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The European Commission's Renovation Wave Initiative for the Building Sector

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Abstract: The European Commission's Renovation Wave Initiative for the Building Sector

The European Commission published its long-term strategic vision for climate policy "A Clean Planet for all" in 2018 which lays out various pathways for a transition to achieve net-zero greenhouse gas emissions in the whole energy sector and economy by 2050. The vision emphasizes that that a net-zero target by 2050 is extremely challenging for all sectors including the built environment. In this context the aim of this paper is to describe and analyze the EU Renovation Wave Initiative of the European Commission as central puzzle piece, which is also the main driver behind the targeted revision of the Energy-Performance of Buildings Directive (EPBD) in 2021. On the one hand the Renovation Wave is put into context within the overall EU policy landscape, on the other hand the ambition, targets and policy options are compared with the overall ambition and to what science says.

Main objective of the Renovation Wave is to at least double the current renovation rates of public and private buildings by 2030 and foster deep renovations. Together with a very ambitious decarbonization of heating this should enable to cut direct building sector greenhouse-gas emissions by 60% until 2030 (based on 2015 levels) as laid down in the Climate Target Plan 2030 (CTP). Apart from elements in the EPBD, also the RED and EED revisions as well as carbon pricing should make sure that the adequate framework for this very ambitious decarbonization is given. Currently, the progress and activities on the ground and in the renovation market are not at all in line what is defined as target-compliant within the strategy, neither with regard to the quality of renovations, nor the quantity of it. The implementation in the market will show whether the strategy can be successfully applied.

Kurzfassung: The European Commission's Renovation Wave Initiative for the Building Sector

Die Europäische Kommission hat 2018 ihre langfristige strategische Vision für die Klimapolitik "Ein sauberer Planet für alle" veröffentlicht, in der verschiedene Pfade für einen Übergang zum Erreichen von Netto-Null-Treibhausgasemissionen im gesamten Energiesektor und in der Wirtschaft bis 2050 aufgezeigt werden. Die Vision betont, dass ein Netto-Null-Ziel bis 2050 für alle Sektoren, einschließlich der bebauten Umwelt, eine große Herausforderung darstellt. Es ist das Ziel dieses Papiers, die EU Kommissionsinitiative Renovation Wave als zentrales Puzzlestück zu beschreiben und zu analysieren, welche auch Haupttreiber der angestrebten Überarbeitung der Energy-Performance of Buildings Directive (EPBD) im Jahr 2021 ist. Zum einen wird die Renovation Wave in den Kontext der übergreifenden EU-Politiklandschaft gestellt, zum anderen werden Ambitionen, Ziele und Politikoptionen mit den allgemeinen Ambitionen und den Aussagen der Wissenschaft verglichen.

Hauptziel der Renovation Wave ist es, die aktuellen Renovierungsraten von öffentlichen und privaten Gebäuden bis 2030 mindestens zu verdoppeln und tiefergehende Renovierungen zu fördern. Zusammen mit einer sehr ehrgeizigen Dekarbonisierung der Wärmebereitstellung soll dies die Senkung direkter Treibhausgasemissionen im Gebäudesektor bis 2030 um 60 % (ggü. dem Niveau von 2015) ermöglichen, wie es auch im EU-Klimazielplan 2030 festgelegt ist. Neben Elementen in der EPBD sollten auch die RED- und EED-Revisionen sowie die Kohlenstoff-bepreisung dafür sorgen, dass der angemessene Rahmen für die sehr ambitionierte Dekarbonisierung gegeben ist. Derzeit entsprechen die Fortschritte und Aktivitäten vor Ort und auf dem Sanierungsmarkt keineswegs dem, was in der Strategie als zielkonform definiert ist, weder in Bezug auf die Qualität noch auf die Quantität der Sanierungen. Die Umsetzung im Markt wird zeigen, ob die Strategie erfolgreich angewendet werden kann.

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List of abbreviations

BIM	Building Information Modelling
BRP	Building Renovation Passports
BSO	Building Stock Observatory
CF	Cohesion Fund
CO_2	Carbon dioxide
COP	Conference of the Parties
CPR	Construction Products Regulation
EED	Energy Efficiency Directive
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Certificates
ERDF	European Fund for Regional Development
ESCO	Energy Service Companies
ESF+	European Social Fund +
EU	European Union
EU SILC	EU Survey on income and living conditions
EU-ETS	EU Emissions Trading Scheme
F-gases	Fluorinated greenhouse gases
GHG	Greenhouse gas
GWP	Global Warming Potential
LTRS	Long Term Renovation Strategies
MEPS	Minimum Energy Performance Standards
MFF	Multiannual Financial Framework
MS	Member States
NECP	National Energy and Climate Plans
NZEB	Nearly-Zero Energy Buildings
PA	Paris Agreement
PJ	Petajoule (energy measuring unit)
PtG	Power-to-Gas (any power-based gaseous fuels)
RED	Renewable Energy Directive
RRF	Recovery and Resilience Facility
SRI	Smart Readiness Indicator
TWh	Terawatt hours (measuring units for energy)
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

In the overall context of the Paris Agreement and its goal to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels, the building sector has a shared responsibility. In the European Union it emits or is responsible for more than one third of the overall greenhouse gas emissions. The scale of the challenge is clearly shown in an open letter from *Architecture 2030* to the UNFCCC, where the global carbon budget is shown as well as remaining emissions allowances [Architecture 2030, 2020].

In this framework, the EU building sector target is defined with climate neutrality by 2050. Since approximately 90% of today`s buildings will still be present by 2050, the energy renovation of existing buildings is a key challenge for the next decades. Therefore, the European Commission launched the **Renovation Wave Initiative** in the framework of the EU Green Deal [source: 2019a]. Main goal of the initiative is to increase current energy renovation rates and at the same time depth of renovations since current levels are insufficient to reach long-term energy and climate goals. Furthermore, it aims to create additional jobs, overcome energy-poverty due to lower energy bills for energy efficient buildings and addressing health and wellbeing in an appropriate way. In addition, financing elements like the Recovery and Resilience Facility (RRF) budgets play an important role, since significant shares of funding (37% for the RRF) should be spent on climate friendly investments and reforms, such as energy efficient renovations in the EU building sector.

