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Integrating environmental sustainability and social justice in housing development: two contrasting scenarios

Silvia Mete*, Jin Xue

Department of Urban and Regional Planning, Norwegian University of Life Sciences, Fredrik Dahls vei 15, 1430 Ås, Norway

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ABSTRACT

The article discusses futures in housing development by applying the approaches from 'future studies' to design two explorative scenarios reflecting alternative strategies for achieving sustainable and just housing development. The main aim is to develop scenarios that can achieve a specific normative goal: a future housing development that is both environmentally sustainable and socially just. Two scenarios are built – ecological modernisation and degrowth – that reflect different degrees of societal change, ranging from conventional to radical. The scenarios are applied to the two selected cases of the Milan and Oslo regions, drawing on the statistics of the contextual housing system and the document analysis on planning and housing. We further discuss how the specific scenarios can take place and which challenges will be encountered.

1. Introduction

This article aims to explore housing futures towards an integrated, normative sustainable development to meet the urgent need for addressing the environmental and social failures of the present dominant housing development model. Using the scenario approach in futures studies, we build two contrasting scenarios for housing development and contextualise them in two city regions – Milan and Oslo. The article is explorative in the sense that it starts with the recognition of the need for shifting the housing development trajectory and then envisions possible alternatives as a catalyst to liberate us from the existing constraints for a better future. Before taking the explorative journey, we will take a moment in the Introduction to address why such a need for shifting the housing development trajectory is crucial and urgent.

1.1. The failures of the present dominant housing development model

Since the late 1970s, housing policies in many Western countries have experienced the process of neoliberalisation (Sager, 2011). Despite the variegated forms, processes and contexts with which neoliberalism unfolds in housing policies, a general housing development model across Western countries can be identified. Central to this model is the perception of housing as a commodity that is traded and exchanged on markets. The market provides the main mechanisms of the supply and distribution of housing, whereas the state only provides correctives to it (Bengtsson, 2018). Deregulation, financialisation and privatisation are common features of neoliberal housing policies. Access to housing is primarily an individual responsibility, determined by purchasing power. This neoliberalisation of housing rationalises and promotes a growth agenda for housing and urban development (Sager, 2011).

However, although a housing development model may be an effective driving force for growth and capital accumulation, it poses both environmental and social risks. Considering the latter, because access to housing is primarily determined by household purchasing power, this leads to uneven distribution in the housing stock and intensifies the risk of inequity (Chiu, 2004). In addition, the general trend of neoliberalisation, weaving with other socio-economic contexts, results in different levels of housing segregation, gentrification and exclusion (Arbaci, 2007). On the environmental side, the housing sector represents a major challenge to environmental sustainability, particularly in terms of energy consumption, greenhouse gas (GHG) emissions and encroachment on land (Høyer & Holden, 2001; Priemus, 2005; Suzuki, Oka, & Okada, 1995). These impacts are caused both in the construction and operation phases of housing, with the latter also including the impacts of housing-related transportation. However, the strong belief in decoupling a growing housing stock from negative environmental impacts through advanced building technologies and compact urban development has not yet fully materialised, leading to increased residential energy consumption and land consumption (Xue, 2015). These failures suggest that the present dominant housing development model does not meet the social and environmental objectives of equity and sustainability (Spangenberg, 2010).

* Corresponding author.
E-mail addresses: Silvia.mete@nmbu.no (S. Mete), Jin.xue@nmbu.no (J. Xue).

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1.2. The need for integrating the social and environmental sustainability of housing development

Studies on housing have a multidisciplinary character and are rooted in different traditions such as sociology, economics, technology, policy studies, building engineering and urban design. Regarding social and environmental sustainability studies, conventionally, the two dimensions are separately discussed. On the environmental sustainability side, the wave of environmentalism since the release of the concept of sustainable development by Brundtland Commission in 1987 has led to a rise of academic debates on environmentally friendly housing. The debates have been concerned with the sustainable design of residential buildings, building technology, building materials and housing-related land use as well as its impacts on transport (Næss, 2012; Priemus & Ten Heuvelhof, 2005). On the social sustainability side, scholars have explored a wide range of topics related to housing, such as gentrification (Smith, 1987), social exclusion (Marsh & Mullins, 1998), segregation (Arbaci, 2007), affordability and accessibility (Neuteboom & Brounen, 2011). For a long time, these two dimensions of housing development have been studied without much engagement with each other. However, the recent realisation of the intermingled social and environmental challenges drives a holistic approach to address housing development. First, environmental sustainability initiatives such as neighbourhood eco-renovation generate negative social consequences, such as ecological gentrification (Cucca, 2012). Second, attempts at enhancing the living standards of the poor to reduce housing inequality can lead to the increased total housing consumption that imposes further pressures on the environment. Finally, the adoption of a more radical environmental sustainability strategy such as limiting the construction of new and spacious housing – as a way to respect environmental limits – is likely to worsen the inequality in access to housing (Næss & Xue, 2016). These existing and potential dilemmas and trade-offs between the social and the environmental sustainability of housing development suggest the need to consider the socio-environmental challenge as a whole.

So far, several scholars within the field of housing have explored the possibility of combining the social and environmental domains of housing but often mainly focus on one side. For example, the theories of Ancell and Thompson-Fawcett (2008) have mostly focused on the social consequences of the application of environmental policies onto the built environment and housing. On the contrary, Chiu (2004) has worked towards the inclusion of environmental sustainability within the realm of social sustainability. Although this approach helps in reducing reductionism in the concept of social sustainability of housing, it still raises questions on how to achieve inter-disciplinarity between environmental and social sustainability in housing research and development.

1.3. Scope and outline of the study

The limitations of the current housing development model and the need for integrating social and environmental sustainability suggest the necessity to rethink future housing development. Our study aims to contribute to the emerging debate on housing development that can break the disciplinary divide. To this end, we draw on a scenario approach that builds alternative future housing development images. We start with a clarification of the ultimate goals of housing development that include both environmental sustainability and social justice. In terms of environmental sustainability, we ground our understanding on an acknowledgement of the environmental limits. This means that achieving an environmentally sustainable housing future requires a reduction in the absolute environmental impacts of housing development (both housing itself and housing-related transportation), including energy use, GHG emissions and land. In terms of social justice, we primarily aim to safeguard adequate housing for all, which includes equitable access to housing of acceptable standards and to the facilities, services and jobs that are associated with the location of housing. In addition, we hold the opinion that a certain level of equality in housing consumption will contribute to a more just society than the one with a high degree of inequality in housing consumption.

Departing from these two ultimate goals of housing development, we explore different possibilities to achieve them. We first question which theoretically informed futures could help us achieve these normative goals in housing development. Next, we look into real world cases to see how the theoretically based future scenarios might apply to real contexts. In building up the scenarios, we draw upon two sustainable development discourses that challenge the current mainstream society paradigm and housing development model to different degrees: ecological modernisation (EM) and degrowth (DE).

EM and DE are two ways of conceptualising sustainable development, which also lead to different pathways to achieve it. The scenarios are based on general principles, which draw from their theoretical conceptualisations of sustainability. On the environmental side, the scenarios focus on three main aspects: domestic energy consumption in the housing sector, residential land consumption at the metropolitan level and housing-related mobility. On the social side, the scenarios focus on adequate housing for all and a certain level of equalisation in housing consumption. Challenges arise when both the social and environmental goals are to be met.

Both theories hold the belief that they can achieve sustainable development, although they resort to different development principles and strategies. In simple terms, EM considers economic growth as the major driver in the development of society and that growth can be reconciled with the betterment of the environmental condition, whereas DE considers social foundations and basic needs, including food, water, health and housing, as central priorities. In the DE theory, the economy is functional to ensuring that the basic needs, or social foundations, which together promote well-being within specific environmental limits and which safeguard the integrity of the biosphere, are met. EM builds upon the belief that growth can be fully decoupled by applying technological measures, environmental governance and changing consumption habits. On the contrary, DE advocates disagree with the basic tenets of growth in economy and the commodification of nature. They argue for a society in which the growth paradigm is set aside to achieve reduction in consumption and an active decrease in production. The main argument is that decoupling infinite growth on a finite planet is not possible.

