Introduction to Panel 7
Make buildings policies great again

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Introduction

Buildings are responsible for approximately 40 % of energy consumption and 36 % of CO_2 emissions in the EU. Climate and social science leave no doubt policies really have to deliver now to make buildings adequately contribute to a sustainable pathway as, e.g., set out in the UN's Sustainable Development Goals. But policies are not there yet.

More and better action needs to be taken much more seriously across the whole policy cycle: target setting, strategy development, implementation, enforcement and evaluation, from both public and private players. Insufficiencies in any of these steps will cause failure. Undoubtedly, this is an enormously challenging task in a complex dynamic world: even before 2 °C targets had been adequately translated into buildings policies, Paris' "well below 2 °C" appeared on the radar; the summer 2018 mirrors the urgency to act on cooling; micro-economically "feasible" building concepts lag behind societal targets; non-residential buildings – still a black hole; how to factor in energy poverty, health, productivity and other multiple benefits as hard rather than soft facts? And how does policy making consider one of the persistent barriers to energy efficiency in buildings – real decision making of actors that affects the building stock, its underlying energy system and their operation?

Panel 7 has received numerous papers addressing the need to take more and better action towards a sustainable pathway for EU buildings. In particular, the contributions address the following issues:

- Deep retrofit approaches and policies supporting the deployment of renewable energies in existing buildings
- Energy sufficiency and policies addressing consumption and investment behaviour
- The role of intermediaries in energy efficiency improvements in buildings
- Co-benefits and innovative financing mechanisms
- Energy poverty and social aspects
- Challenges in data collection and assessment

Deep retrofit approaches and policies supporting the deployment of energy efficiency and renewable energies in existing buildings

Deep retrofit approaches range between one off action lasting just a few days or it can be a staged process that stretches over several years. All those approaches have their pros and cons and specific context where they should be applied. Fawcett & Topouzi (7-162-19) take a specific look at the time dimension of deep retrofits. Their analyses end with suggestions how future policy design could respond to different time dimensions of deep renovation.

Two papers highlight the importance of staged renovations for building retrofit in the EU and address the question how these can be made deep. Fritz et al. (7-242-19) explore the role of the building renovation passport to help making staged renovations deep. Through an economic assessment comparing one-step renovation and staged approaches they find that the one-step renovations lead to higher energy savings over time, while the total cost is lower in the stepwise renovation due to

coupling of the renovation measures to the maintenance and repair work required. Maia & Kranzl (7-289-19) develop common step-by-step renovation sequences for different reference buildings and analyse their impact by upscaling the exemplary step-by-step renovation sequences to the German building stock. Considering the path until 2050, the paper finds, that depending on the construction year, step-by-step renovations may lead to higher energy savings than one-step renovations.

Topouzi et al. (7-349-19) consider a variety of renovation approaches including 'whole house', 'fabric-first', 'room-by-room', 'step-by-step' and 'measure-by-measure' and provide a structured analysis of different risks associated with those approaches. The paper concludes that, while risk management is required for all retrofit approaches, process risks are significantly greater for all retrofit paths other than the 'whole house' approach.

Volt & Steuwer (7-245-19) explore the role of industrialized renovation for scaling up deep energy renovations. By scrutinising the existing business models and the regulatory and financial framework conditions in France, The Netherlands and The United Kingdom, key success factors for replicating the approach in Germany are discussed.

Tigchelaar et al. (7-062-19) focus on the transition of the Dutch building sector, following the decision of the Dutch government to end natural gas extraction at the Groningen gas field in order to limit the danger posed by earthquakes. The paper look into the natural gas free concepts that are being discussed, the supporting policies and the costs and benefits both for society as a whole and for individual households.