This paper will place the Renovation Wave Initiative in the overall policy context in a first step and show relations to other relevant policies and initiatives. Based on this, the main elements of the Renovation Wave Initiative are described in a second step, such as its objectives, potential revision areas within relevant directives (such as the Energy Performance of Buildings Directive EPBD), key principles and funding.

In a third step, the ambition and elements of the Renovation Wave are assessed in relation to the overall EU policy context and whether it matches the requirements derived from climate and energy science. This task is done based on existing studies that show target leading pathways with regard to building energy efficiency levels and renewable energy shares. In case the analysis shows insufficient ambition overall, recommendations for improvement are developed on a general level. Apart from that, the paper will discuss whether increasing the renovation rate is most important, or rather making sure that individual renovations are planned in such way that they are consistent with reaching individual decarbonization targets and at the same time enable to reach the overall building sector target of a climate neural buildings sector by 2050. Organizing building renovations in the right way over buildings lifetime and ensuring compliant overall target levels might be more important that only looking at renovation rates[1].

Finally, conclusions from step three are derived and options of leveraging the impacts of the Renovation Wave on EU and national level are described.

[1] Since "renovation rate" is defined in many different ways, the most common definitions are given in the context of this paper.

2 Main elements of EU policy context

Main elements of EU policy context are the European Green Deal in the first place as one of the priorities for the 2019-2024 European Commission, where the Renovation Wave is defined as a key action. In the field of EU climate action, the 2030 climate and energy framework with its updated 2030 targets is the central part, as well as the 2050 long-term strategy "A clean planet for all" together with national long-term strategies. The EU energy strategy adds the elements of the energy union from 2015, which is updated with an implementation focus by the "Clean energy for all Europeans package" in 2019. In this framework, also National energy and climate plans (NECPs) help to ensure the EU is on a target leading pathway. Finally, the recovery and resilience facility (RRF) is supporting the transitions with a focus on sustainability and climate change as an effect of the corona virus.

2.1 A European Green Deal

The European Green Deal is one of the six high-level priorities the European Commission 2019-2024 has defined [European Commission (EC), 2019c]. It is considered as growth strategy towards a sustainability, that will transform the EU into a modern, resource-efficient and competitive economy [European Commission (EC), 2019e] [European Commission (EC), 2019d]. Cornerstones of this vision are no net emission of GHG by 2050, decoupling economic growth from resource use and the principle to leave no person and no place behind.

Central part of the EU Green Deal is an action plan to boost efficient use of resources by moving to a clear, circular economy and to restore biodiversity and cut pollution, which has climate neutrality by 2050 as target and needs to meet the ambitious 2030 climate targets under the Climate Target Plan [European Commission (EC), 2020a], [European Commission (EC), 2020i].

The **Renovation Wave** (which is the focus of this paper) is one of the actions under the European Green Deal and therefore high on the political agenda. The EPBD will be reviewed and updated by end of 2021 based on the EU Renovation Wave initiative.

2.2 EU Climate Action

In the framework of climate action, the EU has set itself targets to progressively reduce GHG emissions by 2050. The **2030 climate and energy framework** defines the overall target to reduce GHG emissions by at least 55% by 2030 compared to 1990 levels. Furthermore, also energy efficiency and renewable energy targets are defined, but they still relate to the outdated target 40% reduction by 2030.

These targets are defined to put the EU on the pathway towards becoming a climate-neutral economy, as laid down in the **2050 long-term strategy** "A clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy" of the European Commission [European Commission (EC), 2018f], [European Commission (EC), 2018e], [European Commission (EC), 2018a].

In addition to this European strategy, each member state has to develop **national long-term strategies** (based on the regulation on governance of the energy union and climate action) to show how they plan to achieve the GHG emission reductions needed to meet the commitments under the Paris Agreement.

2.3 EU Energy Strategy

The EU Energy Strategy consists of several elements. In the context of this paper the Energy Union, the Clean energy for all Europeans package and the National energy and climate Plans (NEPCs) are relevant. The 2050 Long-term strategy is also part of the Energy strategy, but it is mentioned on the Climate strategy already.

In 2015 the EC published the **Energy union strategy** [European Commission (EC), 2015]. It was one of the key priorities of the previous European Commission 2014-2019 and aims at building an energy union to give consumers, households and businesses a secure, sustainable, competitive and affordable energy supply.

With the **Clean energy of all Europeans package**, the current European Commission updated the Energy union strategy in 2019 and added an implementation strategy towards cleaner energy and to deliver on the Paris Agreement [European Commission (EC), 2020k], [European Commission (EC), 2020l], [European Commission (EC), 2018a], [European Commission (EC), 2018a].

In order to meet the 2030 energy and climate targets, EU member states need to develop integrated **National energy and climate plans** (NECPs) for the period 2021-2030 under the regulation on the governance of the energy union and climate action. They require plans how to address energy efficiency, renewables, GHG reduction, interconnections and research and innovation.

2.4 Recovery and Resilience Facility

As consequence from the Corona virus, the EU hast put the Recovery and resilience facility (RRF) into place [European Commission (EC), 2020f]. It will make 672.5 billion Euro in loans and grants available to support reforms and investments undertaken by member states. The aim is to mitigate the economic and social impact of the coronavirus pandemic and make European economies and societies more sustainable, resilient, and better prepared for the challenges and opportunities of the green and digital transitions.

In this context, building renovation is a centrepiece of the RRF. The European flagship "Renovate" [European Commission (EC), 2020o] is formulated as follows: *"Investments and reforms with high potential to scale up investments in building renovation and leverage public and private financing, with a focus on social and affordable housing, are particularly relevant to achieve the objectives of the RRF: green transition (reduction of energy consumption and GHG emissions, creation of jobs and growth stimulus and social resilience)."*

In order to support the member states to make use of the RRF, the European Semester developed country-specific recommendations [European Commission (EC), 2020e; 2020].

