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Citation for the original published paper (version of record):
van der Leer, J., Femenias, P., Granath, K. (2025). Implementing minimum energy performance requirements ‘from the middle’: shifting levels of
agency and capacity of housing developers in Sweden. Energy Policy, 208.
http://dx.doi.org/10.1016/j.enpol.2025.114901

Energy Policy 208 (2026) 114901

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Implementing minimum energy performance requirements ‘from the middle’: shifting levels of agency and capacity of housing developers in Sweden

Janneke van der Leer *, Paula Femenias, Kaj Granath

Chalmers University of Technology, Department of Architecture and Civil Engineering, SE-412 96, Gothenburg, Sweden

ARTICLE INFO

Keywords:
Energy performance of buildings directive
Implementation
Housing developers
Middle-out perspective
Minimum energy performance requirements
Energy performance certificates

ABSTRACT

Minimum energy performance requirements (MEPR) for new buildings are a key policy instrument to achieve climate targets and have been part of the EU’s Energy Performance of Buildings Directive (EPBD) since 2002. This study provides a novel longitudinal approach, following seven housing developers in Gothenburg, Sweden, and examining their engagement with MEPR implementation in newly built multi-family buildings across the design, construction, and use phases. Drawing on the middle-out perspective, it explores the agency and capacity of developers over time, offering insight into how motivations, priorities, and capabilities affect MEPR compliance. Energy performance data are combined with two rounds of developer interviews (2012 and 2021/2022) and planning documents to compare calculated and actual performance and to understand developer perspectives. Findings reveal that developer agency and capacity decline over time, particularly for those building to sell, and that meeting MEPRs requires not only local government enforcement but also active engagement from residents and energy managers. Based on these insights, four policy recommendations are proposed: (1) verify calculated and measured energy performance using high-resolution or smart meter data, (2) clarify responsibilities across national and local levels, integrating MEPR verification into mandatory inspections and post-occupancy monitoring, (3) strengthen operational energy management by extending accountability and promoting post-occupancy feedback, and (4) improve energy performance certificate (EPC) reliability through standardised, measurement-based methodologies to support compliance, evaluation, and user engagement.

1. Introduction

The building sector accounts for approximately 40 % of the EU’s final energy use and 34 % of its energy-related greenhouse gas emissions (Economidou et al., 2020; EEA, 2024). Improving the energy performance of buildings is therefore central to achieving climate targets. The Energy Performance of Buildings Directive (EPBD), first introduced in 2002 with recasts in 2010, 2018, and 2024, is the EU’s primary policy tool for this purpose. The EPBD requires member states to set and enforce Minimum Energy Performance Requirements (MEPRs) for new buildings. According to the 2024 recast of the EPBD, all new buildings must be zero-emission buildings by 2030 (European Union, 2024). The directive defines these as buildings with “a very high energy performance […], requiring zero or a very low amount of energy, producing zero on-site carbon emissions from fossil fuels and producing zero or a very low amount of operational greenhouse gas emissions” (European Union, 2024, p. 48).

Despite this common EU framework, MEPR implementation varies widely between member states, particularly regarding metrics and enforcement procedures (Allard et al., 2021; Evans et al., 2017; Olasolo-Alonso et al., 2023). Olasolo-Alonso et al. (2023) emphasise that many countries still face challenges in ensuring effective implementation and highlight the need for consistent requirements and mandatory compliance. A key aspect of this process is verification, which is essential to guarantee accurate performance evaluations and appropriate recommendations (Gonzalez-Caceres et al., 2020). The effectiveness of MEPRs depends not only on their stringency but also on monitoring, verification, and enforcement throughout a building’s life cycle (Fawcett and Topouzi, 2021; Thomas and Rosenow, 2020). Accordingly, previous studies underscore the need for more systematic policy monitoring and evaluation to understand how MEPRs for new buildings are implemented in practice (Evans et al., 2017; Fawcett and Topouzi,

* Corresponding author.
E-mail addresses: janneke.vanderleer@chalmers.se (J. van der Leer), paula.femenias@chalmers.se (P. Femenias), kaj.granath@chalmers.se (K. Granath).

https://doi.org/10.1016/j.enpol.2025.114901
Received 20 June 2024; Received in revised form 16 September 2025; Accepted 17 September 2025
Available online 20 September 2025

2021).

Developers play a central role in MEPR implementation, as they make design, technology, and procurement decisions during the development phase that influence the energy performance of the building (Candel and Törnå, 2021; Forde et al., 2021; Shaw and Ozaki, 2015; Shrubsole et al., 2019; Simpson et al., 2020). Developers' core priorities, such as cost control, speed of delivery, and maintenance simplicity, can sometimes conflict with MEPR implementation (Martiskainen and Kivimaa, 2019; Shaw and Ozaki, 2015). Financial considerations are particularly influential: when higher requirements are perceived as threatening profitability, developers may seek to negotiate requirements down (Candel and Törnå, 2021; Storbjörk et al., 2018). Split incentives can further weaken motivation to exceed MEPR, as operational savings often benefit future occupants or housing owners rather than the developer in cases where the developer builds to sell (Agarwal et al., 2024). However, developers are more inclined to invest in sustainable construction solutions when they will operate the building themselves because long-term benefits like lower energy use and reduced maintenance costs accrue directly to them (Agarwal et al., 2024; Candel and Törnå, 2021; Shrubsole et al., 2019).

Sustained compliance requires policies that reflect these priorities and constraints (Shaw and Ozaki, 2016). Feedback loops from middle actors to top-level actors – ranging from designers, builders, and suppliers to policymakers – are essential to ensure that performance is not only achieved at handover but also maintained throughout the building's lifespan (Fawcett and Topouzi, 2021). Despite this central influence, the long-term effects of developer priorities and constraints on MEPR implementation remain underexplored.

Previous research has primarily examined developer experiences during the design and construction stages, offering limited insight into how developers engage with requirements across both the design phase and the operational life of the building (Candel and Törnå, 2021; Martiskainen and Kivimaa, 2018; Smedby, 2016). Addressing this gap, this paper presents a longitudinal case study of seven housing developers in Gothenburg, Sweden, and their implementation of MEPRs in an urban development project developed between 2002 and 2019. Sweden provides an interesting and policy-relevant context: it has fully implemented the EPBD since 2014, with MEPRs in place since 2006, and the energy performance certification (EPC) system is based primarily on measured data. In Sweden, MEPRs are defined in the national building code and vary according to building type. MEPR is expressed as a primary energy number (kWh/m^2 per year), where energy for heating has been adjusted with a geographical correction factor, multiplied by a weighting factor for energy carriers, and divided by the heated floor area. It includes energy used for heating, comfort cooling, hot tap water and property-related electricity, but excludes household electricity use. The current MEPR for multi-family buildings, outlined in the national building regulations of Sweden (BBR31) and measured by the primary energy number, is 75 kWh/m^2 per year. Developers are directly responsible for demonstrating compliance through design-stage energy calculations to obtain building permits and ensuring an EPC is issued within two years of occupancy (Boverket, 2023). EPCs are issued by certified independent experts following on-site evaluations. EPCs use energy performance classes from A to G, with Class C corresponding to the current MEPR for new buildings and each class representing a percentage deviation from Class C (see Table 1). This framework allows for systematic assessment of compliance outcomes using actual performance data, making it possible to evaluate both regulatory effectiveness and developers' experiences.