The paper is organised into five sections. After this introduction section, section 2 will elaborate on the basic tenets and principles of the two sustainability discourses – EM and DE – and their implications for the principles of housing development. The methodology of the study will be introduced in section 3. Section 4 will introduce the background of the two cases of the Milan and Oslo metropolitan areas, with particular attention to the housing sector. Sections 5 and 6 will respectively build two empirical scenarios for housing development in Oslo and Milan. The last sections of the paper will compare the two scenarios across cases and briefly reflect on the challenges of achieving each of them against the existing socio-economic and political settings. Although we do mention some possible polices and solutions, it is not within the scope of the study to identify pathways and propose actions to achieve the two scenarios. An elaboration of these will be an interesting research enterprise in the next step.

2. Theoretical background

2.1. Two contrasting theories on societal paradigms for sustainable development

Since the start of contemporary environmentalism in the 1960s and 1970s, environmental debates have experienced three major waves that characterise different ideologies and discourses. The first wave started in the 1960s with a critical stance on economic growth as a culprit of environmental deterioration. The debate was backed up by a number of publications calling for limits to growth and a steady-state economy (Meadows et al., 1972, Daly, 1993). During the 1980s, the growth critique was gradually replaced by the idea that negative environmental impacts can be decoupled from economic growth. This second wave of environmental debates began with the publication of the UN Our Common Future report in 1987 (Wced, 1987) in support of sustainable development. The 'decoupling' idea was also emphasised in a number of publications focusing on 'EM' (Hajer, 1995; Mol & Spaargaren, 1993; Spaargaren & Mol, 1992). Since then, eco-modernist thinking has been the dominant ideology and strategy for dealing with environmental problems across the globe. The global financial crisis in 2008 and the subsequent great recession triggered a third wave of environmental debates that reinvigorated the growth critique of the 1960s and 1970s. The discourse and movement framed in the term 'DE' quickly gained momentum from both the civil society and academia (Dietz & O'neill, 2013; Jackson, 2009; Schneider, Kallis, & Martinez-Alier, 2010) and have recently entered into political debates at the European Union (EU) level, as manifested in a European Parliament conference in 2018 exploring the possibilities for a post-growth Europe. These debates are not only about discourses on how to perceive and tackle environmental issues but also about how the society should be organised to realise long-term sustainable development. As such, they represent different opinions on the societal paradigm.

2.1.1. Ecological modernisation (EM)

The EM theory originated in the 1980s. Although the positions on many of its dimensions have changed during the maturation of the theory, its belief system and core tenets have remained rather constant. The overarching belief of EM is that economic growth and environmental sustainability can be reconciled (Mol & Janicke, 2009; Spaargaren, 2000). Although capitalism in its current form is acknowledged as a major source of environmental problems, ecologically sound capitalism and green growth are possible as long as these contemporary institutions go through a process of reform and reconstruction. This belief in a win-win situation between society, environment and economy is, according to EM advocates, in a major contrast with the notions prevalent in the 1960s and 1970s that were anti-capitalist and anti-modern. Fundamental to achieving reconciliation between capitalist society and environmental protection is the independence of ecological rationality and its increasing importance in governing social and economic policies (Mol & Spaargaren, 1993). However, ecological rationality should not prevail over economic and political rationalities. The antithesis between ecology and economy can be transcended by 'ecologising the economy' (ibid.)

This belief lays the foundation for reforms in different spheres for achieving an eco-modernist society, including technological innovation, environmental governance, consumption and lifestyle.

Technology and technological innovation have been the key characteristics of EM. Although positions amongst EM scholars are different regarding the importance of technology in developing an eco-modernist society, they all share technology optimism. The eco-modernist conceptualisation of technological change has widened from add-on end-of-pipe technologies, through preventative technologies, to more complex socio-technological systems (Mol & Janicke, 2009). The latter 'combines technological hardware with new management concepts, new ownership relations, new prizing mechanisms, new roles of the state and the like' (ibid., pp.21). The diffusion of technological innovation should be led by private sectors following market mechanisms. A wide range of technologies throughout the lifecycle of a product can be adopted, including technologies for obtaining new sources of resources, eco-efficiency, recycling and waste and emission treatment (Huber, 2009).

Solving environmental problems within the market economy and in light of market logics implies a central role of market actors in environmental governance. Instead of regarding economic actors as antithetical forces to environmental protection, they are seen as potential contributors to improving environmental quality. Thus, eco-modernists call for political modernisation, shifting from a hierarchical, bureaucratic, regulatory governmental pattern to a more innovative, flexible, decentralised and deliberative way of governance (Mol & Janicke, 2009). This requested reform in environmental governance is a response to both the intractability of the persistent environment problems (e.g. climate change and biodiversity loss) and the increasing interconnections and interdependencies among a growing number of actors at different policy levels (Jänicke & Jörgens, 2006). The role of state and non-state actors should therefore be reshaped. Direct command and control as well as law and regulations by environmental authorities and state are considered indispensable but should be limited (Huber, 2009). Instead, more innovative environmental policy making, approaches and instruments should be adopted. According to Van Tatenhove and Leroy (2003), policy innovations can take place in four dimensions: policy coalitions, resources, rules of the game and policy discourses.

Since the late 1990s, EM has experienced a 'consumerist turn', compensating for the original disregard of consumer behaviours and lifestyle patterns and applying the concept of sustainable consumption (Spaargaren & Van Vliet, 2000; Spaargaren, 2003). According to Spaargaren and Cohen (2009), the theoretical foundations drawn by EM scholars for enquiring sustainable consumption are quite diverse. The authors distinguish three major approaches to sustainable consumption. The first deals with the 'infrastructure of consumption' that focuses on how networks can be built to provide households with green choices of energy, water, electricity and other services. The second approach is framed as 'political consumerism', aiming to enable citizen-consumers' purchasing power as a driver of sustainable transition. Here, labelling and certification schemes are considered as an efficacious instrument. The third approaches centres on 'sociotechnical changes in everyday consumer practices'. Co-evolution in social practices, technology, values and norms is needed for sustainability transition. Regarding the modes of change in the consumption sphere that are promoted by EM scholars, despite the lack of consensus on a normative definition of sustainable consumption, it seems that the focus has been on improving resource-efficient consumption and changing the consumption patterns by replacing more environmentally harmful products with green products. Reducing the consumption level is not addressed.

EM is not at the outset a theory revolving around the principles of just and equal distribution or social justice. Over time, a more 'reflexive' type of EM was developed within the theory (Hajer, 1995). In reflexive EM, one addresses the incorporation of social justice, redistribution and democratisation (ibid., p.12) in the process of making changes to production and consumption (Gibbs, 2000). However, the attention to social justice in the EM theory is in terms of deontology – that is, procedural justice concerning decision-making and participation at the local level.

2.1.2. Degrowth (DE)

A fundamental difference of DE from EM is that DE challenges the growth hegemony of the capitalist society as well as any non-capitalist productivism. This challenge is radical and transformative in the sense that it calls for repoliticising the ethical premises of societal development and envisages a deep socio-economic–political restructuring beyond the growth paradigm (Sekulova, Kallis, Rodríguez-Labajos, & Schneider, 2013). The important values of DE include respecting the environmental limits, ensuring social justice and safeguarding the satisfaction of basic needs. Instead of economic growth, securing a good life for all within the planetary boundaries is the overarching goal of the DE society. Principles of well-being take precedence over economic profitability towards a more just distribution within the ecological boundaries. Interestingly, Holden, Linnerud, Banister, Schwanitz, and Wierling (2017)) illustrate the key sustainability themes in terms of three fundamental moral imperatives that express well the basic understanding of DE. The first moral imperative addresses the satisfaction of human needs with two key sustainability themes: eradicating extreme poverty and enhancing human capabilities. The second imperative points towards ensuring social justice by enhancing participation and ensuring fair distribution. The third touches upon the respect of environmental limits through the mitigation of climate change and the protection of the integrity of the biosphere. DE calls for 'a democratically led redistributive downscaling of production and consumption in industrialized countries as a means to achieve environmental sustainability, social justice and well-being' (Demaria, Schneider, Sekulova, & Martinez-Alier, 2013).