2.5 Other elements with relevance for building renovation

In addition to the framework mentioned above, a few elements are also important in the context of the Renovation Wave which will be mentioned, but not further analysed in this paper:

- **Smart Readiness of Buildings** [(EC) 10/14/2020b, 10/14/2020a], [Verbeke et al., 2020; Verbeke et al., 2018; Surmeli-Anac and Hermelink, 2018]
- **Energy Poverty** [European Commission (EC), 2020m]
- **Sustainable Growth Strategy** [European Commission (EC), 2020h]
- **Circular Economy Action Plan** [European Commission (EC), 2020d]

- **EU Taxonomy** [Candriam, 2020], Regulation [(EU) 2020b], Delegated Regulation [(EU) 2020a]
- **Heating and Cooling Strategy** [European Commission (EC), 2016a], [European Commission (EC), 2016b], [Mathiesen et al., 2019]

2.6 Directives and Regulations

The following Directives and Regulations are relevant in the context of the Renovation Wave.

- **Energy Performance of Buildings Directive** EPBD [(EU) 2018d]
- **Energy Efficiency Directive** EED [(EU) 2018c]
- **Renewable Energy Directive** RED [(EU) 2018b]
- **Effort Sharing Directive** [(EP); (European Council) 5/30/2018], [European Commission (EC), 2017+01:00]
- **Governance Regulation** [(EU) 2018e]
- **Energy labelling Regulation** [(EP); (European Council) 7/4/2017]
- **Ecodesign Directive** [(EP); (European Council) 10/31/2009]

3 Main elements of the renovation wave

This chapter provides an overview about the main elements of the renovation wave as communicated by the European Commission since 14th October 2020. A brief evaluation to what extent the renovation wave initiative matches the overall science and policy context on EU level will be provided in chapter 4. To structure the overview, we will structure this chapter as follows:

- Reasons and objectives
- Action plan
- EPBD revision as central piece of action
- Funding.

3.1 Reasons and main objectives

The Commission formulates the **main objective** of the renovation wave as follows [European Commission (EC), 2019f, 2020l]:

- At least double current renovation rates of public and private buildings by 2030 and foster deep renovations.

Why should that happen according to the Commission? Originally two **major reasons** had been put forward, a third has been added as a consequence of the COVID-19 pandemic and the Recovery and Resilience Plans (cf. chapter 2.4).

- Reach climate neutrality by 2050 and contribute to climate objectives for 2030.
- Alleviate energy poverty.
- Stimulate recovery of the EU economy.

Climate neutrality

On 11 December 2020, the European Council endorsed the target to reduce GHG emissions in the EU by at least 55% by 2030 compared to 1990. As often cited by the Commission „*buildings are responsible for 40% of total energy consumption and 36% of energy-related greenhouse gas emissions in the EU*" [European Union (EU), 2021]. This is why decarbonisation of buildings is key for achieving 2030 and 2050 climate targets. Achieving at least 55% GHG emission reduction had been proposed by the Commission in their Climate Target Plan 2030 (CTP) [European Commission (EC), 2020j].

Referring to the CTP, the renovation wave communication also presents concrete 2030 targets for buildings compared to 2015 levels: „*To achieve the 55% emission reduction target, by 2030 the EU should reduce buildings' greenhouse gas emissions by 60%, their final energy consumption by 14% and energy consumption for heating and cooling by 18%.*" Furthermore it notes that the „*increased rate and depth of renovation will have to be maintained also post-2030 in order to reach EU-wide climate neutrality by 2050*."

All numbers provided so far only address energy consumption that result from heating, cooling, ventilation, domestic hot water and lighting, i.e. the operation of buildings. Yet, having the link to the sustainable growth strategy (see below), the renovation wave also aims at reducing material intensity and GHG emissions related to the manufacturing of building materials needed for renovation and new construction.

Energy poverty

The Commission considers its recommendation on energy poverty from 14 October 2020 [European Commission (EC), 2020m]as part of their renovation wave communication. Each Member State has to assess the number of households in energy poverty in its NECP. According to the EU Survey on income and living conditions (EU SILC) nearly 34 million Europeans are unable to keep their dwelling adequately warm. [European Commission (EC), 2020l]. Together with the increased significance of dwellings for being home and work-place at the same time, the renovation wave aims to tackle the worst performing buildings related to social housing as a high priority in order to reduce energy bills and reduce negative health impacts of such buildings. That priority is underlined by findings from a 2018 report on social infrastructure [Fransen et al., 2018] which assumed 800,000 social dwellings were to be renovated each year.

Recovery

In September 2020 the Commission published its Sustainable Growth Strategy [European Commission (EC), 2020h]. It puts forward seven „flagship initiatives", one of them being „Renovate" Flagships are created based on the Recovery and Resilience Facility and meant to address challenges which are common to all EU Member States. For this reason, the Commission encouraged all Member States to integrate these flagships in their recovery and resilience plans. To facilitate this integration, the Commission provided an example component „renovation wave" [European Commission (EC), 2020c] for Member States' recovery and resilience plans. Concretely the flagship „Renovate" is about increasing energy and resource efficiency of public and private buildings by targeted funding which creates local jobs and promotes the „twin challenge" put forward with the Green Deal of a *green and digital* transition. Linking the renovation wave with „Renovate" till 2025 is meant to create synergies for ensuring the envisaged doubling of renovation rates and fostering of deep energy renovations. The Commission expects 35 million building units to be renovated and 160,000 new green jobs created by 2030, requiring additional annual investments of 90 billion Euro [European Commission (EC), 2020o].