By combining EPC data from newly built multi-family buildings with two rounds of interviews, this study examines how housing developers' motivations, priorities, and capabilities influenced MEPR implementation. It provides longitudinal evidence of developer engagement with MEPRs from design through operation, revealing how developers can both enable and constrain MEPR implementation. Using the middle-out perspective as an analytical framework (Janda and Parag, 2013; Parag and Janda, 2014), the analysis shows how developer actions mediate between top-down policy requirements and bottom-up operational realities. The middle-out perspective is particularly suitable because housing developers are positioned between policymakers, owner-occupiers, tenants, and other middle actors, giving them the agency and capacity to influence MEPR implementation across multiple levels and project phases. The findings offer new insights into EPBD implementation, particularly regarding monitoring, enforcement, and aligning developer incentives with long-term energy performance goals.

The paper is structured as follows. In Section 2, the analytical framework is given. In Section 3, the methodology used in this paper is presented, and in Section 4, the results are provided. Finally, Section 5 discusses the results, and Section 6 presents the conclusions, policy implications and limitations of this study.

Table 1
Energy performance classes used in the Swedish EPC framework (Boverket, 2023).

Energy performance class	Energy performance is
A	≤50 % of the current MEPR for new buildings
B	>50 % - ≤ 75 % of the current MEPR for new buildings
C	>75 % - ≤ 100 % of the current MEPR for new buildings
D	>100 % - ≤ 135 % of the current MEPR for new buildings
E	>135 % - ≤ 180 % of the current MEPR for new buildings
F	>180 % - ≤ 235 % of the current MEPR for new buildings
G	>235 % of the current MEPR for new buildings

2. The middle-out perspective as an analytical framework

The middle-out perspective is a relatively new analytical framework in energy studies and introduces middle actors as the enablers of energy transitions, positioned between the actors at the top and the bottom (Janda and Parag, 2013; Parag and Janda, 2014). The middle-out perspective is an additional way to deliver change, in addition to top-down and bottom-up efforts. Top actors, e.g., policymakers, influence downwards; bottom actors, e.g., tenants, can influence upwards, and middle actors can influence upwards, downwards, and sideways within and across their networks (Simpson et al., 2020). According to Parag and Janda (2014), the exact definition of middle actors depends on the context, but middle actors can be individual actors as well as groups, organisations, institutions, or other relevant entities. Examples of middle actors in the building sector include architects, consultants, project managers, constructors, developers, energy advisors, and facility managers (Goulden and Spence, 2015; Janda et al., 2019; Janda and Parag, 2013; Reindl, 2020; Simpson et al., 2020). Janda and Parag (2013) describe that middle actors have three different modes or functions to influence other actors: enabling, mediating, and aggregating. Through their middle position, middle actors can, for example, facilitate technology adoption, mediate policy goals, bundle technical opportunities, decide in the planning and design phase which energy measures will be implemented, and encourage and promote action (Parag et al., 2017; Parag and Janda, 2014; Reindl, 2020). The unique position in the middle enables middle actors to "use their knowledge of the context of bottom actors to influence the actions of top actors, and the other way around" and to influence other middle actors in formalised networks or random connections (Eriksson and Olsson, 2022, p. 1709).

The middle-out perspective advocates that actions and changes, such as implementing the MEPR, are determined by the middle actor's level of agency and capacity (Zohar et al., 2021). The conceptualisation of agency and capacity in the middle-out perspective is developed based on elements and variables from the sociological and psychological concepts of behaviour (e.g., structure, internal and external motivations) and organisation studies (e.g., organisational concern and condition) (Parag et al., 2017).

2.1. Agency and capacity

Agency can be described as the actors' willingness, motivation, and interest to act in a specific way (Parag and Janda, 2014), to enact behaviour, or make things happen (Murtagh and Sergeeva, 2021). The level of agency is "influenced, embedded in, and shaped by social norms, culture, social order, regulation, and standard practices" (Zohar et al., 2021, p. 2). Capacity can be understood as the capability or ability of actors to act according to their choices or desired actions (Parag and Janda, 2014; Reindl, 2020; Zohar et al., 2021). In other words, the level of capacity indicates the ability to make or influence decisions (Gallent and Robinson, 2022). The agency and capacity of actors are interrelated and influenced by technical, institutional, financial, political, social, and psychological factors (Janda and Parag, 2013; Parag et al., 2017; Parag and Janda, 2014). Factors that influence the levels of agency and capacity are either external to the actor, such as "physical and technical constraints, existing infrastructure, and available technologies", or internal to the actor, such as "financial status, knowledge, and expertise" (Zohar et al., 2021, p. 2). Understanding the factors that influence the levels of agency and capacity could help to find ways to empower middle actors to enable change or action (Parag and Janda, 2014). Previous reviews on drivers and barriers for sustainable or energy-efficient buildings also distinguish between internal and external drivers or barriers (Carlander and Thollander, 2022, 2023; Darko et al., 2017).

The middle-out perspective indicates that change and action of actors are most likely when both agency and capacity are high (Parag et al., 2017; Parag and Janda, 2014; Reindl, 2020) – in other words, when actors are motivated to act (agency) and have the means to do so (capacity). Janda et al. (2019, p. 203) note that this perspective often assumes that middle actors are "normative actors working toward achieving a 'good' and common goal, like mitigating climate change". However, middle actors are not necessarily "devoted to making positive environmental change"; their agendas may conflict with broader societal goals (Parag and Janda, 2010). Existing research rarely examines changes in agency and capacity over extended periods, limiting understanding of how these evolve and the long-term effectiveness of middle-actor actions (Janda et al., 2019). This study addresses that gap by tracing housing developers' agency and capacity between 2012 and 2022, offering new insights into the implementation of energy policies.

2.2. Developers as middle actors

In this paper, the focus is on housing developers as middle actors. Previous studies have identified developers as middle actors in developing and implementing energy-efficient buildings (Fawcett and Topouzi, 2021; Janda et al., 2019; Martiskainen and Kivimaa, 2018; Simpson et al., 2020). These studies found that developers determine the development of energy-efficient buildings through their choice of different construction methods, through collaboration with other middle actors, through life cycle approaches that consider sustainability, carbon, and costs (Simpson et al., 2020), and through their capacity to manage construction projects (Martiskainen and Kivimaa, 2018). Developers as middle actors can also disseminate learning from finished projects to other actors (Martiskainen and Kivimaa, 2018). In their overview of previous studies using the middle-out perspective, Janda et al. (2019) situated developers in the middle between policy makers (upwards), customers (downwards), and other developers (sideways).

Developers are often treated as a homogeneous group, but several studies have shown that they differ significantly in their motives, approaches, and strategies (Hedborg and Rosander, 2023; Meijer and Buitelaar, 2023). In the Swedish context, a common distinction is made between three main types of developers: those who build to use, those who build to manage, and those who build to sell, and they can be private or public. While this categorisation may not be unique to Sweden, it reflects a nationally specific way of conceptualising developer roles that may differ from distinctions used in other countries. In some cases, organisations separate the function of developing new buildings from the long-term management of their property portfolios (Haugbølle and Boyd, 2017), adding further complexity to their internal structure. In addition to these more traditional developers, building communities where future residents collectively develop housing for their own use have become increasingly common in Sweden in recent years. However, they still represent a small share of the total housing stock.