Pehnt et al. (7-079-19) explore the mechanisms and impacts of regulatory obligations for the installation of renewable heating technologies in existing buildings, drawing upon the evaluation of the Renewable Heating Act of Baden-Württemberg (Germany). Based on statistical analyses of the available verifications, market observations, interviews with 1,000 clients, 150 heating installers, 250 chimney sweepers, 50 building companies, clients of energy audits and various stakeholder workshops and interviews, the direct and indirect impacts of the law are estimated and recommendations for improvements are developed.

Deep retrofits don't stop at the level of individual buildings. Weyl & Burrows (7-321-19) present the Building Efficiency Accelerator (BEA) partnership that facilitates city building efficiency action as a joint effort of policy and private markets. So far approximately 40 cities or subnational governments and another 40 commercial market players participate. Each city commits to implement at least one building efficiency policy, one demonstration project, and to track their progress. Recently the BEA partnership started to bring city commitments to the level of zero carbon buildings (ZCBs) by 2050 and the authors discuss insights they derive from real-world projects on how to increase city action towards ZCB level.

Janssens (7-267-19) provides a detailed analysis of the impact of retrofit rates for windows and in particular their glazing on energy consumption in the EU. Based on an assessment of the EU current building and window renovation rates, the author develops four different scenarios for the EU-28 to assess the maximum/theoretical savings potential of glazing (in 2030 and 2050) and the impact of doubling the EU building renovation rate between 2020 and 2030.

Hirzel et al. (7-334-19) investigate how energy efficiency of lifts is currently addressed by European policy-making and discuss how policy options on lifts might contribute to achieving energy savings for these installations. Based on an analysis using a quantitative stock model for lifts, different policy scenarios are discussed to analyse their potential impact on the energy consumption of lifts. The results indicate the energy consumption of the lifts currently in operation in the EU-28 could be reduced from 18.9 TWh per year to 10.4 TWh until 2050. The paper discusses policy options such as the inclusion of lifts in the list of technical equipment in the next revision of the EPBD, further investigating on implementing measures within the Ecodesign process and by considering a European energy label for lifts.

Energy sufficiency and policies addressing consumption and investment behaviour

Bold policies need to find ways to drastically reduce the absolute amount of emissions. Obviously, this is getting harder when in parallel demand for services grows, as it counteracts the necessity for absolute reductions. Therefore, policy approaches that look at sufficiency, i.e. reducing demand for energy services or at least at avoiding their further increase, are an option that has been looked at rather rarely recently. Yet several papers emphasize the potential of efficiency as a policy option for target achievement.

Based on the question "How much space and equipment is needed for a decent living, and how much is too much?", Bierwirth & Thomas (7-007-19) propose ways to estimate the sufficiency potential and related energy savings in Europe's residential buildings. They do not only look at floor area per capita but widen their scope to also include sufficiency aspects that can be included during design and construction, during use and relative to appliances. Subsequently they discuss what their insights could mean for policy making.

Kenkmann et al. (7-147-19) specifically look at ways to reduce the forecasted continuous growth of residential floor area per capita in Germany. They identify retirees and households soon reaching retirement age as being amongst the most promising household types. To provide practical policy advice they continue with assessing barriers of these target groups to reduce their living space and which aspects could make such change attractive. This allows them to not just estimate a theoretical sufficiency potential but also estimate what may be feasible in practice. A set of novel policy instruments is proposed and discussed to further exploit this specific potential for sufficiency.

The paper of Fischer & Stieß (7-355-19) complements the previous analysis by specifically looking at alternative housing options for senior homeowners and their tendency to remain in their home even if the "nest" which was originally designed for a whole family with children is empty. Relocation and densification turn out to be the most relevant housing options for these "empty nesters". Results of a survey are presented, which assessed the attitude and acceptance of these options for the target group. Insights are fed into the design of an intervention which seeks to gain practical experience on real-life implementation of these options.

Moving from Europe or Germany to Pakistan, Khalid & Sunikka-Blank (7-027-19) apply socio-technical theory to find out about the influence individual building or district setups

and layouts have on daily practices that imply energy use. By means of time use diaries in different housing arrangements their assumption is confirmed that the built environment acts as a mediator of energy consuming behaviour. Thus sufficiency can also be promoted by a better understanding of policy makers about the relation between built environment and energy using behaviour.

