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A blueprint to deliver
a healthy, affordable,
and sustainable
built environment
for all



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The EEB is Europe's largest network of environmental citizens' organisations. We bring together over 160 civil society organisations from more than 35 European countries. Together, we work for a better future where people and nature thrive together.

The EEB is an International non-profit association /
Association internationale sans but lucratif (AISBL).
EC register for interest representatives:
Identification number 06798511314-27
BCE identification number: 0415.814.848
RPM Tribunal de l'entreprise francophone de Bruxelles

Published March 2021
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Laudes ———
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With the support of the Laudes Foundation and the LIFE Programme of the European Union.

This publication reflects the authors' views and does not commit the donors.

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Executive summary

COVID-19 emphasised the importance of the built environment for our societies. With more than 90% of our time spent indoors, the impact of the built environment on health and productivity should be better valued and understood. The health crisis has also stressed the inequalities in the access for all to suitable and healthy buildings. Social distancing and self-quarantine are not possible in overcrowded homes while centralised heating and cooling systems turned out to be dangerous vehicles for the spread of the virus.

The lockdown measures expanded the South Korean concept of *officetel*¹ to *officetelschool*, which may last longer than earlier thought. The new COVID-19 wave suggests the pandemic might well be endemic and our societies must adapt to this new reality. Policy makers, civil society and industry should seize the opportunity of the new health requirements triggered by COVID-19 to accelerate the metamorphosis of the 240 million homes and 46 million of non-residential buildings into sustainable ones.

Renovating the EU building stock within the seven-year timeframe for keeping within the 1.5°C warming limit set down in the Paris Agreement closes the door to incremental improvements. To the contrary, it requires making zero energy renovation compulsory and renovating more than 34 million homes every year. This makes the move to digitalisation unavoidable. The EU building industry must catch up with other leading markets in the use of digitalisation technologies and upgrade the skills of its employees. The European Innovation Council (EIC) should provide support to projects aiming at developing the technical and

technological solutions needed to renovate Europe.

Making the EU built environment sustainable requires a metamorphosis in mind set, policy design, governance, and industry practices. An overarching Sustainable Buildings Regulation (SBR), in which Principles 19 and 20 of the European Pillar of Social Rights will be made enforceable rights, would be needed to introduce binding sustainability requirements aligned with the EU Sustainable Development Goals (SDGs) and the remaining carbon budget for the EU built environment. The SBR should include sufficiency measures, and be based on the Sufficiency, Efficiency, Renewable (SER) framework. The aim is to ensure all citizens living in the EU have access to decent living standard within the planetary boundaries. Existing instruments should be revised, and their scope widened to include circularity principles along the value-chain of buildings.

The market-centric approach to the built environment and the financialisation of land and housing should be abandoned to avoid gentrification and “renovictions”. Caps on land and housing prices to limit the burden of housing costs should be considered by Member States to allow for social and intergenerational diversity in each EU neighbourhood. The ownership structures and the tenancy laws should also be revised to allow for re-purposing vacant buildings to other uses in the post COVID-19 era and for adjusting the built environment to households’ needs triggered by the new health requirements such as teleworking and home schooling.

Innovation is needed along the value-chain of the built environment. With more than 70% of the EU

¹ The concept of [officetel](#) (office-hotel) was invented in South Korea. The COVID-19 extended the concept to schooling

population living in owner-occupied dwellings, adjusting the size of housing to the size of households requires new business models allowing a rapid shift from ownership to usership. Governance of the built environment needs to be modernised. A European Building Council, independent from existing EU institutions, is needed to oversee, evaluate, and monitor policies and to ensure appropriate public finance is allocated to buildings. The approach of shifting the responsibility of sustainability from corporates who make profits out of unsustainable practices to individuals who are victims of the solutions put in the EU market should be avoided. Instead, corporates delivering

unsustainable solutions should be officially named and blamed.

A user-centric system approach is needed to guarantee access for all citizens living in the EU to healthy, comfortable, and affordable buildings for living, schooling, working and leisure. The first step towards this paradigm shift is to empower citizens through a citizen assembly to rebalance industry's influence. Similar assemblies at Member States level have proven to be effective in proposing unthinkable policy changes such as mandatory deep energy renovation.

The ten actions proposed below provide a blueprint for the metamorphosis of the EU built environment. The aim is to contribute to the upcoming debate on the renovation wave.

1 Making access to healthy and affordable housing an enforceable right

COVID-19 emphasised the importance of residential and care buildings for our societies. The decision to lockdown millions of Europeans in their homes, to limit the spread of the virus, stressed the importance of ensuring access for all citizens to healthy buildings with natural daylight, comfortable temperatures, and clean air. The new working, schooling, and social lifestyles triggered by the health crisis call for innovative solutions offering healthy and affordable *office/school* places for all. Policy intervention is needed to avoid increasing inequalities.