3. Methodology

3.1. Case study

This study follows a single case study research design. Lowe et al. (2018) suggest using case study research to evaluate and assess building energy performance, emphasising the importance of considering the interactions between social and technical factors. This approach enables a deeper understanding of the roles of agency and the actors' responsibility. A case study helps to capture the contextual complexity in understanding the actual energy performance of buildings (Lowe et al., 2018) by combining different types of data to strengthen the validity of interpretations.

The selected case is the urban development project of Kvillebäcken, a brownfield area of 11.5 ha developed between 2002 and 2019 in Gothenburg, Sweden. The case was chosen based on information-oriented selection, a strategy in which cases are selected because they are expected to provide rich and relevant insights into the phenomenon of interest (Flyvbjerg, 2006). For several reasons, Kvillebäcken is an instructive case for understanding the MEPR implementation by housing developers in newly built multi-family buildings. Firstly, it was one of the first sustainable urban development projects in Sweden (van der Leer et al., 2023), applying a stricter MEPR (specific energy use of 60 kWh/m^2 per year) than the national building code at the time of development (90 kWh/m^2 per year) (Hagbert and Femenias, 2015). This makes Kvillebäcken an interesting example for assessing the implementation of a stricter MEPR for new buildings. Secondly, the project involved three different types of developers, allowing comparison across developer categories. Thirdly, as the project was completed in 2019, the EPCs of all buildings were available to verify actual energy performance and could be discussed with the housing developers who still had the project relatively fresh in their memory. Fourthly, building on interviews conducted during the development phase (2012), a new round of interviews in the use phase (2021/2022) enabled a longitudinal perspective.

3.2. Data collection and analysis

The case study combines energy data, interviews with housing developers and document analysis to develop a longitudinal understanding of the implementation of MEPR in the 21 properties in Kvillebäcken. The empirical material includes ten energy performance calculations submitted by the developers during the building permit application process, 21 EPCs, two rounds of interviews with housing developers (2012 and 2021/2022) and four planning documents. This combination of data sources enables an analysis of how MEPRs have been interpreted and operationalised over time. An overview of the data collection methods and the analysed planning documents, presented along a timeline, is provided in Fig. 1.

3.2.1. Energy data analysis

The energy data analysis combines energy performance calculations from the design stage with data from EPCs. The performance calculations, submitted between 2010 and 2014 as part of the building permit process, were retrieved from the local government's archive and were

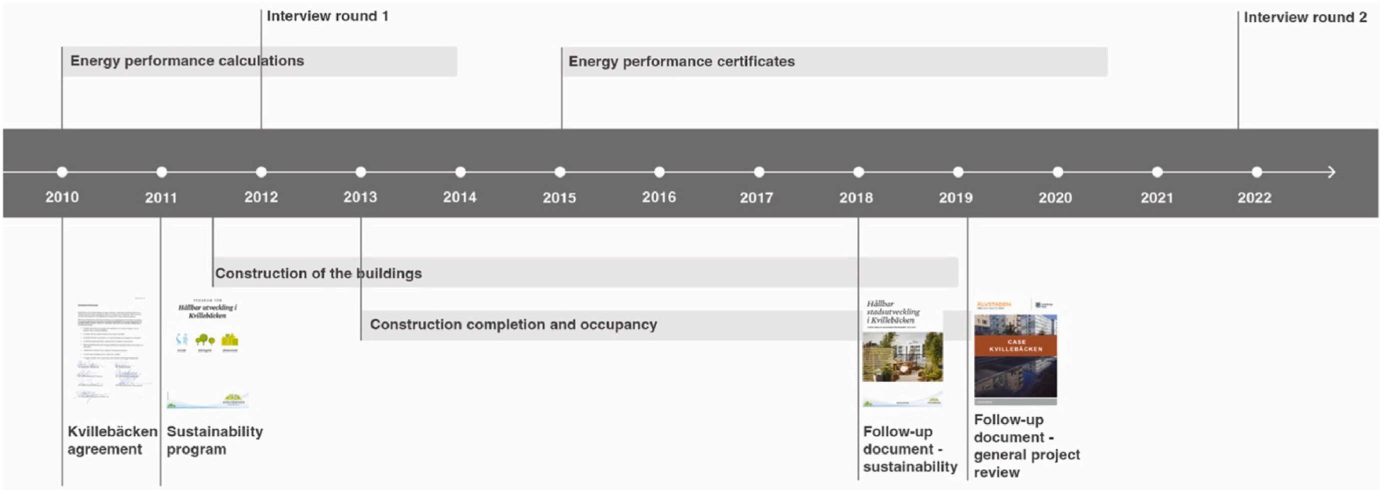

Fig. 1. Timeline with the data collection methods on the top and the analysed planning documents and construction and use phase on the bottom.

available for ten properties. EPC data were available for all 21 properties included in the case study. Of these, nine properties had EPCs issued before 2019, and thirteen had EPCs issued after 2019. One property had EPCs from both periods, but only the most recent EPCs were used in the analysis. For properties consisting of several buildings, each with a separate EPC, the average specific energy use across buildings was calculated to represent the property.

Because the Swedish EPC framework introduced new parameters in 2019, energy performance has been measured using different methods over time: specific energy use until 2018 and the primary energy number thereafter (see Section 1). To ensure comparability across the dataset, all EPC values were converted to specific energy use, following previous research (Li, 2025). EPCs issued after 2019 were recalculated accordingly.

To allow for consistent assessment of building performance, energy performance classes were reinterpreted based on specific energy use relative to 60 kWh/m^2 per year, the stricter MEPR applied in Kvillebäcken. Each property was assigned to a class representing a percentage deviation from this reference, similar to the standard EPC A-G framework (see Table 1). This approach ensures comparability across properties and EPCs issued in different years, despite changes in the methods and reference values over time.

3.2.2. Document analysis

Document analysis has been used to understand the context of the planning process and the MEPR implementation over time. The documents included in the analysis are the Kvillebäcken agreement (Norra Älvstranden Utveckling, 2010), the sustainability program (Miljögruppen Kvillebäcken, 2011) and two follow-up documents, one general project review (Göteborgs Stad, 2019) and one focused specifically on sustainability (Miljögruppen Kvillebäcken, 2018) (see Fig. 1). These documents provide insights into the overarching visions and goals for Kvillebäcken, the agreements between the local government and developers, and the formal processes for follow-up and evaluation.

3.2.3. Interviews

Two rounds of interviews were conducted with representatives from all seven housing developers involved in the Kvillebäcken case, enabling a longitudinal understanding of the implementation process (see Table 2). The first round took place during the construction phase, between April and September 2012. A total of 13 interviews were conducted with project managers, development managers and sustainability managers responsible for the design and construction of the buildings. A thematic interview guide was used, focusing on formulating, communicating, understanding, implementing, and following the sustainability requirements, including the MEPR. The second round of interviews was conducted between November 2021 and August 2022. Identifying suitable representatives at this stage proved more challenging, given the project-based nature of the construction industry and high staff turnover. Many individuals involved in the first round were no longer reachable or expressed limited interest in discussing past projects, especially focusing on energy performance evaluations. As a result, one interview was conducted asynchronously via e-mail (interview 20 in Table 2), at the participant's request, and

Table 2
Overview of the 20 interviews with representatives of the seven housing developers in 2012 and 2021/2022.