Schwarz & Knoeri (7-136-19) investigate how policies influence the decision-making process for low-e glazing, comfort ventilation, and heat pumps in Switzerland. They conduct a quantitative analysis of how policies can effectively target decision makers for these technologies using an agent-based model that represents Switzerland's building sector. By comparing the impact of different combinations of policy instruments on the diffusion of the three focal technologies quantitatively, they provide a differentiated picture of how different policy instrument triggered the adoption of these technologies.

Gilani et al. (7-138-19) present an extended abstract where they present the case of luxury "green" homes in India that feature very high per capita space floor. They investigate whether it's merely building codes or also lack of awareness or social norms on sufficiency that foster this kind of buildings which deepens the absolute efficiency gap between target levels and built reality.

Bernabe and Galarraga (7-222-19) investigate energy decisions in heating consumption by organizing three focus groups in Spain to study which are the main factors that determine households' heating expenditure. The paper provides insights into the determinants of the energy consumption (and thus expenditure) for heating and the role of policies to support sustainable and eco-friendly heating behaviour. They find that, while economic variables such as energy price and income of households play a leading role, other variables related to the physical attributes of houses, lifestyle factors and education are of key importance to reduce energy demand.

The role of intermediaries in energy efficiency improvements in buildings

Since most house owners are laypeople in retrofitting, they consult intermediaries for planning the energy efficient retrofit. By means of a conjoint analysis Arning et al. (7-065-19) investigate the relative impact of these intermediaries on retrofit decision-making in private households compared to other commonly known drivers and barriers for such decisions. It turns out that recommendations of those intermediaries may even have a higher impact on decision making than upfront investment cost. Policy interventions should therefore target this stakeholder group to increase retrofit rates and depth in the residential sector.

Maby (7-235-19) focus on the role of contractors as key market actors having a high potential to influence costumers that plan to conduct retrofit measures and could potentially be the frontline in communicating, selling and implementing energy improvements. By carrying out semi-structured interviews, the paper develops a better understanding of standard practice within the local supply chain in relation to home energy improvements, as a basis for seeking solutions to some of the barriers that exist.

Co-benefits and innovative financing mechanisms

Still, lack of financing mechanisms that specifically address some of the prevalent barriers around exploitation of energy efficiency potentials as well as non-consideration of co-benefits of energy efficiency, hamper energy efficiency uptake in a dimension that ought to happen from a pure micro- or macro-economic perspective, respectively. Several papers address these issues in the building policies panel.

Bertoldi et al. (7-302-19) provide an overview and review of "traditional" financing options for building retrofits but also do the same for rather innovative and recently developed financing options. The applicability of the different financing instruments is analysed in relation to single vs multifamily buildings and also in relation to owned properties versus rented properties. Their paper offers an assessment of the characteristics, benefits and challenges of each of the analysed financing mechanisms and concludes with policy recommendations for their implementation.

Bulut et al. (7-202-19) discuss green leases as an innovative mechanism to overcome the split incentive problem, being one of the primary barriers that prevent cost-effective energy efficiency retrofits in the commercial sector. The contribution provides an overview of the use of green leases for commercial buildings in Sweden and presents a pilot project undertaken by the Swedish Energy Agency.

Moving on to co-benefits, it is often forgotten that buildings and their quality are a major determinant of occupants' health, specifically in industrialised countries where people spend by far most of their time indoors. Dorizas et al. (7-143-19) stress that indoor environmental quality (IEQ) has a direct effect on health, comfort, wellbeing and productivity, and it is therefore crucial that building legislation ensures sufficient levels of IEQ. Typically, this type of legislation will be introduced at national level. The paper identifies four areas of opportunities to achieve that: (i) long-term renovation strategies, (ii) energy performance certificates (EPC), (iii) smart readiness indicator, and (iv) compliance and quality control measures.

