.[59]

A lack of trust in companies adds up to these issues. In general, homeowners are not well informed of the benefits of building efficiency, or of the regulation. Most of them do not know what to expect and some report negative experiences that impact the industry. The heterogeneity of the market and of the available options do not help – each homeowner having their own needs, and each building is unique and needs proper solutions. This complexity can add up to the costs and delays of building renovation work.[60] Some companies take advantage of their clients' ignorance. In France, for instance, authorities have recorded an increasing number of scams involving attic insulation. Such cases increased by 20% in 2019 (mounting altogether to 1,770), and 56% of the companies investigated by the regulator were said not to abide by the rules. Attic insulations benefit from state subsidies (EUR 20/m² for low-income households and EUR 10/m² for the others). They allow some companies to provide attic insulation for one euro, but this can only work for the low-income households benefiting from the EUR 20/m² subsidy and means that the attic is lost in the work. For other households, some of the works are sometimes not properly done, need to be re-done entirely and can create some risks of fire. A fake website isolation-gouv.org has been created to support the scammers.[61]

In addition, some programs simply do not work. The Irish program "Better Energy Warmer Homes", ran by the Sustainable Energy Authority of Ireland (SEAI) provides an unfortunate example of these types of failures. The initiative was launched in 2000, with the purpose to support low-income households exposed to energy poverty risks. The objectives were to support the payment of the energy bills for the poorest, but also to improve their health and well-being. Starting from 2014, the program benefited from EU funds. The total allocation is of around EUR 20 million

58. Trinomics and Visionary Analytics, *BUILD UP Skills Pillar II. Overview Report*, EASME, April 2018, available at: www.buildup.eu.

59. U. Von der Leyen, *State of the Union Address 2020,* European Commission, September 2020, available at: https://ec.europa.eu.

60. Personal interviews and "Expert: 'Lack of trust' Hampers Energy Efficiency Services Industry", *Euractiv,* June 16, 2020, available at: www.euractiv.com.

61. The French Ministry of Economy, Finance and Recovery has issued a warning on its website: "Offres d'isolation à 1 euro, soyez vigilant", available at: www.economie.gouv.fr. See also: "Les arnaques sur l'isolation des combles à 1 euro se multiplient", *Les Échos,* 2019, October 8, and "Isolation à 1 euro: attention, les arnaques se multiplient", *Capital*, August 7, 2019.

per year and is used to finance simple and "low-hanging fruit" upgrades such as dry lining, attic insulation, lagging jackets for hot water tanks and cavity wall insulation). Such work presents the benefits of being relatively cheap (the average cost of project between 2014 and 2017 was EUR 3,161) and therefore provides quick payback. However, it received criticism from the European Court of Auditors (ECA) in 2020 for not delivering and for the fact that Ireland reduced its financial support to the initiative when it started receiving EU funds to support it. The ECA stressed the lack of definition of the energy saving objectives and the lack of reporting of the energy saved – according to the report, energy ratings did not improve in 52% of the households renovated. The national press reported on the ECA's findings.[62]

Tenants and homeowners: the most difficult stakeholders to mobilize

Other issues are directly linked with the attitudes and habits of the homeowners and users. Some of the main ones are the following, presented in the order under which they normally chronologically occur:

First comes the "split incentives" or landlord/tenant dilemma: it refers to the lack of renovation incentives: for landlords who are renting their house (why investing if you cannot enjoy the benefits of the renovation?) and for the tenants (why spending an important amount of money on a dwelling that they do not own?). Some policies exist to address this issue: most of the time, they target transparency (informing the tenants of the building performance and of its potential consequences on the energy bill) or try to market renovation work more attractively. They consist in making minimum energy performance standards and labels mandatory, in establishing financial incentives to promote investments in renovation work, or to install individual meters or submetering devices (as required by the Energy Efficiency Directives).[63]

The payback is another important barrier to renovation works. There is no consensus on this aspect. Recent (and controversial) research even came to the results that in France, EUR 1000 of renovation work would lead on average to an 8.4%-energy bill reduction, i.e. approximately 2.7% of the bill. In other words, it would take 120 years to get a return on the