1.1 Putting healthy buildings at the heart of the EU response to the COVID-19 crisis

The socio-economic characteristics of households and the quality as well as the location of their dwellings played a major role in the capacity of EU citizens to avoid COVID-19 infections. Solutions to limit contaminations such as social distancing and self-quarantine are impossible to practice in overcrowded dwellings. Similarly, packing homeless populations and refugees into buildings and areas considered as virus “hot spots” made these populations even more vulnerable to the virus.

Non-residential buildings have also been impacted by the lockdown measures. Some non-residential buildings (i.e. conference centres...) are no-longer in use. Office buildings, especially those with open spaces, can only be partly used to allow for social distancing while long-term

residential care homes became residents' cemeteries.

The post-COVID-19 building market is likely to be driven by re-purposing existing buildings, rather than by the construction of new ones. This is particularly true for buildings that will no longer be needed in the post-COVID-19 era. Re-purposing existing buildings will require innovative policies, business models, and technologies to offer healthy *office/school* places and/or nearby co-working and schooling areas for all.

The health crisis has also raised questions about some “*environmentally friendly*” solutions, such as centralised heating, cooling and ventilation systems and the use of heat recovery. These solutions were closely scrutinised because they

provide pathways to the circulation and distribution of the virus. Outdoor air is the recommended solution to respond to the new health requirements raised by COVID-19, which emphasizes the urgency for clean outdoor air.

The lockdown measures stressed the importance of eliminating hazardous materials from buildings, which could lead to morbidity and even death. Hazardous construction materials, also known as toxic building materials, are natural or synthetic chemical substances that are harmful to humans and/or the environment. The duration and the level of exposure to toxic materials determine their impacts on human health. Hazardous materials used in buildings include, but are not limited to, silica, polyvinyl chloride (PVC), wood treatments, halogenated flame retardants, asbestos, cadmium, volatile organic compounds (VOCs), which are naturally occurring, or man-made chemicals.

Health problems caused by toxic building materials include, but are not limited to, cancers, liver dysfunction, vision failure, birth defects, asthma, blood, and brain disorders as well as reproductive health complications, damage to kidneys and the central nervous system, disruption of hormones, immunotoxicity, memory impairment, pulmonary oedema, and other respiratory difficulties. It is likely that the lockdown measures have exacerbated health impacts of toxic materials, especially in badly ventilated buildings.

The new COVID-19 waves suggest the pandemic might well be endemic leading to long-term changes in the use of buildings. Ensuring access to healthy buildings for all, requires the EU response to COVID-19 to consider the disruptive changes triggered by the new health requirements.

The renovation wave should therefore ensure:

- **Recovery plans will include measures to re-purpose un-used buildings to healthy office/school places and/or nearby co-working and schooling areas.**
- **The ban of the use of hazardous construction materials and heating/cooling/ventilation solutions which contribute to spreading viruses and increasing the risk of mortality and morbidity.**

1.2 Transforming Principles 19 and 20 of the European Pillar of Social Rights into enforceable rights

The lack of affordable housing combined to the lock-in-effect of ownership patterns in the EU led 15.7% of the EU population to live in overcrowded homes while 41.7% live in under-occupied dwellings (figures from 2017). Under-occupation and overcrowding vary per income, tenure status and location.

More than 25% of low-income households experienced overcrowding, in the same year, against 8.7% for the population in the fifth income quintile. The opposite occurred for under-occupation of dwellings, 39.2% of the population with income above the 60% median income lived

in under-occupied homes against 22.7% of the population at risk of poverty.

Under-occupation of homes was experienced by 43% of owners against 17.7% of tenants. In the rental market, 19.4% of the population living in homes rented at market price and 21.5% of those living in homes rented at reduced price experienced overcrowding.

Rural areas had the highest shares, 16.8%, of the population living in overcrowded homes, but also the highest shares, 40.4%, of the population living in under-occupied homes. Towns and suburbs had the lowest shares, 15.7%, of the

population living in overcrowded homes, followed by cities with 16.2% of the population ([Eurostat](#)).

Policies allowing to adjust the size of dwellings to the size of a household regardless of income, location, and tenure are lacking. Overall, optimising the use of the existing built environment is needed to avoid the construction of new buildings and to limit the use of land and materials. Business models to make moving from ownership to usership will help in adjusting the occupancy of housing to the needs of families. The aim is to reduce the environmental and biodiversity impacts of the built environment while reducing housing costs.

The burden of housing costs in the EU keeps increasing. At least 10.4% of the EU population has allocated, in 2017, 40% of the total disposable income of the household to housing costs. The burden of housing costs is exacerbated by the increase in energy costs driven by low quality buildings, energy prices and low income.

From the quality of buildings perspective, 13.3% of EU households declared living, in 2017, in leaky buildings (i.e. leaking roof, damp walls or rot in window frames or floor) while 5.1% declared living in dark dwellings with almost no daylight and 2.1% had no bath or shower in their dwellings. Consequently, 7.8% of EU households, equivalent to 34 million people, were unable to keep their homes warm in winter ([Eurostat](#)), which has led to increased morbidity and premature deaths. Overall, over [half a million](#) Europeans died prematurely, in 2016, due to indoor air pollution resulting from low quality buildings.