Interviews with the seven housing developers		
The seven housing developers	2012: 13 interviews (27–80 min)	2021/2022: 7 interviews (15–60 min)
D1m, developer who builds to manage	Interview 1: Project manager Interview 2: Development manager1.	Interview 14 (joint): Project manager and operational engineer
D2m, developer who builds to manage	Interview 3: Project manager	Interview 15 (joint): Energy manager and operational engineer
D3ms, developer who builds to manage and to sell	Interview 4: Project manager	Interview 16 (joint): Project manager and CEO
D4s, developer who builds to sell	Interview 5: Project manager Interview 6: Development manager	Interview 17: Project manager
D5s, developer who builds to sell	Interview 7: Project manager Interview 8: Sustainability manager	Interview 18: Technical manager
D6s, developer who builds to sell	Interview 9: Sustainability manager Interview 10: Development manager2. Interview 11: Project manager3.	Interview 19: Project manager
D7s, developer who builds to sell	Interview 12: Project manager Interview 13: Development manager4.	Interview 20: Project manager (e-mail conversation)

interview lengths varied. For three developers, the interview involved the same individual as in the first round (D1m, D3ms and D6s). A thematic interview guide was again used, focusing on developers' approaches to the sustainability requirements and MEPR, reflections on the actual energy performance of the Kvillebäcken buildings (informed by the energy data analysis), and lessons learned from the development process.

The interviews were in Swedish and audio-recorded and transcribed, except for one interview, which was documented in notes (interview 16 in Table 2), and one response was collected via e-mail conversation (interview 20 in Table 2). Following Braun and Clarke's (2006) six-phase model, a theory-driven thematic analysis was conducted, which offers a flexible method for analysing qualitative data. This approach was well-suited to exploring housing developers' experiences, perspectives, and values related to implementing the MEPR. The analysis was guided by the middle-out perspective. This framework helped examine how developers are positioned between top, middle and bottom actors, and how their ability to act is shaped by both internal and external factors (Janda et al., 2019). A deductive approach was used, where codes and themes were informed by the analytical framework, while remaining open to patterns emerging from the data. NVivo software (Lumivero, 2024) was used for the coding process. The six phases included: (1) familiarisation with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report (Braun and Clarke, 2006). Coding focused on dimensions of agency and capacity, differences in developer types, and project phases (development and use). Thematic development (phases 4–5) resulted in different key themes discussed in Section 4.

4. Results

This section presents the analysis of the MEPR implementation over time for the newly built multi-family buildings in Kvillebäcken. Firstly, the energy performance analysis of the 21 residential properties is presented. Section 4.2 discusses the agency and capacity of the housing developers during the development phase, while Section 4.3 addresses their agency and capacity in the use phase.

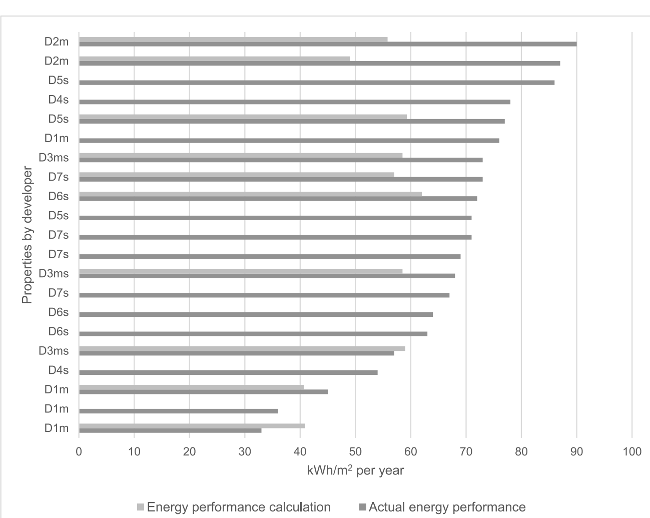

Fig. 2. Energy performance according to the calculations (light grey) and the actual energy performance (dark grey) of the 21 properties in Kvillebäcken, expressed as specific energy use in kWh/m^2 per year, analysis adapted from van der Leer et al. (2022).

4.1. Energy performance of the multi-family buildings in Kvillebäcken

The energy performance of the buildings in Kvillebäcken varies between 33 kWh/m^2 and 90 kWh/m^2 per year (see Fig. 2). Only 24 % (5 of 21) of the residential properties in Kvillebäcken meet the stricter MEPR of 60 kWh/m^2 per year (van der Leer et al., 2022). The ten initial energy performance calculations during the design stage indicated a specific energy use between 41 and 62 kWh/m^2 per year (van der Leer et al., 2022). As it was a prerequisite for obtaining a building permit, it can be assumed that the remaining multi-family buildings had a calculated energy performance of around 60 kWh/m^2 per year or less. However, only two properties achieved the calculated energy performance, and the other eight showed an energy performance gap between the predicted calculated energy use and the actual energy use in the EPCs, ranging from 11 % to 77 % (van der Leer et al., 2022). The average energy performance gap among the ten properties with available energy performance calculations was 33 % (van der Leer et al., 2022).

Although the buildings did not all meet the stricter Kvillebäcken specific MEPR, all complied with the national MEPR in force at the time, which required a specific energy use of 90 kWh/m^2 per year. The energy performance classes of the 21 residential properties in Kvillebäcken relative to a reference value of 60 kWh/m^2 per year are given in Fig. 3.

4.2. Levels of agency and capacity of the developers to implement the MEPR

Analysis of the developer interviews showed that their agency and capacity to implement and meet the MEPR of 60 kWh/m^2 per year were shaped by internal factors and external influences from other actors in the system (Janda et al., 2019). In the development phase, the agency and capacity of the developers to meet the MEPR are relatively high for all developers (see Fig. 4).

The high levels of agency are mainly influenced by other middle actors (other developers, consultants, and contractors) and by top actors (the local government and the Swedish National Board of Housing, Building and Planning (Boverket)) (see Fig. 5). In the use phase, the agency of both developer groups is lower than in the development phase, as is the capacity of the developers who build to sell. This is primarily influenced by top actors and bottom actors.

4.3. Agency and capacity in the development phase

In the development phase, all housing developers experience a relatively high agency and capacity to implement the MEPR of 60 kWh/m^2 per year. Their agency in the development phase was strongly shaped by the Kvillebäcken agreement, signed with the local government's development agency in 2010 (Norra Älvstranden Utveckling, 2010). This agreement required all developers to certify their buildings according to the Swedish environmental certification system *Miljöbyggnad*, with the target of achieving Silver for most categories, including building materials and indoor climate, and Gold for energy performance (60 kWh/m^2 per year). At the time, this represented a stricter requirement than the Swedish building regulations, and for all developers, it was the first project with such a demanding MEPR. Several described the agreement as quite ambitious and acknowledged that they would not have chosen *Miljöbyggnad* certification by themselves. However, because the decision was made collectively within the consortium, the ambitious requirement created a sense of shared responsibility, making the developers adapt their practices accordingly. Today, many developers have internalised these standards, using certification systems and stricter MEPR as part of their sustainability strategies.

> The consortium decided that everyone, the entire area, would be certified with *Miljöbyggnad* Silver, which was probably as far as they dared to go then. We all thought the demands were relatively high. But it worked.