Contrary to the EM perspective on market-based solutions to environmental issues, DE is a critique of the commodification of nature and the expansion of market values and logics. It is argued that the commodification of the environment clashes with the limits of biophysics, institutions and social domains (Gomez-Baggethun, 2015). The biophysical limit stems from the non-separable nature of the ecosystem, which makes dividing the ecosystem into tradable units difficult. The public good nature of many ecological commons means that it is difficult to prevent others from accessing them, thus constituting the institutional limit. When commodification expands to the fields that intrude basic needs, it will encounter social limits in the form of fierce social opposition (ibid.). DE does not support abandoning markets but suggests defining the role of markets against the social, economic and political conditions that can promote human well-being. A limit to commodification will be set. However, a discussion on where this limit should be placed and what may or may not be commodified should be informed by debates on ethical values such as environmental justice, basic needs, human rights and intrinsic values.

In terms of sustaining our lives within the biophysical limits, the technological optimism of eco-modernists is strongly disputed by DE scholars (Jackson, 2009; Victor, 2018). Historical evidence shows that absolute decoupling between economic growth and resource use or pollution has not yet taken place as we have desired through technological fix. Because we have trespassed several planetary boundaries, relying on technological innovation alone to solve environment problems is not sufficient. Furthermore, the direct and indirect rebound effects of efficiency improvement partly offset environmental benefits from environmental technologies. The more intractable issue is that rebound effects can hardly be avoided in a growth society (Nørgård & Xue, 2016). DE addresses the importance of a sufficiency strategy that aims at reducing the consumption level among the affluent, in addition to the functional environmental technologies. The impacts of technologies should be evaluated to ensure that the innovation fulfils the DE values. As such, DE is not against eco-efficiency technologies and does not deny their environmental benefits but argues that a sufficiency strategy should be adopted along with eco-efficiency strategies.

The sufficiency strategy relates to the idea of simplicity – a simple way of life that is the 'minimally sufficient material standard of living' (Alexander, 2015). Connoted to this concept is a new understanding of the good life that is disassociated with material wealth. Well-being or happiness can be obtained through non-materialistic sources such as relaxation, engagement in social and political life, being with family and a fulfilling job. What could be regarded as a 'minimal' material standard has to be decided with reference to basic needs. Although there are different theories of human needs, they all distinguish needs from wants, desires and preferences such that needs are objective, non-negotiable and universal across cultures and over time (Doyal & Gough, 1991; Max-Neef, 1992). This means failure to satisfy them will always produce serious harm – for example, poor physical health – whereas failure to satisfy wants or preferences will not.

The sufficiency strategy in accordance with basic needs is both a solution to the current ecological crisis and the only way to secure everyone's access to a decent life within a limited planet. A fair distribution of ecological space and reduction of inequality within biophysical limits can only be possible through "less competition, large scale redistribution, sharing and reduction of excessive incomes and wealth" (Demaria et al., 2013). The challenges of distribution are larger in a DE society than an eco-modernist one in which growth can to some extent benefit the poor through the trickle-down effect- although in a disproportionate way - which eases up the conflicts between social strata. In a DE society where there exists a ceiling for production and consumption as a result of environmental limits, further increase in material living standard among the rich will imply less available for the poor.

Degrowth scholars underline that the key to avoid worsened inequality in a DE society resides in the political commitment and the willingness to take the social justice and equality issues seriously (Büchs & Koch, 2017; Jackson & Victor, 2016). Proactive redistributive policies do have an important role in mediating the outcome of a Degrowth path. A more intense state intervention to maintain high employment through work sharing will decrease potential severe inequalities caused by unemployment in a degrowth situation. In addition, equalizing income can also help diminish inequality. Furthermore, removing financialization - a driver of inequality, will contribute to check speculation and thus reduce the wealth creation from non-labor activities (NEF, 2014). All these possible measures for dealing with a potential risk of increased inequality in the DE society entail state intervention and the outcome is a redistribution of wealth from the affluent to the poor.

2.2. *Principles of the EM and DE scenarios for housing development*

Considering housing as a societal sector, the two societal paradigms will have different implications for how the housing sector can be developed, leading to different perceptions, regimes and policies for housing development. This section aims to translate the two sustainability discourses to the principles of the housing sector, which provides the theoretical foundations for building the two empirical scenarios for housing development. Table 1 summarises the major principles for the two scenarios for housing development, which will be contextualised in the subsequent cases. As shown in Table 1, both types of scenarios share a common population projection variable, based on the figures provided by national bureaus of statistics; that part is labelled as 'fixed element' in the table. The trend of population development and its size in future will have significant impacts on the demand of housing in terms of both number and type. Demographic changes are a result of both natural growth/degrowth and migration policies. Despite being aware of the impacts of the demographic strategy (in controlling the size and spatial distribution) on social and environmental policies, we will take population change as a given condition in both the EM and DE scenarios to avoid overcomplicating the scenarios. The two scenarios differ in the overall socio-economic structure, understanding of the nature of housing, strategies for the environmental sustainability of housing development (consumption, technology, physical structure) and principles of housing distribution. The reasons for these differences are attributable to the ground tenets of the two sustainability discourses. All these elements appear under 'shifting elements' in the following table.

2.2.1. *Principles of the EM scenario*

In general, the EM scenario of housing development is embedded within a socio-economic setting dominated by capitalist market economy. The economy follows the cyclic form, typical of growing economies, with alternating periods of peaks in growth and unexpected economic crises. Such a society is characterised by a built-in imperative for capital accumulation and an associated materialist and consumerist culture. Without challenging these fundamental characteristics, the EM scenario aims at promoting growth by greening the economy. Within this overall setting, housing development considers that growth in the housing sector can be reconciled with both environmental sustainability and social justice. The scenario therefore follows or pursues a

Table 1
Principles of ecological modernisation and degrowth scenarios for housing development

Ecological modernisation scenario (EM scenario)	Degrowth scenario (DE scenario)
'FIXED' ELEMENT:	
POPULATION: both types of scenarios will use a 'middle' population growth projection from statistics bureaus	
SHIFTING ELEMENTS	SHIFTING ELEMENTS
Overall socio-economic structure:	Overall socio-economic structure:
A capitalist growth paradigm with inherent growth imperative, strong materialism and consumerist culture but incorporates environmental rationality for green growth	A DE paradigm that downscales production and consumption levels, reduces commodification and promotes distributive justice and democracy
NATURE OF HOUSING:	NATURE OF HOUSING:
Housing is to a great extent a commodity. The degree of it as a right/welfare depends on the economic-political regimes	Housing is consistently considered a right and a part of welfare
The typical **tenure form** is ownership	Diversified tenure forms
Often, housing is an **investment** object and is financialised	Housing is unburdened from its **financial** implications
Building sector is considered a crucial part of economic growth	Housing is detached from **social status**
Housing is considered a positional good, representing an indication of **social status**	
CONSUMPTION:	CONSUMPTION:
No limits imposed on the consumption of housing (m^2/capita)	Upper and bottom limits to the consumption of housing (m^2/capita)
Increased share of the 'marketed sharing economy; in housing	
TECHNOLOGY:	TECHNOLOGY:
Eco-efficiency measures	Eco-efficiency measures
'Green' technologies	'Green' technologies
PHYSICAL STRUCTURE:	PHYSICAL STRUCTURE
Metropolitan level: high-rise and high density urbanisation, eventually leading to new expansions to accommodate a growing housing stock	Metropolitan level: high-rise and high density, centralised urbanisation, eventually leading to 'stabilisation' or even 'active urban shrinking', depending on population trends/size and structure
Promoting accessibility in transport planning	Pursuing a sufficiency strategy on accessibility in transport planning
DISTRIBUTION:	DISTRIBUTION:
Trickle-down effect	The state plays a major role in housing distribution
Market as the main distribution mechanism in housing, coupled with interventions by governments, non-profit organisations and foundations for the more exposed groups at risk	Redistribution from those who own big shares of housing stock to those who do not
Ensures basic-standard living conditions	
Social justice and process equity are pursued through participatory processes to ensure that low-income groups benefit from green practices and green projects	