3.2 Action plan

Along with the renovation wave communication an **annex** was published, called "The Renovation Wave: key Commission actions and indicative timelines" which is commonly referred to as the "**renovation wave action plan**". A broad set of initiatives is covered, whose launch is scheduled within a very ambitious timeframe, i.e. the bulk of actions is to be launched still in 2021. Actions are classified into several categories, reflecting the renovation wave communication's "*areas of intervention and lead actions critical to enable a step-change in the depth and scale of renovations*" [European Commission (EC), 2020l] which are meant to address all buildings, plus the last three categories reflecting areas that "deserve specific attention". As

the action plan does not mention all relevant elements of underlying communication, in the following information from both documents is merged. The whole set of actions reflects "**key principles**" the Commission mentions should govern potential revisions of legislation: energy efficiency first, affordability, decarbonization and integration of renewables, life-cycle thinking and circularity, high health and environmental standards, tackling the twin challenge of the green and digital transition, respect for aesthetics and architectural quality. Reading the communication, there is quite some overlap between principles and areas of intervention, therefore we understand the principles as guidance, but the actual measures described to be leading.

- **Strengthening information, legal certainty, and incentives for renovation**

  Lack of information and legal certainty is known to be a major barrier for energy renovation, both on individual building level but also groups of buildings, e.g. districts or Member States' building stocks.

  - The **Building Stock Observatory (BSO)** is meant to be a central information tool for assessing the impact of building policies on several building stock characteristics like its energy performance, GHG emissions and share of worst performing buildings. So far there have been two rounds for setting up the BSO and filling it with data, the third round is planned to start within 2021. It turned out that without a commitment of Member States and other stakeholders to support keeping the BSO meaningful and up to date is hard to do. Therefore, the Commission wants to explore with various stakeholders how to make the BSO a central European repository for building stock data.

  - Ongoing digitalisation may support making data on the energy performance of individual buildings and building stocks and data related to energy performance more easily available and accessible. **Digital Building Logbooks** are planned to integrate all building related data, comprising e.g. data from the Commission's sustainability framework LEVEL(S), the Smart Readiness Indicator (SRI), Building Renovation Passports (BRP) and Energy Performance Certificates (EPC).

  - A revision of the **Energy Efficiency Directive (EED)** is part of the Fit For 55 package. Yet, also several elements will be revised with a view to the renovation wave. So far EED Art. 5 addressed buildings of the central government, which turned out to be a fraction of only 4.5% out of public buildings. **Extending renovations to all public buildings** is therefore under consideration. Likewise, the option to require **audits for large or complex non-residential buildings** like hospitals, schools or offices will be assessed.

- **Reinforced, accessible and more targeted funding**, supported by technical assistance is a cornerstone of the renovation wave strategy. See chapter 3.4 for more information.

- **Creating green jobs, upskilling workers, and attracting new talent**

  The Commission is aware that a fundamental transformation of the building stock requires a fundamental "**re-skilling", "up-skilling" and increase of the related workforce**. Low- or zero-carbon buildings, circularity and the ongoing digitalization require specific knowledge during design, construction and operation of buildings. Adequate training and education is needed and also more women are meant to be attracted to these new profiles. The

Commission's **2020 Skills Agenda**, the launch of the **Pact for Skills**, the continuation of the **BuildUp Skills** initiative or the 2021 release of **Level(s) training materials** all aim at supporting Member States in updating training roadmaps or providing concrete trainings for the construction workforce.

- **Sustainable built environment**

  In this category the Commission mentions a variety of measures, many of them having a focus on **resource efficiency, circularity, longevity or recycling** of components or construction materials, while others focus on the **climate resilience** of buildings or competitiveness of construction industry e.g. through more **industrialised construction**. A few examples are a respective revision of the construction products regulation (CPR), the development of above mentioned whole life-cycle carbon emissions in buildings roadmap, collaboration with standardisation bodies on climate resilience standards for buildings, support for reuse and recycling platforms, a review of material recovery targets by 2024 for construction and demolition waste as well as promoting the use of EU Construction and Demolition Waste protocol and the Level(s) framework during renovation. Digitalisation may also support resource efficiency and reuse by creating "digital twins" with building information modelling (BIM) and the planned EU framework for digital permitting.

- **Integrated participatory and neighbourhood based approach**

  This quite diverse category stresses local stakeholder engagement and demand side potentials that lie in the scale of districts or neighbourhoods, but also covers the "New European Bauhaus" initiative and aspects that are typically linked to "smart cities" or "smart homes". Examples provided by the Commission are smart homes, prosumer, smart meters, e-mobility and the objective to deploy more than 1 million public charging stations by 2025. Furthermore, the Commission would like to further promote so called **energy communities** who generate, consume, store and sell energy, and according to the Commission can help people get out of energy poverty. Economies of scale might be achieved by mayors committing to and implementing **green procurement at scale** using the Covenant of Mayors platform. Finally, the "**New European Bauhaus** initiative" strives to unite "sustainability with style", in order to achieve "appealing and affordable sustainable design". Nature-based materials, specifically wood, are said to play a major role. Being an actual initiative, it will have an advisory and two strands: a „network of thinkers" plus real building projects across the EU. Having three phases - design, deliver, diffuse –in 2022 the design phase is to start across the EU with five „founding Bauhauses with different foci; more Bauhauses will be added later on. Further aspects under the umbrella of the EPBD will be explained in chapter 3.3.

- **Tackling energy poverty and worst-performing buildings**

  This is the first area that according to the renovation wave communication "deserves specific attention" and at the same time, as pointed out above, is one of the major reasons that drove the communication. It also **includes non energy-related** typical **burdens**, older, **worst performing buildings may put on their inhabitants**: bad accessibility, higher exposure to heat waves or cold spells, toxic materials, bad indoor air quality, lack of daylight etc. These can be tackled together with energy renovations in one go. Like with previous areas, the Commission presents a set of measures to facilitate actions for solving those problems. Identification of worst performing buildings and related energy poverty already would improve by **more stringent MS reporting of energy poverty** in their NECP or LTRS, which in principle already exists, and **accessible EPC databases**, which currently exist only

sporadically across MS. The latter may be tackled in the EPBD revision (see chapter 3.3). A bundle of **progressive MEPS**, blended loans brokered by **one-stop shops** and **targeted technical assistance** (see chapter 3.4 on funding) is meant to break up complex decisions in social or multi-apartment housing. Furthermore **large scale implementation** and **improved business models** are meant to bring down (upfront) cost: In their "**Affordable Housing Initiative**" the Commission wants to pilot 100 lighthouse renovation districts in a „smart neighborhood approach" in order to provide blueprints for replication. Specifically, for this building segment experience from projects that tested standardized, **industrialised solutions** is to be scaled up. Furthermore, the Commission wants to promote pilots of "**efficiency purchase agreement**" and extension of **ESCOs and energy performance contracting** to increase affordability.