Energy poverty and social aspects

A major co-benefit of energy efficiency is that it may mitigate energy poverty and also provide further societal benefits. It is therefore a major step ahead that, e.g., energy poverty must be addressed in EU Member States' long-term renovation strategies. Two papers specifically put energy poverty in their centre.

Filippidou et al. (7-087-19) provide a general overview on the state of the art of discussing energy poverty in EU energy efficiency policy. It turns out that even the starting point of finding a consensus on a common definition is a challenge with the negative effect of hampering policy action against energy poverty. Yet it is common sense that energy poverty primarily has its root in both low household income and energy inefficient dwellings. Apart from discussing the issue, the authors also provide an overview on where in the recent EU "Clean Energy package" energy poverty is addressed, and they discuss ways to monitor and measure energy poverty and, last but not least, the role of energy efficiency interventions at household level as an energy poverty mitigation instrument.

Steuwer et al. (7-197-19) based on a broad literature review and stakeholder dialogue shed light on the beneficial health ef-

fects of energy renovation for low-income households which have been largely ignored by the German government so far in their policy making towards 2050 targets. Therefore, the authors propose the introduction of minimum energy efficiency standards for rental buildings to untap this potential. Ideas for designing minimum energy standards for rental buildings are further developed based on lessons-learnt from country case studies, especially FR, UK, NL, Flanders.

Carbon taxes recently have received high attention as a potential policy instrument for combating climate change but also with a view to their distributional impact. In France the instrument has been in place since 2014. Bourgeois et al. (7-376-19) analyse which of two ways to redistribute carbon tax on household energy expenditures for space heating is superior relative to social fairness and economic effectiveness. The first way is an annual lump sum payment to all households in the lowest two income quintiles, while the second is a savings' dependent energy renovation subsidy for homeowners within the same income group. From their simulations energy renovation subsidies turn out to be the superior solution as they effectively mitigate energy poverty and achieve higher energy savings.

Challenges in data collection and assessment

Two papers address the challenges in developing a consistent and reliable methodology for assessing the energy performance of buildings in the context of energy performance certification (EPC). Semple & Jenkins (7-125-19) discuss the methods used to generate EPCs in the six largest European countries and describe how they vary across countries, regions and buildings. The paper highlights the considerable differences and discusses the associated challenges for energy policies based on EPC. Raynaud et al. (7-121-19) provide a detailed analysis of the energy performance assessment for the French EPC. Using an uncertainty propagation (Monte-Carlo method) and a sensitivity analysis, they show that the results of the assessment show large variations depending on the input parameters and calculation approach.

While residential building stocks are comparatively well monitored – although not at all at the level desired for adequate policy making – the stock of non-residential buildings is virtually unknown. Hörner et al. (7-074-19) present an ongoing German study, where an innovative sampling approach based on geospatial data has been applied to collect information on a representative sample of non-residential buildings. By means of thousands of telephone interviews information is retrieved to learn more about building envelopes and technical installations and refurbishment rates.

Kachhawa et al. (7-252-19) highlight the importance of the availability of data on building characteristics such as type of occupancy, built floor area, and associated energy consumption for formulating evidence-based policies. The paper focuses on collecting data with regard to the cooling demand in India, where the rapid growth in population along with rising purchasing power leads to growth in floor space, electricity consumption and appliance penetration, specifically for air-conditioners. Based on a thorough investigation of existing literature along with structured interviews with experts and professionals, the paper provides detailed information on the residential sector floor area, electricity consumption, number of households with room air-conditioner and room air-conditioner penetration.

Ben & Steemers (7-382-19) assess a more tailor-made version of energy performance certificates in order to boost uptake of energy efficiency renovations in the UK. Specifically, they aim for more personalized recommendations for renovation measures, which would not just be derived from building characteristics, but also online to be made inputs on household characteristics and energy use behaviour.