steady growth in per capita housing consumption. Housing is seen as an important pillar of the capitalist economy, representing a driver for boosting the economy. Consumption of housing is encouraged. Academic debates have, since a long time, recognised housing as a 'wobbly pillar under the welfare state' and positioned it as 'half in and half out' of the welfare state (Allen, 2006; Torgersen, 1987). The EM scenario sees housing as, to a large extent, out of the welfare state and as a commercial good. Therefore, access to it is mainly through market competition on an individual basis. As a result, the more common tenure form is homeownership, which is encouraged by policy makers and politicians. Housing plays a central role as a financial object for both consumers and investors. Consumers access housing through banks and financial systems that lend the funds for purchasing a dwelling. Investors use housing as a form of accumulating capital by both building new dwellings and acquiring estates in profitable markets. Therefore, housing can, as an element, manifest the social status and the economic success of the individuals.

For achieving an environmentally friendly housing development, the EM scenario promotes strategies to decouple a growing housing stock from harmful environmental consequences through advanced eco-efficiency technologies. Here, environmental sustainability is not limited to energy use and carbon emissions but is envisioned in a wider perspective, including land consumption, use of raw materials and biodiversity loss. Eco-efficiency measures are enhanced and increased by institutions at the local and national levels. These institutions use eco-friendly materials for buildings from a lifecycle perspective; in addition, they ensure the application of more renewable energy, the increase of land-use efficiency, the retrofitting of existing housing and the promotion of energy-efficient buildings.

Eco-efficiency strategies in land use operate through densification strategies. New constructions required to satisfy the needs of the inhabitants first take place in the existing brownfields or underused urbanised areas and are later channelled to the outer neighbourhoods close to transport nodes through dense transformations or expansions. The compact urban structure is conducive to reduce not only is transport-related energy consumption but also the demand for converting farmland or natural land to built-up areas. Because encroachment on non-built-up environment creates a significant impact on farmland loss and biodiversity loss, containing sprawl by building in a dense manner can to a certain degree reduce the pressure on the available farmland and promote biodiversity preservation.

A potential risk of applying the environmental part of the eco-modernist housing policy is the associated negative social consequences. Recent studies on neighbourhood green projects point to the unintended or even intended consequences of a green growth housing strategy on displacement and lack of housing affordability and accessibility (Checker, 2011; Dooling, 2009). This suggests that the level of social justice achieved in housing is intertwined with and dependent on the specific housing regime that is pursued under the capitalist welfare state. Stamsø (2009), by invoking Esping-Andersen's typologies of welfare regime (Allen, 2006), distinguished three housing regimes: the social-democratic, liberal and corporatist regimes. The three regimes are characterised by the different levels of housing decommodification, the different roles of the state, market and family, the principles of housing allocation and the targeted groups. In the EM scenario, because housing is to a large extent considered as a commercial good, it is supposed that the market plays a significant role in providing and distributing housing, with a low level of state involvement. Through the trickle-down effect, the state accrues part of the benefits from a growing economy to support the most vulnerable groups to enhance their living standard. Such a principle for housing distribution is largely in line with the corporatist or liberal housing regimes.

2.2.2. *Principles of the DE scenario*

In the DE scenario, the ultimate purpose of the economy is to serve the well-being of people and not economic growth. Given the attention

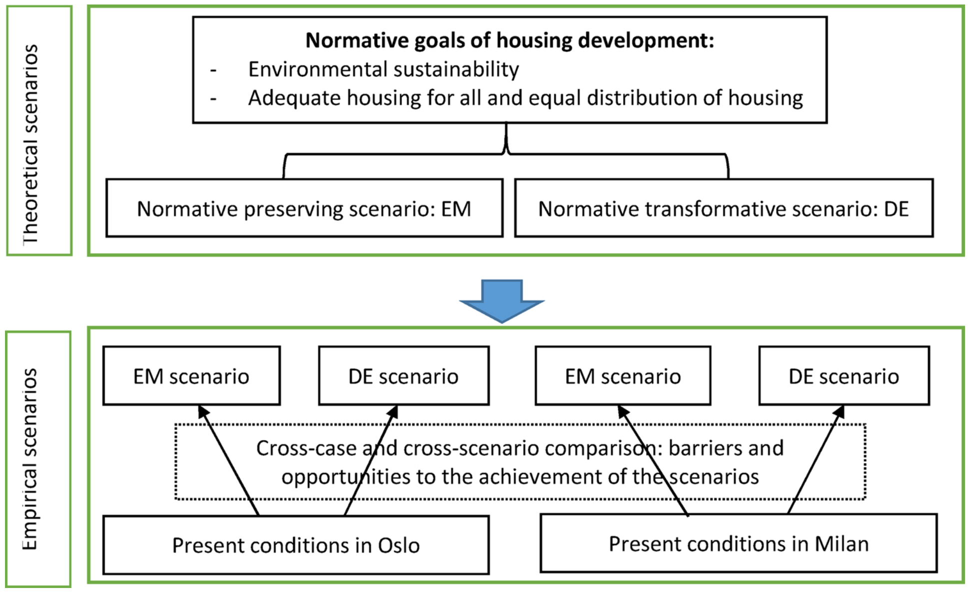

Fig. 1. Methodology.

posed on the basic needs and well-being of human beings, the economic traits of DE need to discard the typical components of the pro-growth economic tenets. Productivity in terms of labour and financialisation ought to be reduced. In the short term, this means increasing the unemployment, which can be counterbalanced by measures such as reduced working hours – to share the reduced level of production efforts among all workable inhabitants instead of leaving some of them unemployed. Within the DE setting, the nature of housing takes the form of a right and is gradually unburdened from its financial implications (Schneider, 2018). Housing is not a positional good anymore and takes a more visible place within the welfare system. Understanding housing as a human right highlights the importance of achieving a more equal housing system. The redistribution of the housing stock needs to ensure affordability and quality for all.

Regarding the environmental goals for a sustainable housing sector, the DE scenario ensures that the environmental goals are met by both adopting eco-efficiency technologies and reducing the per capita housing consumption. Reducing the per capita housing consumption is one of the main aspects of the DE scenario that is grounded on an understanding of sufficiency in housing. Sufficiency in housing is based not on the luxury standard and spacious size of housing but on the basic human needs fulfilled by housing. In practice, this means applying the cap on per capita housing consumption, which addresses both primary and non-primary dwellings (such as vacation homes).

Regarding the land-use dimension of residential development, the scenario we designed deviates from most of the positions expressed within the DE movement. Some DE advocates have promoted localisation and spatial decentralisation as important moves towards a sustainable society (Latouche, 2009; Trainer, 2019). Drawing on the criticisms on decentralisation as the desirable DE spatial development (Xue, 2014, 2018), we imagine an urbanised and a centralised spatial development in the DE scenario. The scenario advocates densification strategies in addition to reduction in per capita housing consumption. The densification strategies are paired with location aspects. For example, densely building in very remote areas, where access to workplaces or services is low, does not necessarily reduce travel distance and its related negative effects (Næss, Strand, Wolday, & Stefansdottir, 2019). In the DE scenario, the need for travel is low and accessibility is promoted through proximity rather than mobility. Different from the EM scenario, we argue for sufficiency in accessibility, meaning that the DE scenario does not aim for ever-enhancing accessibility.