62. European Court of Auditors (2020) and "Half of the Homes in Retrofit Plan No Better Off Despite Cost", *independent,* April 19, 2020, "EU Auditors: Taxpayer-Funded Retrofit Scheme Falls Short on Energy Savings – Despite Cost", *Agriland,* May 14, 2020.
63. M. Economidou and P. Bertoldi, "Practices to Overcome Split Incentives in the EU Building Stock", European Council for an Energy Efficient Economy, *Summer Study*, 2015.

initial investment. The conclusion of the work is that the main benefit or renovation work is not so much savings but better comfort.[64]

Another challenge is the asymmetry of information, briefly mentioned above. The success of renovation depends on number of different factors, such as the type of heating used in the building, the building materials, the local climate, the involvement of the workers involved in the insulation work, etc. Households normally do not have the necessary information and they must rely on renovation companies, without being able to assess their professionalism, and which will not be held responsible for the energy savings after works are completed – this creates moral hazard situations.[65] Some experts recommend better regulation of the sector, and the creation of agencies that would provide tailored advices to households.[66] Some small energy communities aiming at promoting enhanced renovations have been established here and there (for instance in Ireland or in some Spanish cities) and could address these asymmetry of information issues but they remain scarce. Some also call for "one-stop-shops" that would provide these local communities with important information and advice to the citizens about renovation programs.[67]

Finance also remains an issue, though some programs exist to support renovation efforts: these include the EC's Private Finance for Energy Efficiency initiative, as well as local policies in MS, that should be ramped up in the context of the Green Deal. BPIE lists different types of financial support schemes: grants and subsidies that usually trigger significant co-financing of the work (e.g. "Habiter Mieux" in France); debt financing covering loans, for instance KredEx renovation loans in Estonia; tax incentives, for instance in Belgium; guarantees, for instance through the Energy Efficiency and Renewable Sources Fund in Bulgaria; or multiple schemes, for instance those provided by KfW in Germany.[68]

64. G. Blaise and M. Glachant "Quel est l'impact des travaux de rénovation énergétique des logements sur la consommation d'énergie ? Une évaluation *ex post* sur des données de panel", *La Revue de l'Énergie*, No. 646, September-October 2019, pp. 46-60. The results of the paper have been put in question by "Oui, la rénovation thermique réduit réellement votre facture d'énergie – à condition qu'elle soit performante. Décryptage de l'étude de Matthieu Glachant", *Note d'Analyse,* Association Négawatt, January 2020.

65. L.-G. Giraudet, S. Houde, J. Maher, "Moral Hazard and the Energy Efficiency Gap: Theory and Evidence", *Journal of the Association of Environmental and Resource Economics*, Vol. 4, No. 4, October 2018. See also "Efficacité énergétique des bâtiments: la pratique loin des attentes théoriques", *La Tribune*, June 30, 2020.

66. Personal interview.

67. "Dublin MEP Pushes 'Neighbourhood' Approach to Building Renovation", *Euractiv,* April 14, 2020, available at: www.euractiv.com.

68. J. Rieke Boll *et al.*, *Financing Energy Renovations in Buildings – Guidance on Financial Schemes with a Focus on Bulgaria and Romania*, BPIE, November 2019, available at: http://bpie.eu.

Yet some schemes have triggered important progress. During its first 10 years of existence, KfW's Energy-Efficient Construction and Refurbishment programs have provided funds to more than 4 million housing units, and issued close to EUR 100 billion of loans, triggering EUR 260 billion of investments and securing an average of 320,000 jobs per year.[69] A less famous good practice comes from Lithuania where a financial instrument providing a total of EUR 314 million of preferential loans has benefited housing associations during the period 2014-2020. It fits into the national program for energy renovation targeting the renovation of 4,000 multi-apartment buildings, with an average of 20-year payback period and a 3% fixed interest rate. The loans are blended with a grant ranging between 15 to 40% of the loan amount – the grant covers 100% of the investment for low-income households.[70]

Then, once the idea of the renovation has been accepted comes the question of what it should focus on. This is when the risk of a lock-in-effect can materialize: the implementation of low-hanging fruit measures makes the adoption of more comprehensive measures less attractive. In the report mentioned above, the ECA (2020) also criticized the EC for not raising enough the level of needed payback and energy savings in the renovation work benefiting from subsidies. These issues call for ambitious, comprehensive and deep renovation work.[71]