Fig. 3. Energy performance classes of the Kvillebäcken properties. Energy performance data from EPCs have been reinterpreted using specific energy use relative to a reference value of 60 kWh/m^2 per year, corresponding to the stricter MEPR applied in Kvillebäcken. The classes were defined as percentage bands around this reference value (see Table 1) to ensure consistency in the comparison of EPCs issued between 2015 and 2020.

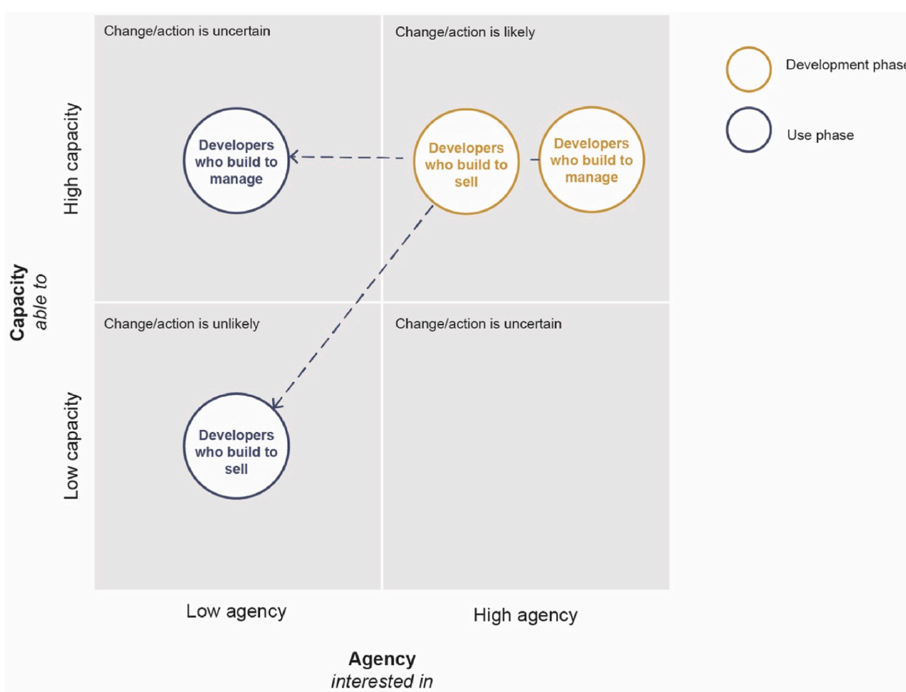

Fig. 4. Levels of agency and the capacity of the developers to implement and meet the MEPR in the development and the use phase.

D6s (2021/2022)

The level of agency of the developers in the development phase is also influenced by their business models. All developers stressed that investments in energy efficiency must be financially justifiable. For example, while shared laundry rooms (traditionally part of Swedish housing developments) reduce overall energy demand, D2m explained that placing machines in each apartment was preferred, since the potential for them to ask for higher rents with machines in each apartment outweighed the collective efficiency gains. Developers who build to manage (D1m, D2m, D3ms) generally demonstrated higher agency in implementing more costly energy measures than those who build to sell, as they adopt longer-term strategies to reduce operating costs.

> Those of us who build rental apartments and manage them ourselves may be a little more concerned, or we think more about the

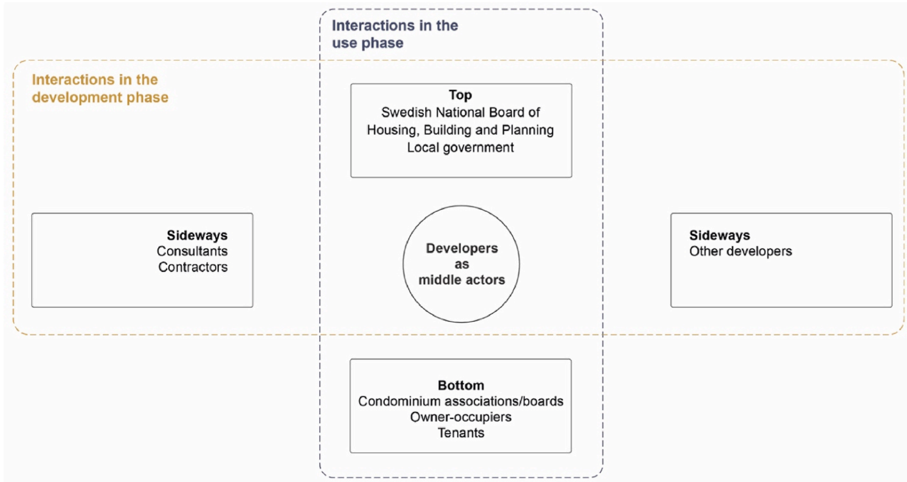

Fig. 5. Interactions influencing the agency and the capacity of the developers in the development and use phase.

> management […]. While those who build condominiums may not always do so […] because if you transfer the responsibility to a condominium association, you get away with it.
>
> D2m (2012)

For D1m, this translated into an ambition to strengthen their market position through energy efficiency. They aimed to establish a portfolio of energy-efficient buildings and test new solutions in Kvillebäcken by combining air-source heat pumps with district heating in one property, benchmarking it against a second property using only district heating. As they explained, energy-saving was primarily seen as an economic driver:

> The energy part is economic; you see that if we save energy, we save money, but the environment is a softer factor […]. It is also a cost driver; if we do not get paid for it, it is harder to motivate us to do things. […] Now, we have focused very much on the installation side because substantial cost savings can be made there.
>
> D1m (2012)

By contrast, developers who build to sell (D5s, D6s, D7s) generally showed lower agency in implementing these types of energy measures, as their shorter time horizons reduced incentives to invest in measures with a more extended return period. While some considered combining district heating with heat pumps, they concluded it was not cost-competitive. In these cases, investments were primarily made when they could provide a competitive advantage in the housing market through visible architectural features, such as rooftop greenhouses, that differentiated their projects. Moreover, benchmarking by D1m demonstrated that the MEPR could be achieved with conventional district heating alone, indicating that technical solutions were less decisive for compliance.

In the sustainability program following the Kvillebäcken agreement, the submission of energy performance calculations to the local government in the design stage was agreed upon to verify compliance with the stricter MEPR (Miljögruppen Kvillebäcken, 2011; Norra Älvstranden Utveckling, 2010). The accuracy of the calculations is a crucial factor for achieving MEPR, and consequently, the choice of a good external energy consultant is, therefore, critical according to D3ms, D5s, and D6s. The developers themselves do not all have knowledge of energy performance calculations. Private developer D1m collaborates closely with several consultants and uses their own verified input data for the calculations, which helps them predict their buildings' energy performance more accurately. D2m, who cannot choose consultants since they are restrained by public procurement, find that the figures used in energy performance calculations are often wrong, and they believe this to be a sector-wide problem.