Housing development, as an important component of the DE society, also faces the challenge of increased inequality if not properly addressed by social policies. Increasing inequality in housing with a limit on total consumption leads to worse repercussions than those in a growing society because the ones who are affected are likely to lose access to the minimum-standard housing and leave their basic needs for shelter unsatisfied. In the DE scenario, housing as a welfare right justifies the need for ensuring everyone's access to housing, which suggests a strong redistributive policy from those who have higher housing consumption to those who have lower consumption. Such distribution leads to a more equal access to housing and certain equalisation of housing consumption. In contrast to the EM scenario, the housing regime in the DE scenario is closer to Esping-Andersen's social-democratic regime typology (Allen, 2006), characterised by the strong intervention by the state in regulating the market – for example, controlling price, reducing financialisation and monitoring speculative activities. In addition, the state plays an important role in housing provision on a universal basis and allocates housing based on need to guarantee high-level housing quality for the entire population.

3. Methodology

Because our enquiry projects into housing future, we use scenarios as the main methodological approach. The scenario approach belongs to the 'future studies' field that explores the methods and tools to discuss future choices and changes (Börjeson, Höjer, Dreborg, Ekvall, & Finnveden, 2006). A scenario approach can focus on either the building of future images or the pathways to the images, or both. In this paper, we primarily address the building of future images and only briefly discuss the possible favourable and hindering conditions leading to the achievement of the images. The overall methodology of the study is shown in Fig. 1.

The use of scenarios within the "Future Studies" field has been often contested (Börjeson et al., 2006). Future studies field itself is considered a "fuzzy field" (Marien, 2002), with different positions taken among so-called futurists and researchers. The approach taken by the Nordic literature includes several elements that appeal to our research. First, the broad use of the scenario concept: this approach covers also predictive attempts using sensitivity testing. "Sensitivity testing" is borrowed from medical sciences and indicates the ability of a test to correctly identify those with a disease: regarding the scenario techniques, it allows testing the efficacy of the scenario itself post-design. Second, the approach by Börjeson et al. (2006), offers a re-arranged typology of scenarios (predictive, explorative, normative), along with a framework of techniques (generating, integrating, consistency).

The scenario approach has been widely used in different contexts such as business environment, military, energy management and transport planning for various purposes. In the more recent decades, the scenario approach has become an increasingly important research method applied to the topics on long-term sustainable development. Given that the current trend often points to an unsustainable future, a combination of explorative and normative scenarios has been employed to explore alternative futures that can better fulfil the sustainability vision. In urban studies, the scenario approach is rather popular in the transport sector (Banister & Hickman, 2013; Geurs & Van Wee, 2000) but has been rarely applied to the exploration of urban housing futures (Xue, 2017).

According to the scenario typology suggested by Börjeson et al. (2006), three main categories of scenarios can be identified: predictive, explorative and normative scenarios; these respectively correspond to the following three questions about the future. What will happen? What can happen? How can a specific target be reached? In our study, we combine the explorative and normative scenarios.

The normativity in our scenarios means that the scenario building aims at a specific goal for the housing future: environmental sustainability and an equitable and just distribution of housing. Such a strong normative statement in housing is chosen for two reasons. The first reason derives from international statements and acknowledgments: the necessity of equity in sharing resources and meeting the needs of the poor (Wced, 1987) and the right to adequate housing for all (Unhabitat, 2009). Sharing resources must happen between generations, with consideration to the needs of future generations, as well as within each generation, hence giving priority for the needs of the world's poor (Wced, 1987). In addition, part of the fundament for environmental sustainability is a moral obligation to the preservation and well-being of other species and nature (Wced, 1987).

The second reason for the development of a sustainable housing future has an ethical and philosophical dimension to it in the form of human needs theories (Assiter & Noonan, 2007). Although the needs and necessities of human beings are culturally relative, some specific needs are essential across cultures and must be satisfied and met. Drawing on human needs theories (Assiter & Noonan, 2007), we could argue that housing indeed represents a universal life necessity and a necessary satisfier to some basic needs – or better, an intrinsic need. The intrinsic needs include necessities in the strong sense, which have to be met to avoid 'objective harm' (Assiter & Noonan, 2007). For example, in the case of lack of adequate dwelling, the person would suffer from objective harm. The person could re-interpret the need and settle for a worse dwelling but only to a certain limit, which is the limit of adequate standard of living wherein some qualitative standards are met. If a re-interpretation of the final goal or the need is possible without causing harm, then it is not objective harm but 'need deprivation'. As Assiter and Noonan (ibid.) exemplify, instrumental needs and functional needs are those that have to be met to attain to a certain goal. For example, to play the cello, a person needs a bow; the lack of a bow is a need deprivation but not an objective harm because life can move on if the person can revise his or her self-interpretation of the need or the scope. Housing and the adequate standard of living instead belong to the intrinsic human needs because the lack of them (e.g. evictions and homelessness), even after their re-interpretation, can cause severe distress and objective harm to the person.

Within the normative scenarios, it is possible to distinguish between preserving scenarios (aimed at suggesting slight changes to the current situation and maintaining the status quo) and transformative scenarios (aimed at removing the structure blocking the space for changes). The use of transformative scenarios would allow the study to investigate rather radical and unexpected futures without the typical compromises and implementation issues that planners encounter when working with preserving scenarios for their plans (Gunnarsson-Östling & Höjer, 2011).

In our building of scenarios of housing development that encompass both environmental sustainability and social justice, we explore two different images based on different theoretical understandings of sustainable development: EM and DE. The two explorative scenarios reflect different degrees of changes needed for realisation. The EM scenario tells the story of a more preserving future, in which some present mechanisms that are typical of the current housing sector are maintained, paired with certain necessary changes to achieve a significant degree of sustainability and justice in the housing future. This scenario is typical of a future that presents a technological optimism or, so to say, the belief that technological advancement can decouple the environmental impacts of the housing sector and, in general, a faith in the growth model. The DE scenario tells a more radical story, with different standpoints from those in the current conditions, where the growth model, which is widely applied to the housing sector, is challenged. This scenario requires significant changes at the societal level and implies a society in which an active form of DE is applied to different sectors. We anticipate that DE in the active form is a chosen path of society and not a passive form of reduction of consumption or production owing to cyclical and unpredictable economic crises. The two types of scenarios have their basis on normative assumptions, as previously described.

In the paper, we contextualise the two types of scenarios in the contexts of two metropolitan areas: Oslo in Norway and Milan in Italy. The two cases offer some elements in common in the housing sector but also some divergences, especially in the economic aspects. Norway is a country experiencing economic growth, represented by growth rates that are slightly fluctuating but still relatively stable since the 1990s. Economic growth in the Italian context has been fluctuating in the past 30 years; the situation is worsened by a severe debt and several financial crises of different severities, the worst being the one in 2008. In addition, the two countries represent different traditions of housing welfare regimes in terms of housing provision and distribution policies (Allen, 2006). The two city regions can be regarded as 'typical' cases in their respective contexts – namely, in the Nordic region and Southern European region (Yin, 2017). Through replicating the scenario approach to the two cases, we can see the how the two futures (EM and DE) unfold in the two parts of Europe. Meanwhile, the two city regions represent two comparative cases with some significant contextual differences that offer the basis for implementing the futures. The comparison between the two cases will demonstrate how the same future scenarios (EM and DE) can manifest differently in different contexts.

The construction of the scenarios in the cases is based on different data sources. We collected documents from planning agencies, institutions and governments and performed document analysis to picture the current conditions in the housing sector of the two countries and metropolitan areas. In addition, we collected data from the national census, energy institutions and statistical projections for the future of the Oslo and Milan metropolitan areas. The data were processed, analysed and interpolated to pinpoint trajectories of their futures. The scenarios shown below for both cases are the result of our analysis. Some asymmetries in the data are present between the two cases owing to the availability and quality of the data.