- **Exemplary role of public buildings and social infrastructure**

  Buildings of public administration and social infrastructure like schools and hospitals have the potential to **showcase resource efficient, deep renovations and its co-benefits** but also to serving **as role models and pilots for industrialised solutions**. As mentioned above it is planned to **extend the EED's renovation obligation to all public buildings**, but also to extend MEPS for building renovation. In this context **indicative 2030 and 2040 milestones** aiming at climate neutrality by 2050 for renovation of public and private service buildings will be published amending existing guidance on LTRS. On top of that, for public authorities in early 2021 the Commission intends to publish **guidance on the "energy efficiency first" principle** and in June 2022 **green public procurement criteria based on Level(s)**.

- **Decarbonising heating and cooling**

  Decarbonising heating and cooling is the indispensable complement to reducing buildings' energy needs for having comfortable and healthy indoor conditions. This goes for onsite, nearby (district heating & cooling) and off-site energy supply options. According to the renovation wave communication, 88% of all heating in Europe is from stand-alone heating, 12% from district heating. Without considering significant amounts of carbon capture and storage obviously for a fully decarbonized system, the renewable energy share should be close to 100%. Scenarios (-55%) for the Climate Target Plan 2030 foresee an increase of the share of renewables and waste heat to 38-42% from 22% in 2019 [Eurostat, 2019]. While the EU Strategy for Energy System Integration asks for electrification of heating [European Commission (EC), 2020g], most of the renovation wave communication's **measures for decarbonization** are related to **district, municipal or national level** which will mainly be addressed in the 2021 revisions of EED and RED, and to a smaller extent of EPBD and Eco-design & energy labelling.

  - **RED**: The revision of the renewable energy directive will assess the introduction of **minimum levels of renewable energy in buildings**. A **toolbox** to promote renewable heating & cooling will be explored which is to include elements like: low-temperature renewable or waste heat and cold and measures to access it, local heating and cooling plans and decarbonised gases.

  - **EED**: The revision of the EED seeks to **strengthen the capacities of public authorities and utilities** to create regulatory frameworks, prepare comprehensive **heating and**

cooling planning in coordination with renovation projects and to create a sound pipeline, as well as their financing and implementation.

Apart from these measures, **Eco-design and energy labelling** regulation will further increase efficiency on the component level while potential inclusion of decentral energy carriers into the **ETS** is also up for decision in 2021.

3.3 Potential revision areas in EPBD and other Directives

A core set of directly effective regulatory measures is to be implemented by a targeted revision of the Energy Performance of Buildings Directive. "Targeted revision" aims at changes to existing articles rather than a complete re-structuring of the directive. In the meantime, the Commission published the Inception Impact Assessment [European Union (EU), 2021], which provides further insight into the policy options the EC draws from the mandate given by the renovation wave communication. **Priority will be given to minimum energy performance standards (MEPS) and energy performance certificates (EPC).**

The Commission currently assesses different options for a phased introduction of **mandatory minimum energy performance standards for** different types of **existing buildings**. This is a change to previous editions of the EPBD that did not include mandatory improvements for existing buildings, except in cases where energy-related components were upgraded or replaced anyway or in case of major renovations. Options for MEPS vary by type of addressed buildings, ambition level, timeline, phasing and level of flexibility for MS. For example, MEPS could be first introduced in public and office buildings, then extend to residential buildings with a view to addressing worst performing buildings and affordability of housing. It is also considered to include district and community approaches in defining minimum standards, to facility the development of zero or positive energy districts. In the context of EPC, the Commission also ponders the definition and introduction of a certifiable **deep renovation standard**, mainly to de-risk investments in energy renovations for financial institutions.

A **revision of EPC** is to strengthen their impact on creating a market pull for energy renovations. More accurate and reliable data for individual buildings on their energy performance, energy cost and share of renewable energy is envisaged for improving EPC quality. Under a so-called "new EPC framework", EPC shall be **harmonised**, be available in uniform EU machine-readable data format and linked to new metering technology. This kind of digitalisation shall also facilitate a **higher availability and accessibility of EPC in databases**, serving e.g. the purpose of identifying worst performing buildings. Digitalisation will also facilitate the introduction of **Building Renovation Passports (BRP)**, which is proposed building on the results of the feasibility study of Article 19a [INIVE and BPIE, 2020].

3.4 Funding

As part of the renovation wave communication package, the document "Support from the EU budget to unlock investment into building renovation under the Renovation Wave" [European Commission (EC), 2020o] provides an overview about potential funding sources. Different estimates can be found in renovation wave documents on *annual* needed investments in energy renovation. While the communication itself mentions 85-90 billion Euro, the Q&A document provides an amount of 275 billion Euro for reaching the 2030 target of -55% GHG emissions, which we evaluate to be more realistic.

Available funding on EU level

On 17. December 2020, the Council adopted Multiannual Financial Framework (MFF) for the period 2021-2027. It includes a budget of 1,074.3 billion Euro for the EU27. Together with the EU recovery and resilience fund "NextGenerationEU", amounting to 750 billion Euro, more than 1.8 trillion Euro will be available for the next seven years, of which at least 30% are earmarked for climate protection measures. In the following we list programs, whose budgets could actually be used for investments in energy efficiency of buildings.[2]

- European Fund for Regional Development (ERDF), European Social Fund + (ESF+) and Cohesion Fund (CF): 330.2 billion Euro, climate share 30%
- Recovery and Resilience Facility (RRF): 672.5 billion Euro (till 2026), climate share 37%
- InvestEU ("Sustainable Infrastructure"): guarantee of 26.2 billion Euro (9.9 billion Euro for sustainable infrastructure), climate share 30%. The guarantee is meant to incentivize additional investments up to 650 billion Euro.
- Just Transition Fund: 17.5 billion Euro, climate share 100%.
- Modernisation fund in the context of EU ETS: an estimated 14 billion Euro; at least 70% for energy efficiency.

