Introduction to Panel 7 Policies and programmes for better buildings

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Introduction

The EU Institutions are at the end of this political cycle, with the European elections in sight and a new Commission in place at the end of 2024. In the last five years, major aspects of the Renovation Wave to operationalise the EU Green Deal in the building sector have been initiated or completed. It is now time to look back and take stock of the policies in place across Europe: do they deliver better buildings? Did they trigger the transformation of the building stock towards a highly efficient and decarbonised building stock?

Better buildings are buildings that are either renovated to highly efficient standards or are new zero-emission buildings along their entire lifetime. They are also buildings that support our resilience against external crises – geo-political or climatic. In light of the EPBD 2024 (Directive (EU) 2024/1275), we extract learnings to inform and strengthen implementation in the Member States also considering the broadening scope of the EPBD. Is there promising new regulation in place? Did policies incentivise new business models to finance renovation? Did policies significantly accelerate transformation of the buildings stock towards decarbonisation and sustainability? At the same time, the evaluations of the policies in place may also contribute to improving strategies and programmes at the EU level. Where do we see room for improvements and adjustments in the years to come?

A wide range of contributions provides a strategic view on the decarbonisation of the building sector, shows progress in policy instrument development and gives insights into existing practices in European Member States and beyond. They can thus inform policymakers to make use of all levers in the EPBD and implement new provisions in view of achieving long-term objectives for a sustainable building stock. Finally, the contributions of this panel may guide European policymakers through new and remaining challenges in the new policy cycle that is about to start.

Advancing policy approaches to decarbonise the building sector

Taking on the challenge to decarbonise the European building stock, the paper by Bertoldi et al. (peer reviewed paper 7-266-24) build on experiences with policies addressing well-studied barriers towards deep renovation and proposes an innovative plan building upon the Renovation Wave initiative to mobilise capital and establish financing mechanisms to accelerate deep renovation. The authors argue that efforts need to be encompassing and would include obligations for Member States to renovate a growing proportion of the worst-performing buildings, increased support and information for end-users, targeted district renovations, blended financing, and the aggregation of projects to reduce costs through industrialized solutions, to boost the supply industry, including, and ensure the availability of a skilled workforce.

Sibileau and Diaconu (extended abstract 7-079-24) look at the contribution the new EPBD 2024 can make to close the gap towards a fully decarbonised building stock in 2050, highlighting the main new elements of the directive and discussing remaining challenges to be addressed in the next policy cycle to come. This is where Thomas and Sunderland's (extended abstract 7-273-24) contribution starts: The authors argue that the new Commission need to focus on phasing in clean heat to reduce emissions rapidly, targeting fabric improvements in the worst performing buildings to make transition-ready and

alleviate energy poverty, integrating buildings as energy system resources, unlocking their flexibility potential, and coordinating planning for the infrastructure needed across networks and policy programmes.

The new EPPD – Directive (EU) 2024/1275 – is now in force and has to be implemented by 29 May 2026. A key and newly introduced provision are Minimum Energy Performance Standards for non-residential buildings (Art. 9(1)). Bei der Wieden et al. (peer reviewed paper 7-174-24) address a key task for Member States when implementing the provision: How to define the worst performing buildings in a heterogenous stock? Building on existing practice in the EU and US, the authors propose two approaches to transfer the calculated share of worst-performing buildings into practical requirements for individual buildings. Mellwig et al. (peer reviewed paper 7-130-24) focus on two other partly new provisions of the new EPBD. They present a concept for an extended Energy Performance Certificate to accelerate deep renovation including elements of Building Renovation Passports, as being developed within the IBRoaD-2EPC project.

Taking stock: Experiences with policies for better buildings

A range of contributions take a deeper look at lessons learned from existing policies zooming in country case studies, or, comparing experiences in countries with similar policy instruments.

Amorocho et al. (peer reviewed paper 7-263-24) analyse available data from EU Member States to provide an overview of the current status, challenges and opportunities regarding Energy Performance Certificates. An extensive data collection exercise that gathered the EPC data available from 19 Member States until 2023, is the basis to provide a comparison and an overview of the relative share of EPCs in Member States in reference to the whole EU building stock. The paper summarizes the challenges and opportunities for next-generation EPCs. Sayfikar and Jenkins (peer-reviewed paper 7-180-24) also analyse the landscape of EPC schemes in Europe. In a comparative study looking at EPC methodologies across Europe the authors identify differences and their implications for future EPC innovations. A last paper on EPCs by Laurent et al. (peer reviewed paper 7-228-24) also points to a challenge of current EPC schemes. They analyse the actual costs associated with high-efficiency renovations required for an EPC label change. The authors argue that the knowledge of what is behind the EPC label change clarifies energy efficiency policy objectives in terms of technology and the type of retrofit possible and/or necessary, particularly for the building industry as well as the introduction of targeted financial incentive.