Exposure to inadequate indoor temperatures, both in winter and in summer, deficient air quality and harmful chemicals and materials increase the risk of morbidity and mortality. Inadequate indoor temperatures lower productivity and causes various health problems.

The health crisis showed that the poorest ones were disproportionately affected by COVID-19 due to their limited ability to mitigate the effects of the virus. The burden of housing and energy costs might well be exacerbated in the post-COVID-19 era given the expected economic crisis.

Unfortunately, ensuring the right of access to housing and essential services such as heating, cooling, and electricity for lighting and basic appliances is not included in any binding EU policy instruments targeting the built environment. Similarly, policies to reduce the burden of housing costs on low-income households are lacking and those aiming at reducing the burden of energy costs have not been successful in alleviating energy poverty.

Policy intervention is needed to increase the share of affordable and decent housing in all neighbourhoods by requiring high rates of comfortable social housing per area as a proportion of all available dwellings. Affordability and access for all, including for people with disabilities and elders, to housing and their related essential services, as called for in the European Pillar of Social Rights, are important elements of the ecological and social justice which should drive the EU response to COVID-19.

The renovation wave should therefore ensure:

- **Principles 19 and 20 of the European Pillar of Social Rights are made binding** to guarantee access for all citizens to affordable, healthy and comfortable dwellings.
- **Business models to move from ownership to usership are put in place** to make mobility, based on the evolving needs of households, possible and to propose alternative housing solutions. The aim is to avoid locking owner-occupiers in oversized or undersized homes.

2 Streamlining the policy framework to deliver on the 1.5°C target

Buildings were responsible, in 2017, for 36% of the energy-related EU greenhouse gas (GHG) emissions and 40% of its total final energy consumption. Importantly, around 90% of the buildings that exist today will still be standing and occupied in 2050. The starting point for the metamorphosis of the EU built environment is the policy framework. Moreover, aligning EU policies with the EU's international commitments, under the Paris Agreement and the Sustainable Development Goals (SDGs), is a prerequisite to make Europe's buildings sustainable.

2.1 Developing an overarching Sustainable Buildings Regulation (SBR) aligned with the Paris Agreement and EU SDGs

The [Energy Performance of Buildings Directive](#) (EPBD), which initially targeted energy savings of individual buildings during the use phase, is the leading instrument targeting the built environment. The 2018 EPBD revision includes a requirement to develop long-term renovation strategies (LTRS) aiming at decarbonising the overall building stock by 2050. However, the [Effort Sharing Regulation](#) (ESR) sets, since 2006, national binding annual greenhouse gas (GHG) emission reductions for the overall building stock. ESR targets do not include embodied emissions, which represent the [hidden challenge](#) of decarbonisation, nor necessarily, link to the EPBD or the Paris climate target.

Embodied emissions in the built environment are indirectly targeted by the EU [Emissions Trading](#)

[Scheme](#) (ETS). The same occurs for emissions from various chemical elements used in construction products which are regulated under the [Directive on industrial emissions](#). Emissions from halocarbons are regulated under the [F-gas Directive](#) while the [Construction Products Regulation](#) (CPR) provides a framework for assessing the performance of construction products.

The [Energy Efficiency Directive](#) (EED), somehow targets all buildings through its cumulative, economy-wide, energy savings target, of at least 0.8% per year. This target is often met by the Member States by reducing final energy consumption of individual buildings either by means of Energy Efficiency Obligations (EEOs) or alternative instruments such as energy and/or

CO₂ taxes. The EED specifically targets public buildings by setting a requirement for 3% annual renovation rates for buildings owned and occupied by central governments. These buildings represent less than 4.5% of all public buildings. Appliances and equipment used in buildings are regulated through the [ecodesign](#) and energy [labelling](#) directives. The former establishes a framework for setting eco-design requirements for energy-related products while the latter provides end-users with information on the energy consumption of the products sold in the EU. However, none of these directives eliminates fossil-fuel based appliances.

The [Renewable Energy Directive](#) (RED) includes a target of 1.3% annual increase of the share of renewables used for heating and cooling, which also includes the use of recovered waste heat in buildings. Furthermore, the [Energy Taxation Directive](#) (ETD) lays down a minimum tax rate for energy carriers including heating fuels and

electricity while the [Directive on Public Procurement](#) is the EU instrument to ensure public procurement contributes to meeting climate targets. The 2019 [EU Governance Regulation](#) introduced requirements on planning, reporting, and monitoring of energy and climate goals as well as on energy poverty alleviation.

The fragmentation of EU policy instruments reflects the organigramme of the European Commission. Almost every instrument belongs to one department leading to unjustified internal competition resulting in status-quo and low ambition. Existing instruments are not aligned with the 1.5°C target nor are the requirements included in different instruments always consistent. Despite the plethora of EU instruments, energy used by buildings during the operational phase and to some extent energy poverty are the only two sustainability aspects targeted by EU instruments.