None of these programs is specifically earmarked for investments in buildings. Because of that it is hard to estimate, how much will actually feed into this sector, also because there is little data available from previous years that would support an estimate. We assume that an annual 8-16 billion Euro will be available from these programs for energy renovation of buildings.

[2] Funds for research and technical assistance are not included in this list.

4 Match of renovation wave, science and policy context on EU level

In the first part of this chapter (4.1) we would like to provide a brief evaluation of the extent to which the renovation wave covers all the major activity fields that science and experience from policy design and analysis tells would be needed for a sufficiently comprehensive approach. In the second part (4.2) we look at the renovation wave's ambition level relative to climate and energy efficiency.

4.1 Activity fields

For an evaluation it is important to keep in mind the renovation wave's genesis.

"A Clean Planet for All", the Commission's strategic long-term *vision* for a prosperous, modern, competitive and climate neutral economy by 2050, was announced in November 2018. Without at that moment setting new specific targets, it called for a climate neutral EU by 2050 and a process that was to inform a new strategy to be submitted to the UNFCCC by early 2020 as requested by the Paris Agreement. Embracing that vision, in December 2019 with the *European Green Deal*, the Commission published its new growth strategy to transform the EU into a fair and prosperous, climate-neutral society. The Green Deal's action plan, amongst others, called for the renovation wave and revision of RED and EED.

In our view, the Green Deal's action plan set out an extremely ambitious agenda to be achieved within quite a short time frame. There appears to be some truth in Commission President's van der Leyen's statement that the Green Deal is Europe's "man on the moon" project. Like the Green Deal action plan, the renovation wave's action plan pushes forward a very ambitious and complex agenda, again to be set up within a very short time frame. During the work on the renovation wave, the Commission realized, that also the EPBD would need to be updated. This means that EED, RED and EPBD will be revised in 2021, only three years after their last revision within the "Winter Package". Full transposition still has not been communicated by all Member States. This development given, we see a highly dynamic policy framework, while the renovation of the building stock and the renovation rate have shown rather static over the last years.

During the last few years and accelerated by the COVID-19 crisis "buildings" have developed into a **horizontal** topic, recognizing buildings' systemic relevance, i.e. for the energy system, the economy, culture and societal well-being. The extent to which buildings interfere with these areas has received increasing attention, emphasizing the interrelated nature of buildings with other sectors and policies. Specifically, the importance of buildings for societal well-being also in times of crises, where e.g. schools, hospitals and homes got into the spotlight of how societies handle COVID-19 and stay safe and healthy, but also buildings' importance for economic recovery was disguised. This bandwidth is reflected in the Commission's **example component** "Renovation wave" for national recovery and resilience plans. It also emphasizes that the Renovation Wave Communication clearly should not be seen as a "stand-alone" document or activity, respectively. It is an integral part of the **Green Deal** in conjunction with the recovery plan.

The bandwidth of activities covered by the renovation wave communication has been described in previous chapters and is summarized in the Commission's example component:

- Jobs and growth
- Green transition

- Social resilience

In terms of policy making societal change can be driven by policy measures of three categories:

- Regulation
- Information and education
- Financial incentives

For a complete analysis these aspects could be mapped against each other to allocate the actions communicated with the renovation wave, as shown in Table 1.

Table 1. Matrix for complete evaluation of completeness of renovation wave measures

	Regulation	**Information & Education**	**Financial incentives**
Jobs and growth			
Green transition			
Social resilience			

As this document is meant to be a short paper, we won't go into that detail and rather focus on some specific elements, which we draw from selected insights from the "*Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU*" [Esser et al., 2019]. In the following we will briefly check to what extent the study's findings are reflected in the renovation wave communication.

- **Precise definitions for renovation rates and depths (deep, medium, light) are needed**.

  Although the renovation wave communication cites numbers from that study (e.g. 1% renovation rate, 0.2% (one-off) deep renovations) it does not explicitly mention the specific definition that was chosen in that study: annual non-renewable primary energy savings achieved by energy renovation of buildings, which is different from all kinds of other notions about renovation rates. In our opinion **it is crucial to have explicit, useful and commonly accepted metrics for renovation rates and depths** across Europe, also as pre-condition for setting unambiguous targets which afterwards can be monitored unambiguously. This also reveals another weakness of the renovation wave communication: it does not say much about **monitoring** of its impact. Certainly, the MS' LTRS would be a good place to do so – yet, in spite of being due by April 2020, still not all MS have handed in their LTRS – and their update cycle is ten years. As long as Member States do not stick to reporting requirements, LTRS do not include clear requirements for metrics to report and update cycles remain at ten years**, LTRS are not a suitable tool for monitoring progress**. Still they could be after having made changes to previously mentioned issues. Such changes are not suggested in the renovation wave communication.

- **"One-off" deep renovations have a share of approx. 0.2% in terms of floor area and approx. 10% within total primary energy savings. Staged renovations dominate. A systematic approach to staged renovations, i.e. getting to a deeply renovated buildings or districts through a series of coordinated light and medium renovations, is needed. Furthermore, energy renovations highly coincide with non-energy renovations.**

  Several related aspects are addressed across the renovation wave communication– BRP, MEPS, Affordable Housing Initiative, ESCO, One-stop-shops, technical assistance, municipal heating & cooling plans etc. Yet, the strong coincidence between energy and non-energy renovation is missed out. The question remains how all these elements could fit together and be synchronized in one coherent approach. Building Renovation Passports (BRP) appear to be a very good starting point and will be discussed in the EPBD revision. From our point of view a roadmap for promoting staged renovations combining all the useful elements mentioned in the renovation wave communication coherently a would make sense.