O'Callaghan et al. (extended abstract 7-070-24) analyse in an Irish case study the progress towards achieving the targets of the national climate action plan through comprehensive retrofit measures and decarbonised heating system. The findings highlight that, despite some modest progress, existing policy measures are unlikely to achieve the targets. The paper provides insights for policymakers, suggesting targeted interventions to foster retrofit uptake and mitigate disparities in access to cleaner energy solutions and energy efficiency improvements. Wade and Webb (extended abstract 7-051-24) identify local and regional planning as a potential route to faster decarbonisation of the building sector. They analyse an emerging innovation in Local Heat and Energy Efficiency Strategies (LHEES) in Scotland that aims to create area-based, costed and prioritised, 20-year strategies for upgrading energy efficiency and decarbonising heat in all buildings. The authors highlight the importance of governance, multi-level governance coordination as well as sufficient resources and capacities at the local level. In order to meet the Paris Agreement and other decarbonization targets, new homes and buildings will need to be net zero emissions. It is much easier to build efficiently at the time of new construction than having to retrofit these buildings later. The paper by Nadel and Janssen (peer reviewed paper 7-007-24), jointly written by European and American experts, reports on and contrasts net zero new construction efforts in Europe and North America, identify lessons learned, and discuss some needed next steps.

Beyond operational energy – sufficiency policies and embodied energy and carbon in the building's life cycle

EU policymaking to decarbonise the building stock has extended its scope over time considerably well portrayed by recent changes in the EPBD. While not yet anchored widely in policymaking, sufficiency policies are increasingly subject of research as several contributions to the panel show. Aumont (extended abstract 7-054-24) argues for an inclusion of sufficiency as an element of national building renovation plans (Art. 3 EPBD 2024) to tackle the environmental impact of the sector and the current housing crisis. The author presents a number of best-case examples of sufficiency measures and policies proposals related to the existing building stock (addressing issues of wrong-sized space, vacancy and misuse of existing space) and unbuilt land (addressing issues of inner-city densification and urban sprawl). Sula et al. (peer-reviewed paper 7-260-24) examine building practices through the lens of sufficiency and flexibility. In a scenario of ongoing urbanization and increasing population influx into cities, the demand for new construction intensifies, putting pressure on available land resources. This situation underscores the importance of reviewing the need for space and rethinking the use of existing built environments. In this context, introducing sufficiency and adaptability/flexibility principles becomes essential, promoting more effective utilization of current structures and resource utilization during construction and optimizing operation and maintenance.

Janßen et al. (extended abstract 7-289-24) explore the acceptability of sufficiency policies in the housing sector, drawing on representative survey data from five European countries (Germany, France, Italy, Denmark and Latvia). The acceptability of a ban on the construction of new single-family homes and an annual financial fee for dwellings with an above-average living area has been tested and discussed in view of impacts for different societal groups, specifically vulnerable groups. Gilani et al. (extended abstract display 7-295-24) look at architecture pedagogy at universities to prepare students to become driver of a real transformation towards a sustainable building stock by showcasing a progressive university from India.

In addition to energy efficiency and sufficiency in the operational phase of buildings, embodied emissions are increasingly addressed in policymaking. The new EPBD not only requires

the disclosure of the global warming potential of new buildings but also asks European Member States to set up a roadmap to introduce limit values on the total cumulative life-cycle GWP (Global Warming Potential). The energy demand and embodied emissions of buildings and political measures for integration into decarbonisation paths and emission reduction targets are discussed at a microeconomic and macroeconomic level.

Toth and Kockat (peer-reviewed paper 7-308-24) develop macroeconomic scenarios for reducing operational and embodied emissions. The analysis suggests that reduction of operational carbon will not be sufficient and will be partly offset by a growth in floor area and emissions embodied in the materials used for the construction of new buildings and the renovation of the current stock. This implies that further and more ambitious measures targeting both operational and embodied emissions will be required. In addition to GHG emissions, Deurer et al. (peer reviewed paper 7-085-24) also calculate the cumulative energy demand of various reference buildings and derive policy recommendations. The authors developed a model to calculate the environmental impact of the technical building equipment in a highly detailed manner to analyse the effects of different construction variants and building materials both at the level of individual buildings and for the entire building stock in Germany. The comparison of different construction methods shows the potential for saving GHG emissions by reducing the embodied energy and compares its relevance for different building types and energy standards. Pallerlamudi et al. (peer reviewed paper display 7-143-24) present a case study and demonstrate the embodied carbon reduction potential and corresponding cost impacts of a residential building in the Indian context and proposes a broad range of strategies that can be adopted at various stages of project execution to reduce embodied carbon and evaluate policy and institutional mechanism at national and state/city level for driving the adoption of the identified strategies.