The renovation wave should therefore ensure:

- **An overarching Sustainable Buildings Regulation (SBR)** is developed to make requirements in different instruments consistent between themselves and aligned with the Paris Agreement and EU SDGs.
- **Widening the scope of carbon requirements to include circularity principles along the value chain** of the building. The aim is to capture the missing mitigation potential of [60% of GHG emission](#) reductions in buildings by 2030.

2.2 Tackling the causes of energy and materials' demand by including sufficiency measures in the SBR

Emissions from the built environment include those related to carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and halocarbons. However, halocarbon emissions are not disaggregated per sector while CH₄ and N₂O emissions from buildings are negligible compared to CO₂ emissions. The lack of data on different emissions narrows the scope of the analysis of GHG emissions to CO₂ emissions.

CO₂ emissions from the built environment reached 1.73 GtCO₂ in 2017, out of which 60%

were indirect emissions resulting from the use of carbonised heat and electricity generated off-site, 31% were direct emissions produced on-site by buildings such as those due to the use of gas or oil boilers, and 9% were emissions embodied in cement and steel used for construction and to some extent the renovation of buildings. Residential buildings had the highest share of total CO₂ emissions, with 86% out of the total against 14% for non-residential buildings ([IEA](#)).

In the last two decades, heating and lighting energy consumption per square metre decreased by almost 25% while the overall energy consumption per dwelling increased by more than 15% (ODYSSEE). The decrease in heating energy consumption per square metre is driven by the insulation of new buildings as required by the EPBD. The decrease of lighting energy consumption per square meter is driven by the ban of incandescent bulbs through the ecodesign directive which has led to the high penetration of light-emitting diodes (LEDs).

However, despite the decrease of heating and lighting energy consumption per square metre, the overall CO₂ emissions per dwellings kept increasing driven by the increase of the floor area per capita, and the increased ownership of appliances and equipment. A typical European household is today equipped with a refrigerator and a freezer while twenty years ago a refrigerator was a norm.

EU policy instruments targeting the built environment are driven either by the efficiency improvement of technologies used in buildings and/or the increased penetration of renewables. Efficiency improvements tackle the symptoms of energy demand by reducing energy consumption while the penetration of renewables tackles the consequences of energy demand by reducing greenhouse gas emissions.

The causes of energy demand, and consequently GHG emissions, such as the increased number of square metres per capita and the increased ownership of appliances are not tackled by any of the existing EU policy instruments. Tackling the causes of energy demand requires including sufficiency measures in EU policy instruments.

Sufficiency is defined as the measures aiming at reducing the demand for materials and energy while delivering a [decent living standard](#) for all within the planetary boundaries. Decent living standard being defined as a set of material preconditions for human wellbeing which includes nutrition, shelter, basic amenities, healthcare, transportation, information, education, and public space.

Including sufficiency measures in the instruments targeting the built environment will widen the scope of current EU policies from single buildings to neighbourhoods. Sufficiency measures will also shift policy design from the current narrow focus on energy used in the operational phase to the life cycle approach which requires considering embodied and halocarbon emissions.

Sufficiency measures will encourage re-purposing existing buildings to avoid constructing new ones. By doing so, the need for more cement and steel, the two-most carbon intensive materials used in buildings, will be cut-down and the flow of materials reduced. The pressure for greenfield construction and biodiversity losses will also be reduced leading to more preservation of nature and fertile agriculture land.

The sufficiency concept, if included in EU policies, will be a game-changer in these days of the re-building of the EU economy. Sufficiency will make buildings more circular over their life cycle by including requirements on the lifetime of buildings and products, their use, reuse, and recycling. However, sufficiency policies might be perceived as a threat by those making profits from oversized homes and appliances.

The renovation wave should therefore ensure:

- **The overarching EU built environment instrument will be based on the Sufficiency, Efficiency, Renewable (SER) framework**, where the upper limit should be the remaining carbon budget and the lower limit should be driven by the requirements for a decent living standard for all.
- **Over-construction of new buildings and larger homes are avoided** to preserve nature and limit biodiversity losses.

3 Rebalancing power through governance improvement

A transparent and inclusive policymaking, as called for by [EU Better Regulation](#), requires the participation of all stakeholders in the policy process. Unfortunately, industry is the main stakeholder with the capacity to invest in the human resources needed to contribute to EU policies. Without policy intervention, the full participation of citizens to policy design is not achievable, especially given the complexity of the EU policymaking process. The imbalance between the participation of industry and citizens in policy development is lowering ambition.

3.1 Empowering citizens through a European Citizens' Assembly to rebalance industry's involvement in policymaking

Almost three decades after the Rio conference, citizens, who are the users of buildings, do not really contribute to policymaking in the EU. Initiatives such as the [Covenant of Mayors](#) and the [green capitals](#) do not seem to be the fora needed for a full participation of citizens in decision-making.

The recent experience of the French climate citizens' assembly provides evidence that citizens' participation could be a gamechanger in policy design. Contrary to the dominant voices, the assembly proposed to make energy renovation compulsory and to renovate all buildings deeply to ensure the overall French building stock will be decarbonised by 2050.