Once the renovation has been completed, another problem that usually arises is the "performance gap". This expression can be used to describe "the difference between predicted and actual/measured building energy consumption, either for an individual building or for a large group of buildings", stressing the fact that often, the anticipated savings from building efficiency measures are not met due to diverse reasons (Hinge, 2019), sometimes because of issues in the system design, which is optimized for a full load performance only, that actually only occurs during a few hours per year.[72] Technologies like Building Information Modelling (BIM), that create a digital copy of the building, can help better visualize the use of the building and therefore address his performance gap.[73]

69. "Ten Years of the KfW's 'Energy-Efficient Construction and Refurbishment' Programmes", KfW, March 13, 2017.
70. European Court of Auditors (ECA), *Special Report: Energy Efficiency in Buildings: Greater Focus on Cost-Effectiveness Still Needed*, 2020.
71. Personal interviews.
72. "Closing the Energy Performance Gap of Buildings", *Euractiv*, January 15, 2018, available at: www.euractiv.com.
73. Personal interview and "How BIM Can Make Building Renovations and Retrofits More Efficient", *Archdaily,* 2019. November 22, available at: www.archdaily.com.

Finally, another important factor to take into consideration is the rebound effect, which can also be part of the performance gap. It can be defined as a phenomenon that result in "increases in consumption due to environmental efficiency interventions that can occur through a price reduction (…) or other behavioral responses".[74] In other words, it refers to energy efficiency measures that will not result in energy savings, but in an increased use of a product or service. For instance, if a household chooses to isolate its dwellings, it then can either choose to keep the same temperature in winter as before the renovation work, which should normally result in a reduction of energy consumption for heating and of the energy bill. Or, it can choose to keep its energy consumption and bill stable and increase the indoor temperature.

Though it is facing important challenges, Europe can also be seen as a unique laboratory for policies promoting building renovation, that could benefit other parts of the world, especially the countries currently building their stocks. Some innovative tools are developed and experimented across the continent and may help accelerate the renovation wave. These could potentially also feed "co-creation" space called by Ursula von der Leyen in her 2020 State of the Union speech.

Key technologies for deep renovation

First, some technological solutions can be used to promote energy savings. Through programs such as HorizonEurope, the EC supports research for innovative technologies with a strong potential, including:

- Vacuum Tube Window,
- Self-cleaning coatings,
- Phase change materials,
- Aerogel and vacuum insulated panels,
- Passive zenithal light guides,
- PV Systems and Façade Integrated PV Systems,
- Solar Thermal Heating Systems,
- Gas Absorption Heat Pumps.[75]

74. D. Maxwell *et al.*, *Addressing the Rebound Effect*, a report for the European Commission DG Environment, April 26, 2011.
75. "OVERVIEW. Innovative technologies for deep renovation of buildings", *Build Up*, December 7, 2017, available at: www.buildup.eu.

All in all, an EU strategy for energy efficiency should ensure that all materials used for building renovation are not based on fossil fuels and have low carbon footprint. Experience shows that passive houses and energy sufficiency are two innovative solutions that could be further developed in Europe.

Passive houses

Passive houses consist in a voluntary energy efficiency standard for buildings, with a low-tech approach that focuses on the building envelope, resulting in houses with very little energy use for heating and cooling (no more than 15 kWh/m² per year), i.e. reduction of heating and cooling demand by 80 to 90%. The rest of the energy demand can normally easily be covered by renewable energy, making passive house nearly zero-emission buildings. They do not suffer from performance gaps and can be implemented in every climate. In addition, passive houses maximize the health and co-benefits with excellent indoor thermal comfort and air quality.[76] Regulations promoting this standard exist in a few European countries: Austria, Belgium, Germany, Ireland, Italy, Luxembourg and Spain – and also, beyond the EU, in Australia, Canada, Norway, and the United States. In Germany, local regulations promoting the use of passive houses exist in number of places, including the States of Bavaria, Rhineland-Palatinate, Saarland, and important cities such as Cologne, Frankfurt, Hamburg, or Hannover[77]. At the national level, the KfW bank provides support to passive houses through "energy efficient constructions" or "energy efficient retrofits". These consist in low, fixed interest-rate loans with no payment on principal required during the first years. The funding can amount to up to EUR 50,000 per housing unit for construction, and up to EUR 75,000 for renovation. Additional mechanisms exist at the local level.[78]