> It was found that the energy calculation had been calculated at an energy loss of 4 kWh, but it is actually 28 kWh. This is nothing unique, but the losses are misjudged for new properties. This is almost a third of the property's energy use.
>
> D2m (2021/2022)

During the development process, collaboration with contractors, internal skills, and knowledge transfer were important factors in implementing the MEPR. The quality of the building has a significant impact on the energy performance, for example, to minimise losses in the heat distribution of the building and through thermal bridges. D2m and D5s explain that a common problem is that contractors purposely reduce the amount of insulation to save costs. D1m, D3ms, D4s, and D7s collaborate closely with the same contractors through several projects, helping them monitor the construction over a longer time, something which the public actors are restrained from doing due to the Public Procurement Act. These developers increasingly include the MEPR in the tender for the contractors and thus redistribute the responsibility to meet the MEPR to the contractor. However, collaboration goes beyond the contractor, and D5s explains that energy-efficient buildings involve many disciplines and require collaboration between all actors, from planning, design, construction, installation, and management.

Internal skills and knowledge transfer within the developer organisation also impact the developers' capacity. For the larger developers, different organisational departments work in different phases of the building project. D2m explains that the different departments of their organisation are not aligned and that it would be beneficial if the people working with the management of the buildings were involved in the development of the buildings to share lessons learned from the use phase. In that way, the awareness of energy performance could be increased and discussed earlier in the planning process and during construction. D1m underscores the importance of integrating technically skilled individuals with energy management expertise into project teams to develop energy-efficient buildings successfully. Throughout the development of Kvillebäcken, there has been a lack of a structured approach to monitoring energy performance within the consortium, and the developers have not indicated the presence of established frameworks for knowledge management. Knowledge transfer occurs informally between colleagues, for example, in discussions during coffee breaks. D1m, D4s, and D6s indicated that discontinuities within their project teams during the development of Kvillebäcken negatively affected the implementation of the MEPR, due to the loss of agreements and critical information in the process.

> It would have been desirable if the same people had been with us all the way. You have an information loss. What did we decide two years

ago, and what was the level of ambition? And then other people come in who have not taken the whole journey with them, or what has been decided is not fully documented.

D1m (2012)

D3ms, as a smaller private developer, has had more continuity in the project team and believes it has been important for their team to have participated since the initial formulation of the vision and the setting of requirements for having a better understanding of the MEPR. Most developers acknowledge that disruption in the project teams, with staff leaving their employment, has posed problems to knowledge transfer within the organisation. D1m and D6s have started to work on more formal ways to transfer internal knowledge from their experience with the development of Kvillebäcken.

4.4. Agency and capacity in the use phase

The seven developers completed the buildings in Kvillebäcken between 2014 and 2019, and the first residents moved into their apartments in Kvillebäcken in 2014. In the use phase, the developers' levels of agency and capacity to meet the MEPR differed considerably. The developers who build to sell (D3ms, D4s, D5s, D6s, and D7s) point out that by the time they handed over the building to the condominium association, the association of owner-occupiers that took over the ownership and maintenance, the energy system was calibrated and set to reach the MEPR. However, as most of these properties do not meet the MEPR in the EPC, one explanation is that the energy system setting could have been changed after delivery, e.g., the incoming district heating temperature.

My reflection is that it is, of course, important for us developers to deliver projects with the conditions to keep energy consumption low, but it is also important to educate the condominium board on how their operation is affected. We always sign agreements with technical managers on behalf of the association and ensure that the manager receives training in the project's system and information about what conditions/settings the system should have.

D7s (2021/2022)

The capacity to meet the MEPR in the use phase is thus constrained for the developers who build to sell because the actual energy management of the building is performed by bottom actors (the condominium association). The developers explain that they do not have the right to enter the buildings and that the responsibility for the management of the energy system in the buildings lies with the board of the condominium, resulting in a low level of capacity for the developers to implement the MEPR or improve the energy efficiency of the buildings in operation. D4s and D7s explain that it is important to educate the condominium association and their board about the influence of the management of the energy systems on the actual energy use and the operational costs of the buildings. According to D4s, it is difficult to communicate with the condominium association because of the many changes in board members, which, according to D4s, results in a lower interest in energy efficiency from the condominiums.

When we handed over, we designed the entire property based on these values; the energy performance and everything are based on an indoor temperature, which in our case is 20°. When the condominium association takes over, and there are people on the board who think, 'Ah no, this can only be 20°; we want it warmer'. They change it quite early and release much more energy into the property.

D4s (2021/2022)

The constrained capacity for energy management is different for the developers who build to manage since they operate the energy systems themselves as landlords. However, they admit that the management of the energy system for multi-family buildings is a difficult task because individuals have different indoor temperature preferences, while management needs to be optimised at the building level.

It is so individual what people want. Some want it warm. It is difficult to regulate in a large building with 250 apartments.

D6s, 2022

The developers mentioned finding skilled people to manage the buildings' energy systems is challenging. D2m admits that they lack expertise within the organisation to manage the energy systems correctly. D1m states that energy management can be further optimised in their buildings through, e.g., sensors in the rooms.

According to the Swedish building regulations, developers must engage an energy expert to issue an EPC within two years after the building is taken into use (Boverket, 2023). Consequently, all buildings in Kvillebäcken have EPCs, since this is a nationally mandated requirement. In parallel, the Kvillebäcken agreement stipulated a stricter MEPR than the national building regulations and required that completed buildings undergo follow-up through measured energy use, to be reported to the local government within two years of occupancy (Norra Älvstranden Utveckling, 2010). However, according to the developers, this local follow-up has not been carried out. Several developers (D1m and D5s) state that there has been no interest from the local government in enforcing the stricter MEPR, despite having imposed it during the development process.

I do not think they follow up. I have never been asked any questions or heard of them. So that is how it is. I do not think they have the time or the skills, and I do not know. Or are they looking at other developers, perhaps?

D5s (2021/2022)

During the development process, D1m, D3ms, and D4s expected a more robust follow-up by the local government on their efforts to meet the stricter MEPR. While some monitoring took place during design meetings, this did not explicitly focus on energy performance. In later stages of the development, confusion arose concerning the MEPR of 60 kWh/m^2 per year. Although this requirement was clearly specified in the signed sustainability contract – stipulating *Miljöbyggnad* Silver certification for all buildings, except for energy performance, which should achieve Gold – this exception was overlooked in the following stages. Follow-up documents do not report actual measured energy performance of the buildings, although available in the EPCs. Instead, they assume compliance through the *Miljöbyggnad* certification system (Göteborgs Stad, 2019; Miljögruppen Kvillebäcken, 2018). The documents note that all buildings were certified, though not verified, at *Miljöbyggnad* Silver level (which corresponds to an energy performance of 90 kWh/m^2 per year) (Göteborgs Stad, 2019; Miljögruppen Kvillebäcken, 2018). This suggest that the stricter MEPR orgininally agreed upon may have been diluted or lost during the process. Similarly, D3ms, D4s, and D6s argue that compliance with the MEPR is demonstrated through the *Miljöbyggnad* certification and verification process, given that an approved EPC is required for verification. However, they appear unaware that the initial MEPR target corresponded to *Miljöbyggnad* Gold, which entails stricter energy performance criteria than level Silver.

Kvillebäcken was one of the first projects of its kind with the local government's environmental program, and *Miljöbyggnad* level Silver. It was a journey together with the consortium. I think the energy performance numbers are not so bad and are according to plan.

D3ms (2021/2022)

Three of the developers (D1m, D3ms, and D4s) mention that the way EPCs are issued is a factor that influences the measured energy performance, and thus their capacity to meet the MEPR. D1m explains that some differences in the specific energy performance of their buildings, having the same energy system, could be explained by how the energy expert carries out the EPCs.