Industry is highly involved in the design of policies targeting the built environment. The EC consultation on the renovation wave received [187 feedbacks](#), out of which 76% were from industry associations and their supporting

“think-tanks”, against just 10% from organisations representing civil society and almost no direct responses from citizens. Industry's responses to the EC consultation on the renovation wave is the visible part of industry's influence of EU policies. The hidden part of the iceberg includes the variety of events organised by industry at the European Parliament and the regular meetings with EC officials as well as those taking place at Ministries in EU capitals.

The lack of ambition of EU policy instruments can partly be explained by the lack of citizens' participation in policymaking and the lobbying activities of incumbents' vested interest. Industry is successful in promoting its existing solutions as the most sustainable ones without necessarily providing the scientific evidence to support such claims. The inclusion in EU policy instruments of the concept of staged deep renovation and its

supportive instruments (i.e. the building renovation passport, minimum energy performance standard), illustrate very well how EU policies have been locked in green-washing solutions and practices at a high cost for taxpayers while contributing to increasing the share of the EU population facing energy poverty. Buildings renovated during the current decade, are unlikely to undergo another major renovation in the following decades, as residential buildings undergo major renovation, on average, once every 25 years. As shown by an [ADEME study](#), the staged renovation roadmap proposed by the promoters of the building passport and/or the Energy Performance Certificates (EPCs) cannot lead to deep renovation, especially given the cost and the burden of renovation work. The only way to make a useful instrument out of the proposal

to introduce minimum energy performance standards (MEPS) is to set requirements, as it is done for new buildings, at the zero-energy standard. Incremental increase of the stringency of MEPS is unlikely to occur within the time left to make Europe's buildings carbon neutral.

Staged renovation, buildings passports and MEPS will lock Europe's buildings into high carbon at a high cost for taxpayers. However, these solutions will bring high profits for incumbents' vested interests. Ensuring no one is left behind requires making one-off zero energy renovation compulsory, to alleviate energy poverty and reduce the cost of the energy transition. Delivering on the circularity objectives requires implementing the zero concept to the overall life cycle of the buildings when renovated.

The renovation wave should therefore ensure:

- **A full participation of citizens to policy making through a European Citizens' Assembly (ECA) to deliver on citizens' wellbeing and Europe's societal and environmental short and long-term objectives.**
- **One-off zero-energy renovation is made compulsory in the SBR to meet Europe's climate and energy targets and to avoid locking low-income households in energy poverty.**

3.2 Shifting policy design from being market-centric to the societal approach

The renovation market, which is growing at a rate of 1.5% per year, has overtaken, since 2010, the market of construction of new buildings. The recovery measures implemented to address the economic crisis of 2009 combined with the implementation of energy requirements to meet the EU 2020 energy and climate targets have led to the [emergence](#) of a renovation market.

[Digging deeper](#) in the emerging renovation market shows renovation rates of maximum 0.3% of the so-called "deep renovation" and almost 0% of zero energy/carbon renovation projects. In practice, staged renovation, which belongs more to maintenance than to energy renovation, dominates the market. The argument

behind the policy support to staged renovation is the lack of willingness of citizens to renovate their homes.

[Behaviour economics](#) succeeded in shifting the responsibility of the metamorphosis of the built environment from corporates to individuals. The latter being [locked](#) into the solutions put in the market by the former. The proliferation of one-stop-shops to inform citizens and the high number of financial incentives targeting single measures illustrate this shift in policymaking very well.

In the absence of requirements in EU policy instruments to deliver zero energy/carbon renovation, market actors use public finance to

deliver shallow renovations which puts Europe's climate neutrality and just transition objectives at risk. An energy renovation market, which would deliver on the Paris agreement and EU SDGs, is yet to emerge.

Progress has been made in the implementation of the EPBD nearly-zero-energy requirement for new buildings. However, architects, designers, and developers encourage larger homes which cancels out the energy performance improvements. Similarly, manufacturers of appliances and equipment overrule ecodesign requirements by shifting their production to larger appliances with higher energy consumption per unit. In the absence of requirements in EU instruments on the size of dwellings and appliances, solutions put in the EU market will continue to lock citizens in high energy demand, which is not necessarily needed for their basic needs, and to increase GHG emissions.

The lack of life cycle approach to the built environment combined with the continuous race for low-cost and high profits made insulation products with high embodied carbon, such as [expanded polystyrene \(EPS\) foam](#), the ones privileged by installers. In the absence of life cycle assessment of the environmental impact of insulation products, new emerging insulation solutions such as biotic renewable or biopolymers-based are unlikely to emerge in the European building market.

The financialisation of land made housing a tradable asset and increased gentrification and “renovictions”. Housing costs are pushing an increasing share of the EU working class and low-income families to re-locate in areas with

lower housing costs but also with limited access to essential services such as public transport, education, and health facilities. The financial burden of the combined fixed costs related to housing and mobility, especially for car-dependent families, is increasing the share of the EU population at risk of poverty.