- **A huge additional workforce would be needed for doubling or tripling current renovation rates, if progress and shares of light, medium and deep renovation would remain at today's levels. Significant improvements in productivity will be needed to compensate for a potential lack of such needed workforce, which does not seem reachable at the moment even with new processes like industrial renovations.**

  According to the renovation wave communication by 2030, an additional 160,000 green jobs could be created in the EU construction sector through a renovation wave. This number at first sight appears to be surprisingly low. Checking the source provided in the communication reveals that it has no clear relation to the renovation wave and dates several years back. [Esser et al., 2019] estimate the current workforce involved in energy renovation to more than 5 million people. Without productivity gains a doubling of renovation rates certainly would increase the workforce by significantly more than 160,000 full time employees. Therefore, the objective to "at least double the renovation rate" by 2030 bears a significant risk of failure due to lack of workforce. If this isn't the most relevant obstacle at all. Industrialised renovation is mentioned a few times in the communication, specifically with a view to social housing. Compared to the high risk of workforce shortage, this topic needs significantly more emphasis, a strategic approach, and to be expanded beyond social housing. Construction works bind a huge workforce, e.g. because the output per hour worked is only half of the average production industry, without seeing higher productivity gains over time [Ward et al., 2017]. For this reason, finding and supporting ways for increasing the share of factory production should be undoubtable a high priority in order to increase productivity, but effectivity in the short term until 2030 still might be restricted. It even could have a link to digital building repositories and Building Renovation Passports. Seeking for more factory production, where one major characteristic is optimization of interfaces between production steps, would have synergies with better planning and cost reduction of staged renovations.

- **Architects and installers influence on decisions about energy renovations has been underestimated so far. They will be crucial for removing some of the main barriers for energy renovation, especially as upskilling this group also turned out to be crucial.**

  Although "up-skilling" and "re-skilling" is mentioned a few times in the communication, typically only the aspect of new technical skills is addressed. Yet the interviews conducted in [Esser et al., 2019] not just revealed a significant lack of expertise, experience and trust in low-carbon construction of both architects and installers, it also revealed their major role as influencers of decisions specifically for the huge amount of non-professional decision makers like homeowners. Homeowners heavily rely on the advice of these so-called "intermediaries". As long as architects and installers do not act as ambassadors of "deep" renovations, it remains unclear how non-professional decision makers will act in a "minus 55" compatible way. Therefore, this aspect should be an integral part of information and education efforts.

- **A vast majority of consumers use their own capital to finance renovation works – due to reservations against loans.**

  In the light of the NextGenerationEU recovery funding, which is equally divided into grants and funds, this is striking. For up-scaling energy renovation this appears to be a significant bottleneck that needs specific attention. Yet, we could not identify a direct focus on this aspect in the renovation wave communication although several instruments are mentioned like energy performance contracting by ESCOs, on-bill financing or efficiency purchase agreements. A strategic approach seems to be needed to lower this major barrier.

- **Non-residential buildings have a very significant share in the building stock and in total needed energy renovation**

  Like many other strategies the renovation wave communication puts a much stronger emphasis on residential than on non-residential buildings. Typical reasons: much better statistics exist for residential buildings and their *social* significance seems to be rated higher because of being people's home. As mentioned before, the implementation of a strategy needs proper indicators that can be monitored. Due to the very significant lack of data on non-residential buildings, the renovation wave should be used to close that gap for non-residential buildings in order to dedicate adequate attention and action to this part of the building stock. The Building Stock Observatory could be used for that purpose. Not just the buildings themself are quite different from residential buildings, but also the structure and type of owners [Hermelink et al., 2019], who need to be approached differently.

4.2 Energy and Climate: Ambition vs. status

While being the natural focus of the renovation wave, also new buildings need to be put into focus in order to get buildings on the Climate Target Plan's -55% pathways. After a long transition period, since 1st January 2021 all new buildings need to be NZEB. Yet, above mentioned study on energy renovation and the uptake of NZEB [Esser et al., 2019] as well as the NZEB status the Commission provided along with their State of the Energy Union report [European Commission (EC), 2020q] revealed less ambition than recommended by the

Commission in 2016 [European Commission (EC), 2016d]. Therefore, reviewing NZEB, both for new and existing buildings, is needed, too, in the context of the upcoming EPBD impact assessment as part of the renovation wave strategy.

The Climate Target Plan creates a new situation for evaluating the European building stock. Not only for the first time there is a 2030 milestone being in line with a reasonable pathway towards climate neutrality by 2050 as shown in Figure 1.

Figure 1: Stylised representation of future net GHG emission pathways compared to historic reduction rate since 1990 (Source: [European Commission (EC), 2020b])