For each case, we developed two scenarios. The time span for all the four scenarios is from now to 2030. We chose this year in the future because it allows for a high degree of reliability of data interpolation, which we have used for the energy and environmental considerations of the future images. In fact, we were able to retrieve reliable data for both metropolitan areas up to 2030; therefore, for the sake of credibility of the energy figures shown in the scenarios, we had to limit the period up to 2030. Moreover, for consistency between the different aspects of the scenarios, both qualitative and quantitative, we had to adhere to the year 2030.

The scenarios for Oslo and Milan are based on the assumption of growing projected population. In both cases, we selected data from

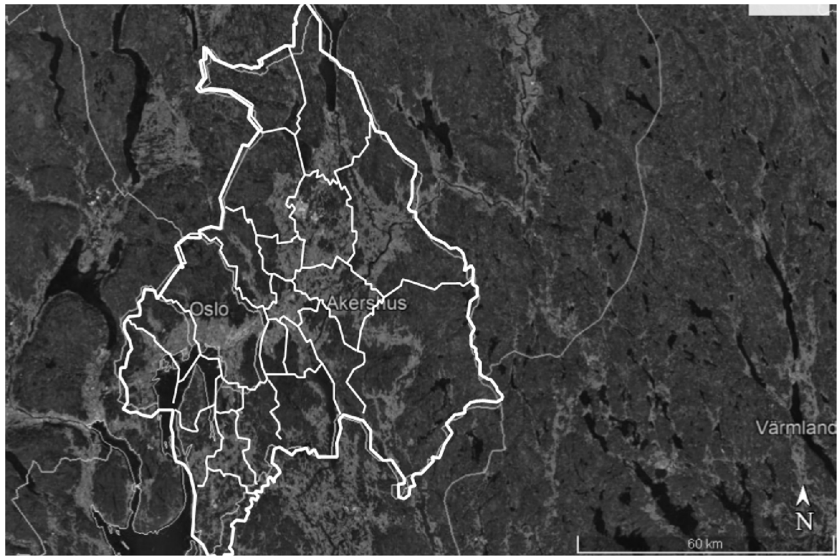

Fig. 2. The Oslo metropolitan area. Source: author's elaboration on Google Earth (2019).

national and municipal agencies that prospect middle growth demographic projections. All the scenarios are normative and aim to achieve an environmentally sustainable and socially just housing development. For environmental sustainability, we worked on different dimensions: we made calculations for the stationary energy use, for the land consumption and distribution of housing in the metropolitan areas and for housing-related transportation impacts.

In terms of stationary energy use, housing impacts the environment at various levels: it consumes land and therefore threatens biodiversity, consumes raw materials in its production stage and requires energy during the use stage, including operational energy, water and energy for maintenance and repair. For our purposes, it will not be possible to use the values that include all possible variables and impacts, and for consistency reasons with existing statistics and research, we used for our calculations the unit of measurement, toe (tonne of oil equivalent), which covers the widest possible sources of consumption in the use stage of housing. For practical purposes and for simplifying our results, we decided to convert the results in a more accessible unit of measurement, kWh/m^2, which will be used from now on in all the four scenarios. We utilise the environmental targets formulated in national and local policies in the respective countries and metropolitan areas. In the Milan case, the national goals are in compliance with the EU ones. We therefore referred to the national and supranational goals to assess the need for adjustments in the stationary energy use. The ways in which the goals are met are different in the two scenarios: in the EM scenario, reduction happens mostly through eco-tech innovation in the housing sector, whereas the DE scenario limits the consumption of square meters per inhabitant.

Under the environmental sustainability aspects, we always addressed the question related to land consumption in the two scenarios as well as the transportation impacts of different housing futures. The land consumption figure for the two metropolitan areas is retrieved from the current planning documents for future developments. Then, the two scenarios, through different strategies (e.g. densification strategies), assess the distribution of housing increase, or eventually cuts it.

Regarding transportation impacts, a number of studies worldwide have shown that low-density suburban development increases the need for motorised travel, particularly by car, whereas densification within existing urban area demarcation, especially the densification in areas close to the city centre, reduces car travel and encourages the use of non-motorised travel modes (Ewing & Cervero, 2010; Næss, 2012; Næss et al., 2019). Based on the data from a recent study in the Oslo metropolitan area (Næss et al., 2019), we were able to roughly estimate the energy use for intra-metropolitan travel in the Oslo case for the 2015 situation (when the data of the above-mentioned study were collected) and for the business-as-usual (BAU) EM and DE scenarios of 2030. Owing to the lack of data, no similar quantification has been made for the Milan case. The transportation energy consequences of the Milan scenarios will nevertheless be qualitatively discussed.

Controlling for the demographic and socio-economic characteristics of the residents as well as for residential preferences, the study in the Oslo metropolitan area showed that intra-metropolitan travelling distances by car and by transit were mainly influenced by the distance from the dwelling to the city centre of Oslo. No other built environment variables showed statistically significant effects on travel distances by car or by transit. We have therefore applied the regression coefficients for the effects of residential distance to the city centre of Oslo on weekly car travelling distance and distance travelled by transit, respectively, to the 2015 situation as well as for the BAU EM and DE scenarios of 2030. Energy use per person kilometre travelled by different travel modes has been calculated from the empirical data for the Oslo metropolitan area available from Akershus Fylkeskommune (2019) and VY (2019). The results of the calculation should be interpreted with a great deal of caution because we have assumed that the influence of residential location on travel distances by car and transit will remain the same in 2030 as in 2015 and that energy use per person kilometre travelled by the different travel modes will also remain the same. In reality, these parameters, particularly the energy figures, could be expected to change. To illustrate the main differences between thescenarios, we still think the estimates may be illuminating.

4. Current conditions in the two metropolitan areas

Before addressing the scenarios, it is crucial to contextualise the trajectory and status quo of housing development in the Oslo and Milan city regions with a focus on the features of the housing sectors. The contextualisation provides a baseline for the following scenario building. We will delve into the social, environmental and economic aspects that shape housing development and its structure. The following table gives some information about the aspects related to the two contexts and shows some differences. Nevertheless, the specificities of the two contexts will be discussed in detail in the upcoming sections.

4.1. The Oslo region

The Oslo metropolitan area includes both the central core municipality of Oslo and the county Akershus (Fig. 2). Today, the metropolitan area covers approximately 5 000 km^2 and includes 22 municipalities with 1 305 122 inhabitants, of which ~681 000 live within the core municipality of Oslo (SSB, 2019). The Oslo metropolitan area extends from the Oslo Fjord in the South up to the Mjøsa Lake in the north. It is the most populated region in Norway and is one of the most important economic areas of the country.

Oslo, as the largest Norwegian metropolitan area, is attractive for business and newcomers. The relative stability of the Norwegian economy, which has kept growing since the 1990s, enables Oslo to be a growing arena for housing and business. The growth trend in the finance and economic sectors keeps increasing the values of the building sector and the real estate market in the city of Oslo. Moreover, housing consumption, which is measured in monetary expenditure, increases owing to the governmental policies aiming at stabilising the interest rates on housing mortgages. The positive demographic trends of Oslo and its metropolitan area concur with the pressure on the housing market in Oslo, making the housing market attractive and raising the financial values of the stock.

Low rates of unemployment and profitable access to mortgages facilitate the entry into the very expensive housing market in the Oslo metropolitan area. As Statistics Norway underlines in its 2018 report (SSB, 2018), housing prices in the Oslo metropolitan area increased by 815% from 1992 to 2017, even though a slight decrease was observed in 2017. The housing sector is strongly marketised and has a very significant share of homeownership, which is the preferred and most common form of tenure. The housing market, with its elevated costs, is not counterbalanced by the presence of a large social housing stock, which partly contributes to the observed social segregation in Oslo. Some segregation patterns of relocation have been underlined (Turner & Wessel, 2013): these patterns hint at a population distributed according to income, ethnicity and education, especially between the eastern and western areas of Oslo. Housing prices and distribution are therefore different too, with the west being more affluent and having higher housing prices and the east being more diverse but typically having lower housing prices.