Social and economic aspects of the transition in the buildings sector

With the rising energy costs, the need for a socially fair transition of the building stock became very obvious. Several contributions analyse different aspects of a fair transition – from better understanding the needs of vulnerable households to analysing solutions to better address those groups. Fermenias (peer-reviewed paper 7-215-24) explores how tenants perceive the impact of housing renovation on their quality of life. The paper analyses extensive empirical data from renovations conducted across three municipally owned companies in Gothenburg. The study argues that insufficient attention has been given to potential adverse impact on people's quality of life following a renovation and calls for better communication about the renovation activities as well as better studies at the intersection between energy savings, social welfare, and quality of life of people, with special attention to the vulnerable situation of residents in rented housing. While this paper shows that the introduction of smart meters was not always perceived as an advantage for building occupants, Kenington and Gornall (extended abstract display 7-090-24) present an innovation "smart meter enabled thermal efficiency ratings". He claims that by developing in-use data-derived systems, retrofit can be enabled due to a greater understanding and agency for householders to understand the actual performance of their homes and in doing so overcome informational barriers to action.

Owen and Killip (peer reviewed paper display 7-189-24) look at a similar aspect but from a different perspective. Their contribution is analysing the results of a survey about the self-confidence of the industry implementing renovation solutions. It provides interesting insights e.g. in how the size of a company is correlating with the firm's self-perceived ability to answer customer questions on energy efficiency, or their ability to carry out energy efficiency projects.

How do governments best support households to protect them from higher energy costs? Hesse et al. (extended abstract 7-309-24) quantify the impact of shifting part of the funding for measures compensating for higher energy costs to targeted investment support for low-income households and address the question of how such approaches can contribute to long-term solutions to the energy security and climate crisis in selected EU countries. The study shows that targeted support for low-income households for investing in energy efficiency and renewable energy is essential to address energy poverty and decrease the dependency on fossil fuel imports. Moeller (extended abstract 7-245-24) examines different models to realise warm rental models to address the split incentive dilemma in Germany and proposes a new warm rent model that addresses issues such as the shared responsibilities between energy consumption between landlords and tenants, rebound- as well as prebound effects.

Brown (extended abstract 7-182-24) argues that a new framing is needed to accelerate the decarbonisation in the building sector. The author identifies the mainstream 'rational actor' framing as a core reason for the failure of insufficient progress on the decarbonisation challenge. He introduces an alternative 'relational' framing, to re-examine the assumptions surrounding the retrofit 'customer journey' and the accompanying policy framework, drawing on three United Kingdom (UK) case studies, exploring the customer journey of households, self-funding renovations and retrofit.

How can decarbonisation strategies both from the demand- as well as from the supply-side be implemented in the most (cost-)effective way? Wood is classified as a renewable energy source. However, this is only appropriate with strict forest management techniques. Huebner and Brown (peer-reviewed paper 7-181-24) argue that domestic combustion – including wood burning – is the biggest source of fine particulate matter (PM 2.5) in cities like London. The public health costs of wood burning are substantial, in the long-term contributing to chronic health conditions, e.g., cardiovascular, and respiratory diseases, and in short-term to acute health outcomes, such as exacerbation of asthma. The paper shows that wood burners might become cost-competitive only for those who can largely source their own wood for free. With the new EPBD, the on-site installation of solar energy systems as part of the decarbonization strategies in the building sector is taking the next step (see Art. 10 EPBD 2024). Sandin Lompar and Neij (extended abstract 7-015-24) quantify the transaction costs carried by Swedish households acquiring PV systems through online surveys with 264 respondents, encompassing residential single-family house-owners who acquired a building-mounted PV system 2015–2020. The authors conclude that there are opportunities

to further streamline the acquisition process and thereby reducing transaction costs.

Frysztacki et. al (extended abstract 7-251-24) employ a top-down, sector-coupled European model with a carbon dioxide emissions constraint to examine the impact of energy efficiency measures in buildings, specifically targeting the significant 40 % of final energy consumption in the European Union attributed to space and water heating to flatten the peak demand curve. On that basis, the authors recommend an increased collaboration of stakeholders between the demand- and supply-side to better inform policymaking. Hasse et al. (extended abstract 7-032-24) compare the effect of a strong implementation of either a carbon price or a fossil-fuel boiler installations ban as well as both at the same time using the new building stock model BRICK. The analysis shows that the stock development differs considerably between the two scenarios. Introducing only a carbon price leads to an immediate and persistent switch towards clean heating technologies whereas the installation ban only takes effect after the effective date but then leads to a faster phase out of fossil fuel boilers.

Dharmarathna et al. (peer-reviewed paper 7-120-24) conducted a systematic review and meta-analysis to identify the relevant drivers and stakeholders for the adoption of sustainable buildings in developing and developed countries. The results showed differences in the significance of the drivers depending on their dynamics with the socio-economic status of a country (developed/developing), geographic region, and the relevant stakeholders, which is critically discussed.