Another important factor is the energy behaviour of residents, mentioned by D3ms and D6s. According to D3ms, the fact that people spent more time at home during the pandemic greatly influenced energy performance. The MEPR is influenced by behaviour related to heating and hot water use, as this is included in the Swedish EPC. As buildings become more energy efficient with respect to heat demand, hot water use is becoming increasingly important, something which developers have less control over.

> Behavioural aspects become increasingly important as you get down to such low energy numbers. Today, hot water is a more significant item than heating in new houses. And it is something that we usually have no control over; it is about people's behaviour. So, working with those questions is important.
>
> D6s (2012)

The developers explain that they do not find that residents or tenants are especially interested in energy efficiency. Instead, they are more interested in other values, such as the apartments' appearance, location, and rent. D1m, D4s, and D6s think that residents or tenants are unaware of the building's energy efficiency and the district's sustainable ambitions because these are not visible or tangible at the district level or in the buildings. However, according to D6s, the recent increase in energy costs contributes to increased awareness. D1m, D5s, and D7s see that people, in general, are becoming more interested in energy efficiency because of environmental concerns and the availability of green mortgages and loans, which are dependent on high energy performance.

5. Discussion

5.1. Shifting agency and capacity of different types of developers over time

In response to Janda et al. (2019), this study considers the temporal aspects of agency and capacity and examines how developers' ability to implement the MEPR evolves over time in new multi-family buildings in an urban development project in Gothenburg, Sweden. The average energy performance gap among the ten properties with available energy performance calculations was 33 % (van der Leer et al., 2022), which is in line with previous studies in the Swedish context that found gaps between 25 % and 60 % (Grazieschi et al., 2020; Johansson et al., 2016; Nilsson and Elmroth, 2005). Previous research suggests that developer type or ownership may influence building energy performance, but findings are contradictory. Some studies indicate that rental buildings tend to have higher energy use than condominium-owned buildings (Broberg and Egüez, 2018), whereas others suggest that developers who build to manage deliver more energy-efficient buildings than those who build to sell (Carlander and Thollander, 2022; Green, 2006; Mahapatra, 2015). This study finds that developers' levels of agency and capacity to implement the MEPR shift over time and differ between developers who build to sell and those who build to manage. However, these differences are not clearly reflected in the EPC data, and no clear correlation exists between actual energy performance (as expressed in EPCs) and developer type.

The agency and capacity are relatively high for all developer types during development. Still, they all have decreased agency and, specifically, capacity to implement the MEPR during the use phase, especially the developers who build to sell. Developers who build to sell often view the MEPR as a project goal, achieved when they deliver the building and hand over the energy management to the next owner, in this case, condominium associations. Since their financial returns are tied to sales revenues rather than long-term operational savings, they have little incentive to invest in measures that would primarily benefit energy savings over the building's lifetime. As a result, they show a lower agency to meet the MEPR after the project handover. Previous studies have referred to a 'design for compliance culture' in this context, meaning that the actor involvement and interest stop as their part of the project is complete (Bordass, 2020; Cohen et al., 2017; Willan, 2019) or a 'lack of accountability', meaning that the actor does not feel responsible for the outcomes of the project (Cozza et al., 2021; Willan, 2019). As shown in this paper, for the developers who build to manage, financial drivers work differently: operational energy saving reduces costs and can strengthen market positioning through a portfolio of energy-efficient buildings. The developers who build to manage generally have a long-term interest in the buildings as they continue as landlords, and energy for space heating is part of their business case, as it is included in the rent for tenants in Sweden. This creates more substantial incentives for evaluation and investing in measures beyond mere compliance, which was also found by Shrubsole et al. (2019). However, the developers who build to sell theoretically have the capacity to enable and facilitate condominium associations, which are responsible for the energy management of the buildings in the use phase. A study by Zalejska-Jonsson and Hungria-Gunnelin (2019) concluded that property management is isolated from the construction process and that there is a need for a "more effective exchange of experience, information, and use of data" between construction and management of the building to ensure the energy performance of new buildings (Zalejska-Jonsson and Hungria-Gunnelin, 2019, p. 181). This study shows that construction and management could be further integrated through an extended accountability of the developers who build to sell in the use phase, and a better or more standardised way to exchange knowledge from development to management. An example is a commitment agreement (Cohen et al., 2017), which developers and their teams sign to design, construct, and manage new buildings to agreed levels of actual in-use energy performance of the base building, which could ultimately lead to a 'design for performance culture'. The agreement actively monitors and enforces performance: operational energy use is verified one year after occupation, with adjustments allowed if targets are not met, and building users receive annual updates on the rating. Advanced simulations, independent design reviews, and mandatory reporting support the ongoing maintenance of the commitment throughout the process (Cohen et al., 2017).

In the use phase, the developers who build to manage have higher levels of agency and capacity than those who build to sell, since they control the energy management of the buildings. However, this paper found that the developers who build to manage also face problems with the energy management of the buildings because of the complexity of the systems in multi-family buildings and the difficulty of finding skilled energy managers. The case of Kvillebäcken highlights the importance of energy management for MEPR implementation in new buildings. This is in line with previous studies on energy management, which argue for an extension of the roles and responsibilities of energy managers, going beyond the delivery of a constant supply of energy, including energy demand management and energy reduction (Cozza et al., 2021; Goulden and Spence, 2015; Royston et al., 2018; Zalejska-Jonsson and Hungria-Gunnelin, 2019). Moreover, recent studies highlight the importance of frequent performance assessments and rapid feedback mechanisms. Daily or near-daily monitoring can support incremental improvements, allowing small deviations from targets to be corrected quickly with minor adjustments. Such practices reduce the need for drastic interventions that might compromise comfort or health, while also providing developers and energy managers with actionable insights for improving ongoing energy management and the design of future projects (Agarwal et al., 2024).

5.2. The role of top actors and bottom actors in relation to middle actors' agency and capacity

The middle-out perspective is an additional way to deliver change next to bottom-up and top-down efforts (Simpson et al., 2020). The results of this paper indicate that housing developers require support from both top and bottom actors to implement and comply with MEPRs effectively. In the case of Kvillebäcken, the local government is not taking responsibility for following up or enforcing stricter MEPRs after the design phase. Developers face no consequences for failing to meet the MEPR, as responsibility is left entirely with them, which was found in other studies too (Lane et al., 2017; Parks, 2019). The absence of follow-up and enforcement from the local government or other policymakers contributes to a 'design for compliance culture' (see Section 5.1). Strengthening compliance requires moving beyond calculated performance to incorporate measured data, such as EPCs based on actual energy use or high-resolution metering, for more reliable assessments. Building certification systems like *Miløbyggnad* or BREEAM could support this and reduce administrative work at the local government level by linking environmental goals to market incentives and industry norms. However, their effectiveness depends on internal consistency, as highlighted in the case study. Responsibilities across governance levels must also be clarified: while MEPRs and EPCs are managed nationally, enforcement occurs locally. Stronger integration with existing inspection or audit procedures on a local level could help extend accountability to developers. There is thus potential for top actors to integrate existing policies and regulations better to increase the agency of developers to implement the MEPR. Wahlström et al. (2020) propose verification before final consultation and again two years after occupancy, using EPCs (Wahlström et al., 2020). Unlike current legislation, this would link final approval and energy certification, and include (financial) consequences for non-compliance. As Evans et al. (2017) argue, developers are more likely to comply when penalties directly affect their projects, e.g. measures like denying permits create strong incentives. At the same time, positive incentives, such as faster approvals or more flexible regulations, can further improve compliance rates and encourage higher building standards (Evans et al., 2017).