However, according to the Germany-based Passive House Institute, the dissemination of this type of houses is being delayed because of inappropriate policy and measures that are more generally damaging the overall evolution of building performance in Europe: lack of clear and ambitious policy requirements for buildings, with performance targets and quality assurance measures; capacity building issues among the workers

76. D. Johnson *et al.,* "Are the Energy Savings of the Passive House Standard Reliable? A Review of the as-Built Thermal and Space Heating Performance of Passive House from 1900 to 2018", Energy Efficiency, published online on March 18, 2020, available at: https://link.springer.com.
77. A comprehensive and regularly updated of different places across Germany and the rest of the world can be found on the page "Passive House Legislation & Funding", International Passive House Association, available at: www.passivehouse-international.org.
78. *Ibid.*

(especially for construction companies), general awareness of the technology, competition with partial insulation or building performance improvement measures (ventilation units, high quality windows), code compliance issues, and sometimes lack of financial incentives.[79]

Some companies are also developing some new solutions to improve energy performance. EnergieSprong, a Dutch energy service company, recently attracted an important attention in the sector. Its services consist in the installation on existing houses of prefabricated facades, insulated rooftops with solar panels, smart heating and ventilation and cooling installations. The works normally take about one week and the dwellers do not need to leave their home. The company is normally financing its renovation work by the "future energy cost savings plus the budget for planned maintenance and repairs over the coming 30 years".[80] It is operating in the Netherlands, Germany, France, Italy, the UK and the USA.[81]

Energy sufficiency

Energy sufficiency is not a technology, but a concept that is gaining more and more traction, especially at the European level, and that can help address issues such as the rebound effect. Different definitions of the concept can be found, including: "a state in which people's basic needs for energy services are met equitably and ecological limits are respected".[82] It targets habits from dwellers that result in important energy-use, and provides with solutions on how to change these, for instance by turning off electronic devices or light when not using them, or by lowering down the heating in winter. Its benefits go beyond energy efficiency, as they allow to reduce energy demand without any investment, new technology or even renovation work. Its potential is important in the building sector and some researchers concluded that the measure of space reduction could save up to more than 40% of some building energy consumption in some countries (see table 3) – this would mean reducing the number of square meters available for one inhabitant. However, energy sufficiency is extremely difficult to promote as it relates directly to individual consumer behaviors and can be seen as an attempt to limit individual freedoms – one way to do

79. Personal interview.
80. See Energiesprong.org.
81. The company was mentioned in three different interviews.
82. T. Fawcet and S. Darby, "Energy Sufficiency in Policy and Practice: The Question of Needs and Wants", ECEEE, 2019.

so may only be through an increase of energy prices, considering these policies also have downturns.[83]

Table 3. Ten most important theoretical energy savings from space reduction to 35 m²/capita in Europe

Country	Reduction	Country	Reduction
Portugal	45.1%	Denmark	44.2%
Malta	43.8%	Cyprus	40.7%
Austria	36.4%	Greece	34.9%
Finland	33.5%	Netherlands	33.3%
Spain	33.2%	Luxembourg	31.5%

Source: A. Bierwirth, "Sufficiency Policies in Buildings: Key Messages for Policy Makers", 2019, presentation at workshop "The Energy Sufficiency – Future Reality Accepted or Suffered: the Viewpoint of Stakeholders", Paris, May 16, 2019.