Overall, the market approach to land, housing, construction materials and appliances combined with low investment in affordable housing and the low protection of tenants in tenancy laws keep increasing the share of housing costs in the disposable income of households in the first three income quintiles.

Building back better and meeting EU international commitments requires ending the market approach to land and housing and shifting towards a more societal approach. Increasing investment in affordable, comfortable, and sustainable housing and revising tenancy laws to ensure a better protection of tenants are of a paramount importance to deliver on a just transition.

Protecting citizens will occur only if paradigm shifts in policy design, governance, and in decision-making process are implemented. Making the polluters pay instead of making citizens guilty requires ensuring a full participation of citizens in policy design and transparency about the solutions placed on the market. Otherwise, building back better might well end-up in increasing profits of those already taking advantage of the unsustainability of Europe's buildings and the awaited metamorphosis of the EU built environment will not occur.

The renovation wave should therefore ensure:

- **End the financialisation of land and real-estate** to avoid gentrification and “renovictions” and to guarantee social and intergenerational diversity in each neighbourhood.
- **Stop shifting the responsibility of the metamorphosis of the built environment from corporates to individuals.** The latter being locked into solutions placed on the market by the former.

4 Making the best use of public finance

Europe spends up to [€90 billion](#) annually in improving the energy efficiency of buildings and an additional €275 billion per year are needed to meet the EU 2030 climate target. A plethora of financial instruments are used by EU institutions to channel the available public finance to the market. The EU financial support includes, but is not limited to, Project Development Assistance (PDA), Technical Assistance and support to cities and local authorities. However, existing rules make bundling existing EU finance challenging and combining EU funds with national funds almost impossible.

4.1 Bundling public finance and providing a guarantee to back-up zero energy/carbon projects

The design of EU financial instruments follows the design of policy instruments and reflects the organigramme of the European Commission. Almost every instrument belongs to one department leading to fragmentation and inconsistency with long-term goals. Thereby, the impact of the EU contribution to financing energy renovation is undermined, especially given the lack of zero energy/carbon requirements for renovated buildings.

The Internal Market Directives for [gas](#) and [electricity](#) require Member States to develop “innovative pricing formulas” to incentivise energy demand reduction. In practice, the “innovative pricing formulas” have mainly increased the share of the population facing energy poverty without reducing the energy demand.

The [Mortgage Credit](#) and [Consumer Credit](#) Directives, which provide lower credit risk to sustainable finance products are two other instruments which could play a major role in driving the renovation of buildings in the EU. However, these two directives do not include requirements on the zero energy/carbon

renovation nor on clear sustainability criteria related to buildings.

The [Multiannual Financial Framework](#) and the [State Aid rules](#) provide, under specific conditions, grants for energy renovation based on the requirements set in the EPBD. For the period 2014-2020, around €14 billion of cohesion funds were dedicated to building renovation. However, given the lack of zero energy/carbon requirements in the EPBD, public finance is increasing the lock-in-effect of buildings.

Other EU funding sources include, but are not limited to, the flagship initiative, [Smart Finance for Smart Buildings](#), the [Private Finance for Energy Efficiency](#) (PF4EE), the [European Local Energy Assistance](#) (ELENA) and the [Joint Assistance to Support Projects in European Regions](#) (JASPERS) which are co-managed by the European Investment Bank (EIB) and the European Commission (EC), while research and development is funded through the [EU Research and Innovation programme](#).

The plethora of EU financial instruments [does not deliver](#) on its intended objectives. The fragmentation of EU financial instruments, the

difficulties of bundling them, the lack of rules for using EU funding in conjunction with national ones (i.e., energy taxes and EU ETS) are major barriers to developing robust project pipelines.

In practice, EU financial instruments combined with the lack of requirements for zero energy/carbon renovation in EU policy instruments and the reliance on failed instruments such as the Energy Performance Certificates (EPCs) are locking Europe's built environment into carbon and low-income households in energy poverty and unhealthy buildings.

In the absence of a single investment support, in which all EU funding is bundled, it is likely that

the new instruments proposed under the recovery plans will only add another layer to the existing complexity without delivering on the climate neutrality and just transition objectives.

Overall, public finance will not be able to fill-in the identified investment gap of €275 billion. Private finance will be needed. However, unlocking private investment will not take place if it is not backed up by an EU guarantee fund. Moreover, without mandatory requirements on zero energy/carbon for renovated buildings, it is likely that the expected unprecedented investment in energy renovation will lead to business-as-usual staged renovation, especially if the EPBD relies on failed and unproven policy instruments.

The renovation wave should therefore ensure:

- **EU financial instruments support the development of project pipelines** to make energy renovation projects bankable and attractive to investors.
- **EU funding does not rely on failed and/or unproven policy instruments** to avoid the lock-in-effect and enhance the use of public finance.