In terms of the public provision of social housing, Norway represents an exception among the Nordic countries. The share of social housing is quite small in Norway and amounts to around 5% of the entire housing stock (Andersson et al., 2010). Some scholars have pointed out that the small share of social housing in general and of the rental sector in particular might have caused a segmentation of the housing sector (Skifter Andersen, Andersson, Wessel, & Vilkama, 2016). The presence of large co-operatives seems, however, to have been able to bridge the gap between ownership and the rental sector. This was true especially in the past, when the establishment of these co-operatives (OBOS, USBL, etc.) enabled many workers and citizens to access housing on a more affordable basis. The largest housing estates in Oslo have been built by co-operatives and their units were sold at an affordable price to the inhabitants. Many of their larger estates were located in the eastern part of the city, thus contributing to the concentration of certain social groups as mentioned above. Even though co-operatives still play the bridging role (Skifter Andersen et al., 2016), they have increasingly been offering dwellings at the private market price, thus acting as private actors. The responsibility of the public provision of social housing usually belongs to the different municipalities and this includes providing dwellings at a low rental price for persons in financial or personal distress. The public provision of social housing usually addresses individuals or families presenting financial problems, which more often are accompanied by some other problems (sickness, drug addiction, etc.). An important question related to housing future is whether the path taken nowadays leads to more segregation or integration in the city. The main policy from the government side to secure accessible housing for all is to secure a stable interest rate for housing mortgages (Andersson et al., 2010).

On the environmental side, Norway, and mostly Oslo, has been very progressive. In particular, the Norwegian authorities have encouraged the compact city strategy in most of the big urban areas. The compact city strategy promotes the construction and densification of areas within the inner core of the city, near crucial public transportation nodes and hubs, thus reducing the conversion of rural land or natural environments in the outer areas of the city. The result is decreased environmental impacts owing to the reduction of car transport and travelling distances in general. The promotion of this strategy is even more evident in the latest regional plan for the development of the Oslo metropolitan area (Akershus Fylkeskommune, 2015). The plan reaffirms the goals and suggests growth corridors along the public infrastructure axes and existent major transportation nodes. Densification strategies of the housing stock in the Oslo metropolitan area are accompanied by the positive fertility rates and the longer-living population (SSB, 2016).

Some changes can be observed in the housing habits and lifestyle of Norwegians. On average, the dwellings in Norway have four rooms, compared to 3.6 in 1980 (SSB, 2018). The increase of space available per person could have been one of the reasons for an increase in the domestic energy consumption. The increase in per capita floor area can lead to increased total energy consumption, despite increased energy efficiency. Particularly in the Oslo Metropolitan area, the trend of domestic energy consumption has been increasing over the years, reaching a very high level in 2008, which has then decreased and stabilised to 172 kW h/m^2 in 2015.

The economy in Norway is healthy and booming according to major indicators and standards, and it is widely supported by population growth. Statistics Norway projects an increase in the population of Oslo by ~284 000 inhabitants within the next 15 years (SSB, 2016), which is a significant element to be considered when planning for a strategy at the metropolitan level. Norway is referred to as an example of eco-modernisation and care for the environment in urban development (Næss, Næss, & Strand, 2011), both for the quality in the housing stock and for the clear aim of discouraging sprawl in the regional area, which has been pursued in the past 30 years (Næss et al., 2011). The preserving approach towards natural areas, active policies towards the reduction of emissions and the improvement within the public transport sector have been the core reasons for Oslo being appointed as the European environmental capital of 2019.

4.2. The Milan region

The Milan metropolitan area includes as many as 133 different municipalities for a total of 3 234 658 inhabitants (Città Metropolitana Di Milano, 2017) (Fig. 3). It covers 1 575 km^2 and is located in the northern part of Italy. The core municipality of Milan accounts for almost half of the inhabitants, 1 372 810 (ISTAT, 2018). The Milan metropolitan area is situated inland at the northern end of Po valley, which makes it topographically quite flat. The Milan metropolitan area is considered as one of the most affluent city regions in Italy and the most important economic area in Italy based on Gross Domestic Product (GDP).

The economic, social and demographic conditions of Italy tell a different story from Norway. Economic growth in Italy has seen extreme fluctuations in the past 30 years; the situation is worsened by a severe debt and several financial crises of different severities, the worst being the one in 2008. All the economic strategies that have been used since the financial crisis of 2008 have aimed at containing the public debt, imposing a form of economic crisis containment and the so-called austerity measures with the clear aim of re-establishing economic growth. The result has been a rise in the income taxes along with fewer investments in different sectors, elevated unemployment rates, especially among the younger generations, and increased emigration rates. Even after almost 10 years, the economy has not reached the level of the pre-crisis decade, but some signs have pointed at positive changes.

This is the typical case for the national level; for the other regions

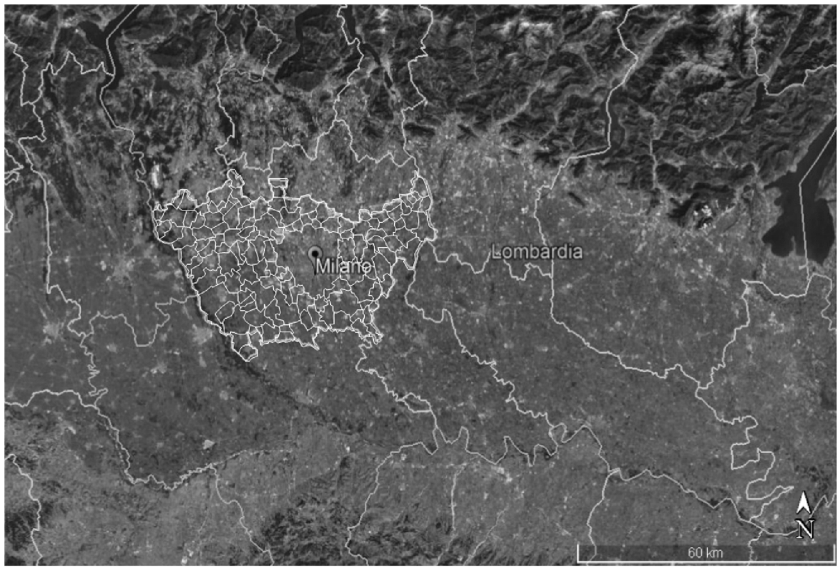

Fig. 3. The Milan metropolitan area. Source: author's elaboration on Google Earth (2019).

and the more remote areas of the country, some exception might occur. Milan might be included among the exceptions because it is a central node and hub for business and attracts investors, city users, tourists and workers from the rest of the country. The city is counted among the so-called global cities (Sassen, 1991), a conceptualisation representing the cities that can attract jobs, tourists, investments, flow of capital and goods. In this sense, Milan represents a space of opportunity and an arena for new businesses and investments. At the same time, the metropolitan area presents significant unresolved social issues: inequality and poverty. They might be visible in the form of homelessness (Tosi, 1994), ranging from the more critical forms that include sleeping rough to overcrowded housing situations or unsecure forms of tenancy and risks of eviction. Homelessness might be attributable to different reasons: migration, financial distress and economic crisis affecting the poorest groups and structural causes linked to the housing sector and its financialisation. In general, even if Milan has an economic background that is similar to Oslo, it presents differences within the housing sector, which are worth noticing. The gap between the rich and poor in access to housing as well as the risks concerning marginalisation, segregation and housing exclusion in general are much more significant in Milan than in Oslo.

The housing sector in Milan is highly financialised and has high costs; moreover, some of the stock is bought as an investment object. The Italian housing sector shares several common points with the Norwegian one, especially when comparing Oslo and Milan. First, the housing sector is significantly marketised, meaning that after the 1980s, most of the public housing stock has been sold, leaving to the market the complicated redistribution responsibility. Second, as in Norway, homeownership is the most common tenancy type in Italy, followed by the private rental market. Third, similarly, the public sector has retrenched from the production of social housing and often retrenched from the maintenance of the stock as well, leaving a very low quality of dwellings for the poorer groups. Owing to the global financial crisis, affordability has quickly become a significant issue in the housing sector: households have diminished their expenditure, and at the national level, cuts were made in public policy investments (Baldini & Poggio, 2014).