This paper's findings also indicate a growing interest in the EPC of the buildings among tenants, condominium associations/boards and related owner-occupiers, which can potentially increase the agency of all developers in the use phase. Hagbert and Malmqvist (2019, p. 713) highlighted the need to acknowledge the role of communities or third-sector actors in "pushing agendas and norms to bring about transitions" (Hagbert and Malmqvist, 2019). Given the increasing energy prices and the importance of the EPC for green loans among owner-occupiers, it could be expected that the interest in energy performance and the demand of the bottom actors on developers will grow, which could increase the agency of the developers in the use phase accordingly. Additionally, the results suggest that achieving lower MEPR depends not only on design and construction but also increasingly on how occupants, as bottom actors, interact with and use the buildings. In line with this, Agarwal et al. (2024) recommend "restructuring performance metrics to make them more occupant-centric" (p. 10).

6. Conclusion and policy implications

This study aims to provide a longitudinal understanding of the agency and capacity of housing developers to implement MEPRs in newly built multi-family buildings. Using the middle-out perspective by Janda and Parag (2013), a case study of the MEPR implementation in the urban development project of Kvillebäcken in Gothenburg, Sweden, was carried out. The results of the analysis of the energy performance data, the planning documents and the two rounds of interviews with the housing developers show that only one-fourth of the buildings in Kvillebäcken achieved the MEPR of 60 kWh/m^2 per year and that the levels of agency and capacity of housing developers to implement the MEPR vary over time. Enforcement from top actors and active involvement of bottom actors and other middle actors are essential in the policy implementation of MEPR. In addition, this study emphasises the importance of energy management for achieving MEPR in newly built multi-family buildings. The results of this study have four important policy implications for the EPBD, specifically for the implementation of the MEPRs for new buildings, which apply not only in the Swedish context but also could be applied in other countries with similar frameworks for MEPR implementation.

Firstly, this study found the importance of verifying both calculated and actual energy performance of buildings to assess the efficiency gains achieved through stricter MEPRs. The case study shows that while buildings meet the stricter MEPRs based on calculated energy performance, actual measured performance indicates compliance is achieved in only some properties. This paper highlights that verification can be effectively carried out using existing tools, such as EPCs, provided they are based on measured data, ideally from smart metering rather than one-time assessments. Holmstedt et al. (2018) advocate for dynamic, high-resolution metering to improve the accuracy and detail of energy performance evaluations. Currently, MEPR verification in Sweden and many other countries relies primarily on design-phase calculations, limiting understanding of the policy's impact, evaluation and learning opportunities. The recast of the EPBD includes provisions for calculating annual energy performance and emphasises the use of metered energy for verification (European Union, 2024). Implementing a stronger, standardised approach to monitoring and verification, using measured data, would support consistent enforcement and improve overall energy performance outcomes.

Secondly, this study highlights the difficulty of defining responsibilities across different policy levels. The recast of the EPBD emphasises that local and regional authorities are critical for the successful implementation and that local planners and building inspectors must be provided with adequate guidance on the implementation (European Union, 2024). The case study lacks clarity in enforcing MEPRs. While regulations are set nationally and EPCs are managed centrally, verification occurs locally, and stricter requirements are often introduced locally. This fragmented governance structure risks accountability gaps and uneven enforcement. The Swedish National Board of Housing, Building and Planning (Boverket) should clarify responsibilities by aligning national MEPR standards with local verification. These responsibilities should be integrated into existing mandatory building inspections or audits, which are already in place in many countries to ensure buildings meet quality standards (Zalejska-Jonsson and Hungria-Gunnelin, 2019). This could include integrating EPCs into the final inspection phase and introducing post-construction monitoring to ensure measured performance matches design expectations. Following Wahlström et al. (2020), verification should occur at the design stage and two years after occupancy, with consequences for non-compliance (Wahlström et al., 2020). Stronger coordination and accountability would improve compliance and energy outcomes.

Thirdly, this study stresses the importance of energy management and user behaviour for meeting stricter MEPR. The recast of the EPBD calls for further reductions in primary energy use in residential buildings and emphasises minimising whole life-cycle greenhouse gas emissions of buildings (European Union, 2024), underscoring the role of operational energy management. Findings from Kvillebäcken show that managing newly built multi-family buildings becomes more complex as efficiency standards increase. While the recast highlights the role of tenants and buyers, this study suggests that greater involvement of property owners, landlords, or extended accountability for developers is also necessary. Introducing operational energy requirements alongside MEPRs could help unite these actors, supported by post-occupancy data and feedback loops between design, construction, and operation (Willan, 2019). Such requirements should cover energy demand management and obligations for energy reduction.

Fourthly, the quality of the EPC data needs to be further improved and unified. In many EU countries, including Sweden, EPCs may only be issued by certified or accredited professionals. However, as both this case study and previous research suggest (Pasichnyi et al., 2019; von Platten et al., 2019), the reliability and consistency of EPCs can still vary depending on how the assessment is carried out, the data available, and the tools or assumptions used by the individual expert. These variations introduce uncertainty into the potential use of EPC data for monitoring policy implementation, evaluating MEPR compliance, and supporting energy management or user engagement. This case study demonstrates that EPC data can be a valuable tool for verifying building performance and tracking policy outcomes, but only if the data is trustworthy, standardised, and based on real measured values. Therefore, EPCS must be issued using transparent, harmonised methodologies, emphasising measured energy performance, ideally through smart metering.

Although this paper offers valuable insights into MEPR implementation in newly built multi-family buildings and the agency and capacity of housing developers over time, it has some limitations. First, our research design was based on a single case study of a project in Gothenburg, Sweden. More comparative case studies on MEPR implementation are needed to understand the agency and capacity of the different actors in different contexts. Secondly, the energy performance data analysis is based on Swedish EPC data, which is based on measured values but still has some issues depending on how the energy expert is issuing the EPC (von Platten et al., 2019). More attention is needed to the quality of EPC data. Thirdly, the role of other actors in implementing MEPR was highlighted, based on the perspective of the seven housing developers interviewed in this case study. Therefore, future research should examine the agency and capacity of local governments as top actors, and condominium associations and energy managers as middle actors. In particular, it should explore how local governments implement and follow up on MEPRs, how energy managers handle demand management and efficiency improvements, and how insights from energy management can inform the development of new buildings.

CRediT authorship contribution statement

Janneke van der Leer: Writing – original draft, Methodology, Investigation, Conceptualization. **Paula Femenias:** Writing – review & editing, Supervision, Investigation, Conceptualization. **Kaj Granath:** Writing – review & editing, Supervision, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This work was supported by the Swedish Energy Agency (grant number 50345-1). We thank Emma Persson for conducting the 2012 interviews as part of the Formas-BIC-funded research project *Initiating and implementing innovation for sustainable building: the construction client as a change agent* (grant number 2009-205). We also thank the anonymous reviewers for their valuable comments.

Data availability

Data will be made available on request.

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