4.2 Using public finance only for zero energy/carbon projects

Staged renovation and/or staged deep renovation are two misleading concepts introduced in EU policy instruments with the arguments that i) one-off zero energy renovation is not achievable everywhere and ii) it is much more costly than staged renovation approaches. However, [literature](#) shows the opposite. Zero energy/carbon buildings are achievable across the world for all building types and climates. Importantly, the cost for delivering deep renovation is in the range of, and could be even [lower](#) than, delivering staged renovation.

The [French low-energy building observatory](#) includes more than 175,000 dwellings and 3.6 million square metres of non-residential buildings renovated in one-stage to the French low-energy building standard of 80 kWh/m².yr for the regulated loads (heating, cooling, ventilation, lighting, and water heating). The renovation costs vary from €315/m² for multi-family buildings to €345/m² for single-family homes.

The French experience shows that one-off deep energy renovation is possible by bundling all the existing public finance available and creating project pipelines under the leadership of progressive local authorities and/or buildings' owners. Careful planning played a major role in coordinating different actors and ensuring the continuity of installed insulation to deliver a high level of airtightness linked to good ventilation. The aim is to avoid building pathologies.

Despite the growing evidence that one-off deep energy renovation is technically doable and cheaper than staged or staged-deep renovation, the established market actors, and their supporting "think-tanks" have been successful in convincing policymakers of the opposite. Promoters of the building passport argue that a roadmap over the lifetime of a building will deliver on staged deep renovation by helping owners and investors to creating better conditions for the renovation work.

However, a recent [study](#) provides evidence that staged deep renovation will not achieve the objective of a decarbonised building stock. The study shows that the higher the number of steps, the lower the potential for achieving low energy buildings. It also shows the need for integrating renewable energy solutions to reduce GHG emissions due to space and water heating.

Making Europe 's buildings carbon neutral is a societal issue. It can be addressed only if the challenge of the metamorphosis of the built environment in the EU is no longer on the shoulders of individuals. Instead, the responsibility of delivering a carbon neutral building should be first on industry and financial incentives should be linked to buildings not to individuals.

The first step towards this shift is to make zero energy/carbon renovation mandatory in the SBR, as proposed by the French Citizens' Assembly, and to stop using public finance for single measures. Moreover, creating project pipelines requires moving from the single building approach to the neighbourhood scale. Neighbourhoods are better suited for the implementation of the [heating and cooling strategy](#) and also for re-purposing buildings no

longer in use for shared spaces. Moreover, the neighbourhood approach allows for implementing the cross-sectoral measures needed to alleviate the combined housing and mobility energy poverty.

Monitoring and verification of the savings achieved is another overlooked issue in the existing instruments because staged renovation requires allocating the savings to single measures which physics does not allow. The assessment of the effectiveness of the use of public finance is, therefore, based on deemed savings and not on the measured ones as this is not technically possible for each single measure. Including requirements to guarantee savings over a pre-defined period is of a paramount importance to ensure that the use of public finance will deliver a decarbonised building stock.

The metamorphosis of the built environment requires setting up a European Building Council (EBC), independent of the existing EU institutions, to oversee the progress made in aligning EU policy instruments and the budget allocated to deliver on the societal and decarbonisation objectives of buildings. The EBC should be empowered to guarantee accountability of each actor.

The renovation wave should therefore ensure:

- **The neighbourhood approach is required in the SBR** to allow for project pipelines to be developed.
- **The setting up of a European Building Council (EBC), independent of existing EU institutions**, to oversee, monitor and evaluate the compliance of policy actions with the Paris Agreement and EU SDGs.

5 Enhancing competitiveness by investing in innovation and skills

The apparent labour productivity per person employed in the building sector was, in 2017, at €39,000 in the renovation sub-sector and €48,000 in the sub-sector of construction of new buildings against €62,000 in the manufacturing sector. Moreover, average investment in research and development in the construction sector was, the same year, at €2.3 per inhabitant against €181 per inhabitant in the manufacturing sector ([Eurostat](#)). The low investment of the building industry in skills and research hinders the metamorphosis of the built environment towards a sustainable one.

5.1 Upgrading skills

The building sector plays a unique role in the EU economy and employment. Its value-added reached EUR 484 billion in 2017, which was 6.5% of that in the non-financial business economy. The sector employed 11 million people, which was equivalent to 7.6% of total employment in the non-financial business economy. The contribution of the building sector to the EU economy would be much higher if the overall value-chain of the sector, from extracting raw materials to their use, maintenance, and recycling, could be included.

The sector is dominated by small and medium enterprises (SMEs). Enterprises with less than 50 employees generated more than 70% of the total value added of the sector while contributing to about 80% of jobs in the sector (Eurostat). One drawback of the dominance of SMEs is the low productivity driven by the lack of investment in new technologies and upskilling of workers.

Renovation work is characterised by the employment of low-qualified males from Member States with GDP per capita below the EU average. Staged renovation and the lack of requirements to guarantee the savings makes the sector even less attractive to highly qualified employees as the work can be done without specific qualifications.