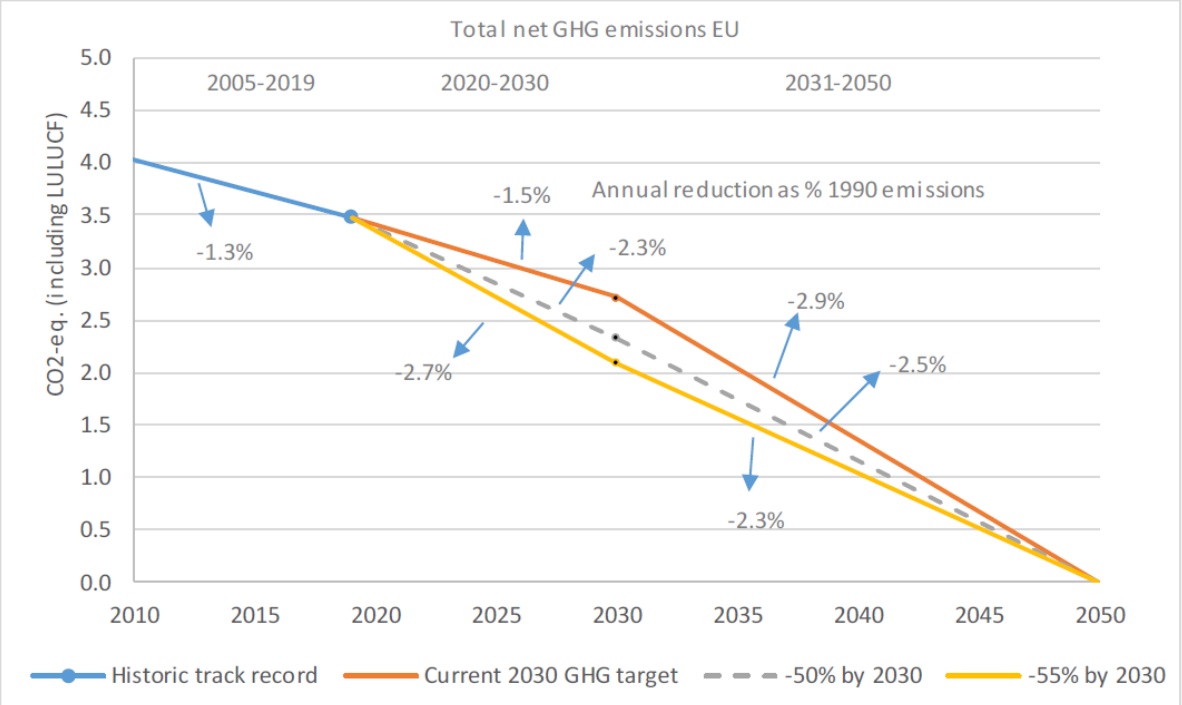

Figure 1 helps acknowledging the steep stepping-up of the ambition level. While still having in place the -40% GHG target in 2015/16 ("Current 2030 GHG target" in Figure 1), on December 2020 the EU adopted the "-55% by 2030" target with a view to realistically being able to achieve net zero emissions by 2050. Looking at the details of policy scenarios "MIX" or "REG" reveals that (apart from power generation) the sectors **"residential" and "services" - whose emissions to a large extent stem from building operation – by far need to have the highest reductions of around 54% to 64% only between 2015 and 2030**. This ultimately highlights the urgent need for utilising both energy efficiency *and* renewable energy to a very significant extent within the upcoming regulatory and non-regulatory framework.

Although this is very ambitious, we still would like to raise two points that deserve attention specifically for revising the EPBD.

- **The key efficiency indicator in the EPBD currently is primary energy**

  The revised EPBD entered into force on 19 June 2018. Like its predecessor, its Annex I focusses on primary energy use as the main indicator for the energy performance of buildings but now provides far more details on primary energy, which strengthens the role of primary energy specifically compared to energy needs in determining the energy

performance of buildings. A citation from Annex I underlines the outstanding role of primary energy:

"The energy performance of a building shall be expressed by a numeric indicator of primary energy use in kWh/(m2.y) … The calculation … shall be based on primary energy factors …, … Primary energy factors … shall be defined by Member States. … Member States may define additional numeric indicators of total, non-renewable and renewable primary energy use, and of greenhouse gas emission produced in kgCO2 eq/(m2 .y)."

Energy efficiency accounting around the EED is based on total primary energy. As pointed out in [Surmeli-Anac et al., 2014], due to several inherent distortions primary energy is a questionable indicator for energy efficiency. In the context of NZEB it has been strongly recommended to build the overall evaluation of building energy efficiency on separate evaluations of the building envelope (energy needs or use) and from there extend to either primary energy or GHG also considering how the energy needed is supplied [Schimschar et al., 2013]. A further developed concept also rewarding the compactness of buildings (i.e. total GHG emissions rather than just specific (per m^2) emissions) has been presented in [Bettgenhäuser et al., 2018]. For the sake of clearly promoting both minimum energy needs and their supply with low-carbon energy the EPBD Impact Assessment should carefully look into this issue. Furthermore, distinguishing between energy needs and emission factor for supplying them could easily be translated into building stock decarbonization rates and depths without mixing up direct impacts stemming from building envelope improvements and indirect impacts stemming from simply replacing fossil fuel by renewable energy.

- **Focus on operational energy in the EPBD**

  Traditionally the EPBD only looks at "*energy use for space heating, space cooling, domestic hot water, ventilation, built-in lighting and other technical building systems*" [(EU) 2018a]. While in inefficient buildings operational energy by far dominates energy used for manufacturing of materials or building construction this has changed significantly with the advent of NZEB and similar very low energy concepts. [Hermelink, 2009] pointed out that even considering an NZEB operation of 80 years, the global warming potential of construction, maintenance and repair may easily exceed the cumulated GWP from operation. Expecting steeply decreasing GHG emission factors for energy supply this ratio may even get worse for the construction part, at last for the next few years where construction uses today's high GHG emission energy mix and operation benefits from decreasing GHG factors. In addition a recent study has shown the significant potential of wood for decarbonisation of new constructions [Bettgenhäuser et al., 2020]. The renovation wave mentions whole-life cycle concepts in several places, yet it doesn't appear to be fully embraced with a view to the upcoming revision of the EPBD but rather for parallel tracks. Either way, as buildings have developed and will further develop towards very low-energy concepts [Tsiropoulos et al., 2020; Ürge-Vorsatz et al., 2020; Filippidou and Jiménez Navarro, 2019], it will be important to find a solution that strives for minimizing the life-cycle carbon footprint of buildings rather than risking sub-optimisation by a continued focus on operational energy.

4.3 Conclusions

The above analysis has shown that the Renovation Wave Initiative is a very ambitious and also complex plan that has been put high on the political agenda of the European Commission. The defined goals are highly aspirational and the whole process is very dynamic. At the same time, the progress and activities on the ground and in the renovation market are not at all in line what

is defined as target-compliant within the strategy, neither with regard to the quality of renovations, nor the quantity of it. The implementation in the market will show whether the strategy can be successfully applied. In order to succeed with the Renovation Wave Initiative, the European Commission would need to take action the activity fields shown above. But not only on EU level action is required, also member states like Germany and others need to actively support the Initiative and need to implement it. Since the European level sets out the framework only, member states are in charge to apply the framework and requirements to their local context. Elements like better implementation and definition of nearly-zero energy buildings (nZEBs) and the cost optimality framework for example, but also individual renovation plans and passports are key elements to the success of the Renovation Wave Strategy.

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