In France, the Negawatt think tank has conducted important work on energy sufficiency (*sobriété énergétique*). One of their rationale is that part of the energy efficiency gains in the country have been partially neutralized by a lack of energy sufficiency. For instance, car drivers tend to have more efficient vehicles, but they also drive over longer distances. They have come up with a scenario of 28% of energy saved thanks to energy sufficiency by 2050 as compared to 2015. More specifically, in the building sector, they forecast an important increase of new buildings between 2015 and 2050, with 380 million of additional square meters in the service sector, and 6 million of new housings. Their modeling work assumes that 512 TWh could be avoided. In order to avoid a surge in energy terms of energy use, Négawatt recommends different measures: stabilizing the number of people per dwellings, reducing the proportion of individual houses, stabilizing of the size of new dwellings, etc.[84]. Meanwhile, the French Ministry of Ecological Transition is taking energy sufficiency into account in its long-term strategy that aims at reaching climate neutrality by 2050, though most of the focus is dedicated to food and agriculture. As for the

83. S. Sorrell, B. Gatersleben and A. Druckman, *Energy Efficiency and Rebound Effect*, Concept Paper, ECEEE, 2018.
84. Association NégaWatt, "La sobriété énergétique. Pour une société plus juste et plus durable", leaflet, available at: https://negawatt.org.

building sector, their planning includes an average heating reduction of 1 degree, which would represent a 15% reduction of energy use.[85]

Most of these recommendations require important and social and behavioral transformations. Bierwirth and Thomas suggest policies such as the creation of municipal living space agencies, financial incentives for alternative forms of housing, cap on dwelling floor area per person, etc. Some areas and cities in Germany or Switzerland have developed similar instruments.[86] There is – at least in Europe – a growing interest on the concept: for instance, the influential ECEEE recently launched a dedicated initiative.[87] In addition, the Wuppertal Institute, the French Development Agency, and the KR Foundation are also conducting research on the topic.

85. J. Hajjar, "Sufficiency in the French Long Term Strategy", presentation at workshop "The Energy Sufficiency – Future Reality Accepted or Suffered: the View Point of Stakeholders", Paris, May 16, 2019.
86. A. Bierwirth and S. Thomas, "Energy Sufficiency in Buildings", ECEEE, Concept Paper, 2019.
87. See: www.energysufficiency.org.

Conclusion: make or break?

The building renovation plans that the EU has set are critical, for many reasons. It will test the capacity of the EU to meet its economic, energy and climate targets. It will also have direct consequences on each citizen of the EU, to the extent that it will determine the energy performance of the place where they live. Indeed, building efficiency policies not only deal with energy and climate, but also with health, comfort, job creation, innovation and many other key areas. If the Renovation Wave succeeds, it will probably be looked at as a global model. If it fails, it may create some lock-in situations with inefficient dwellings and high level of CO_2 emissions, and be instrumentalized by far-right parties to show how the EU is melding in everyone's life.

The Green Deal is however an impressive move. To be more successful than previous attempts, the European strategy requires:

- A stronger policy leadership and a better coordination at the European level with the generalization of a "whole-of-government approach", ensuring more coordination between the different departments and sectors that are/should be concerned with building renovation (health, climate change, jobs, etc.). This is crucial in order to better understand the benefits of building renovation and coordinate policies that will touch upon broader areas (such as smart cities, electrification).
- More ambition and proactivity from the MS:
    - A strong acceleration of public buildings renovation;
    - Better data collection and maintenance work, as well as monitoring, reporting and verification on the results of the existing programs;
    - Better dissemination of key technologies such as passive houses, building information modeling, or district energy systems;
    - More research and support policies on innovative approaches and tools such energy sufficiency.
- A more efficient market regulation in order to help consumers better understand and benefit from renovation services, more specifically:
    - The generalization of "Building renovation passports", using the Belgian "Woningpas", French "Passeport Efficacité Energétique" or the German "Individueller Sanierungsfahrplan" as models. These are established based on

energy audits and quality criteria, and they provide with long-term renovation roadmaps that can be used to plan deep renovations;[88]

- Increase the role of local actors, that could play the role of "one-stop-shops" on building renovations: from cities to local energy communities. These would benefit from the creation of local agencies providing the dwellers with more tailored information on building renovation.

The COVID-19 crisis and recovery plan must be a tremendous opportunity to accelerate these changes, and possibly to explore more innovative solutions, such as zero-interest rate loans or mandatory building renovations.[89]

88. M. Fabbri, M. De Groote and O. Rapf, *Building Renovation Passports: Customized Roadmaps towards Deep Renovation and Better Homes*, BPIE, 2016, available at: www.bpie.eu.
89. "Regard sur le Plan de rénovation énergétique des bâtiments", *Connaissance des énergies, op. cit.*

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