The Build-Up skills initiative, under the LIFE programme, was launched with the objective of upgrading the skills of on-site workers and craftsmen. The two major barriers to upskilling identified by the Build-Up skills initiative include the lack of awareness by companies about the availability of free training programmes and/or the lack of time to allow workers to enrol in training courses.

Despite Europe's digital agenda and the lack of a workforce trained in digital skills, the Build-Up skills initiative did not include trainings on the use

of digital technologies. Similarly, industry did not invest in updating the knowledge and competencies of its employees as it did not invest in digital tools and emerging technologies.

Unfortunately, Europe's building industry is not digitising at the same speed as other major building markets. EU construction companies invested, in 2017, less than 1% of their revenues in digitalisation. Unsurprisingly, the first 3D printed building was delivered in Dubai, in 2016,

while EU capitals are still on the waiting list for the digital revolution of their building industries.

According to the European Centre for the Development of Vocational Training (ECDVT), by 2030, the age of the working population will increase by 3.7%, while the labour force will grow only by 1% leading to more shortages in the workforce. Digitalisation of the construction sector is expected to also help in overcoming this challenge.

The renovation wave should therefore ensure:

- **Public finance is used only for state-of-the-art training** to guarantee workers are up to date with new technologies.
- **Industry invests in digital technologies** to make sure it will work on updating the knowledge and competencies of its employees.

5.2 Harnessing innovation

Innovation is needed along the value chain of the built environment. Disruptive thinking is necessary to develop the proposed overarching SBR (Sustainable Buildings Regulation) based on the SER (Sufficiency, Efficiency, Renewable) framework. Implementing the sufficiency concept will require moving from the market-centric to the societal approach in the design of policy measures and developing business models to allow moving from ownership to usership.

Ensuring the SBR will deliver on the 1.5°C target will require shifting the current modelling methodologies, based on fictitious baselines, to modelling methodologies driven by the remaining carbon budget for the EU built environment. Making access to affordable, comfortable, and healthy buildings enforceable rights in Europe and a one-off zero-energy renovation compulsory will require setting up a European Citizens' Assembly (ECA) and a European Building Council (EBC). The former will mitigate industry's influence in policy making and the latter will avoid conflict of interest when monitoring and evaluating the impact of policies.

Making the 240 million homes and 46 million non-residential buildings carbon neutral within the seven-year timeframe for the 1.5°C target requires renovating more than 34 million homes

and almost 7 million non-residential buildings every year. Doubling the current deep renovation rate of 0.3% is unlikely to achieve these objectives.

Off-site production of innovative solutions is needed to accelerate the pace of renovation. Digitalisation of renovation is doable for at least the 60% of EU buildings constructed using industrialised processes.

Seven digitalisation technologies including i) Building Information Modelling/Management (BIM), ii) additive manufacturing also known as 3D printing, iii) robots, iv) drones, v) 3D scanning, vi) sensors and vii) Internet of Things (IoT) are already in use by the construction industry. Digitalisation will deliver the volume needed only if the digitalisation technologies are used in combination with each other.

BIM supports decision making in the early design stage and allows assessing a variety of design options and their embodied emissions. 3D printing reduces material waste and the duration of the construction phase as well as accidents. Coupling 3D printing and robots allows for increasing productivity through fully automated prefabricated buildings.

Drones allow for a better monitoring and inspection of construction projects through real-

time comparison between planned and implemented solutions. Coupling drones with 3D scanning allows predicting building heights and energy consumption. Sensors offer a continuous data collection and monitoring of end-use services (i.e. heating, cooling, and lighting), thus, allowing for preventative maintenance while providing more comfort to end-users. Coupling sensors with IoT, which connects the internet to household appliances and devices such as thermostats, enable demand-response, and flexibility to reduce peak loads. Connected appliances offer a variety of opportunities for end-users to optimise their energy demand by improving the responsiveness of energy services. The EU provides support to the digitalisation of the construction sector. However, this support is fragmented through different instruments (i.e. Horizon Europe, Digital Innovation Hubs). Importantly, the European Innovation Council (EIC), the main EU instrument for innovation, does not include any project related to the digitalisation of renovation.

Catching-up with the leading building markets is a question of survival for the EU building industry. The unavoidable digitalisation of the building industry will open the renovation market to global competition and leave for EU actors only the tasks of printing and installing solutions designed elsewhere.

Digitalisation will i) address the issue of data scarcity, ii) avoid wasting time in improving instruments from the past century (i.e. the Energy Performance Certificates (EPCs)), iii) drive the aggregation of projects and iv) the standardisation of financial solutions while v) delivering standardised technological solutions and vi) reducing waste of materials.

A partial digitalisation of renovation works, as currently planned, is likely to slow-down the modernisation of the EU building industry while locking the built environment in to carbon and low-income households in energy poverty while increasing the cost of the energy transition.

The renovation wave should therefore ensure:

- **Compulsory digitalisation targets are set** in EU policy instruments to push the building industry to invest in digitalisation and catch-up with the leading building markets.
- **The European Innovation Council (EIC) prioritises the built environment** in its calls to avoid widening the gap with leading building markets.



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