At the same time, land conversion into residential areas has considerably increased in the past 30 years, particularly in Milan and Rome. Governments and economic policies have endorsed the building sector, considering it a fundamental trigger for economic growth. The Institute for Protection and Environmental Research (ISPRA) has released in 2015 a very rich report that shows how weak the links between housing production and demography have become (ISPRA, 2015). As ISPRA (2015) underlines, in the past, population growth was positively and stably correlated with urbanisation. However, in recent decades, the link between demography and urbanisation processes is no longer coherent. The paradox here is that housing production has increased over the years but apparently not the population.

As previously underlined, land consumption (including land for housing) does not relate anymore with a real increase in population. The Italian population is actually ageing and fertility rates are at one of the lowest levels ever, whereas land consumption and the production of new dwellings have been on the rise in the past decades. This manifests through the longstanding problem of vacancy in the housing sector. The paradox, therefore, involves a population struggling to access housing owing to unemployment and tense economic contingencies and, on the other side, an underused housing stock. This problem is well-known in the housing literature and occurs both in major cities and in smaller areas (Glock & Häussermann, 2004; Hospers, 2014).

If some of the housing stock cannot be used because of private ownership, there is still the public share of housing stock to be discussed. The public sector hardly manages to mobilise funds to ensure new social housing. Municipalities could hypothetically work with the private owners to mobilise the unrented and vacant dwellings using incentives and tax discounts. In terms of the existing social housing stock, issues related to the very low level of maintenance of the dwellings exist. The public sector, by law, cannot rent out for social purposes houses with very low standards; moreover, because of the economic crisis, many municipalities have not managed to keep up with the maintenance work of their housing stock, leaving many empty unused dwellings behind. On the contrary, the over-production of the pre-crisis period has created a housing bubble in some cities in Italy, leaving many units empty.

The housing market is difficult to access owing to the rising costs both for purchasing and renting. In terms of social housing, state intervention represents a very small percentage in the housing provision: only 4.5% of the entire Italian housing stock is social housing (Boatti, Quaranta, & Tripodi, 2012). In the Milan metropolitan area, the figure is slightly more positive, where social housing accounts for 9.8% of the entire housing stock (Regione Lombardia, 2018).

The mismatch between the social housing stock and the housing needs of the Milan metropolitan area today is quite alarming. In 2012, a research group of Politecnico di Milano (Boatti et al., 2012) had estimated for the year 2018 an unmet need for social housing of ~281 000 units. The figure was very high: one third of the entire amount represents a normal and cyclical need, which includes new couples and households, divorces, etc. The rest, as underlined by the association, includes different forms of housing deprivation typical of several degrees of homelessness (Edgar, 2012). As stated in the ETHOS typology, homelessness includes both the forms of inadequate housing (overcrowded, unsecure conditions, etc.) and the most extreme forms, such as rooflessness. Regarding the most extreme forms of homelessness, the Italian National Statistics office (ISTAT) periodically releases a report including the mapping of homeless persons in the entire country, with specific data for the major cities. In the case of Milan, the count for 2014, which the latest available count (ISTAT, 2015), has a figure of 12 004 persons.

The share of social housing needed to meet the needs of the poor is significantly high. At the same time, however, the free market has an excess of ~85 000 private housing units in the Milan metropolitan area (Boatti et al., 2012). These units are plausibly vacant dwellings that are neither sold nor rented out for various reasons not explicitly stated in the data. There might be several reasons for this; we can only speculate. The economic crisis has hit different sectors, including the housing market. As a result, large-sized units are too expensive for low-income groups, and the demand for such dwellings has diminished. The supply of housing has kept increasing owing to the policies within the building sector to boost the economy and economic growth, creating an exceeding amount of dwellings on the market. In certain areas, the financial value per square meter of these dwellings might have decreased, discouraging owners from selling them. Other vacant dwellings might be the result of evictions; in other cases, the dwellings might have been re-acquired by banks as a result of unpaid mortgages. Other reasons for the presence of vacant dwellings within the Milan metropolitan area might include the high costs of renovation, which the owners choose not to bear before renting or selling the units. The presence of vacant dwellings on the market does not automatically represent an opportunity for the poor. Even if the units were to be rented out or sold, they would do so on private-market–based transactions with significantly high real estate values. This element creates quite a visible mismatch in the current housing sector, leaving open questions about the equity of the system.

The 2017 report from the General Commission on Social Policies, Housing and Disability (Regione Lombardia, 2018) underlines that the current distribution issue derives from the fact that the private housing market does not seem to be able to satisfy the housing needs of the inhabitants. The available large-sized dwellings are expensive and therefore raise difficulties for the increasing number of single-household groups to access those dwellings. One of the reasons mentioned in the report is that the housing needs have become more segmented and differentiated (ibid.). Within the definition of segmented and differentiated, we could include different phenomena. Today, people need more temporary and flexible accommodations to reflect their jobs and lifestyles. These same people who tend to relocate often and have only one income per household might not be interested in some of the expensive features offered in some dwellings (e.g. terrace, garage and double bathrooms). They might not be interested in the bigger properties available on the market. Families today are not as large as before and have become more prone to separations. Some families prefer to invest in other leisure activities, or hobbies, instead of prioritising a very large-sized dwelling.

The same report (Regione Lombardia, 2018) also mentions that the vacant housing phenomenon represents an alarming signal, which highlights the difficult distribution situation in the Milan metropolitan area. This phenomenon is referred to as an increasing misalignment between supply and demand in the housing sector and responds to the examples we just presented. Within this frame, which the report addresses as a real 'housing emergency' (ibid., p.26), the institutions have decided to reinstate forms for housing welfare. These housing welfare measures might include financial support to low-income households as well as funds to increase the share of social housing in the metropolitan area. In 2017, the metropolitan area of Milan had 144 884 social housing dwellings. Further mapping has revealed that in the sole municipality of Milan, hence excluding the rest of the municipalities in the metropolitan area, 10 900 social housing dwellings were vacant. Note that the figure of homeless people in the same municipality amounts to ~12 000 persons. The reasons for the dwellings being vacant are different: some might be simply on hold to be rented, some do not meet the quality standards set by law and some others are illegally occupied.

Regarding the environmental aspects, Milan has paid attention to the creation of green spaces for recreational purposes in urban areas and to the eco-tech advancements in the building sector that can help in reducing the environmental impacts. However, priority has been given to economic growth partly through the housing sector. This has certainly produced a higher level of ecological impacts. These impacts might have been partially decoupled through eco-tech measures (e.g. better insulation, more sustainable materials and more efficient heating and cooling systems) but have surely led to increased land use and emissions in the building phase of the sites.

4.3. Different conditions, different challenges

In the domain of environmental sustainability, the Oslo city region seems to be a forerunner owing to its more ambitious and proactive land use policies in pursuing sustainable housing and urban development. Its strategy is more in line with the eco-modernist paradigm. The Milan city region, however, is less active in adopting measures for housing and urban sustainability owing to the political priority of rebooting economic growth over environmental issues. In terms of social justice in housing development, both metropolitan areas face inequality, unaffordability and segregation issues to varying degrees. The neoliberalisation of housing policy is a common general explanation to the generation of these social issues in the two metropolitan areas. However, the growing economy in Norway helps to relieve the hardships of the poor and soothe the potential conflicts between the social groups regarding access to housing. In contrast, the passive DE condition in Italy worsens social inequality that is manifested in a more severe form than that in the Oslo region.

These similarities and differences between the two countries and between the metropolitan areas provide rich settings to explore alternative futures for housing development. The scenario building below will show that given the different baseline conditions and challenges, the scenarios manifest differently in the two cases.

5. Housing development scenarios in the Oslo metropolitan area

5.1. EM scenario applied to the case of Oslo

In the current scenario for the Oslo metropolitan area (comprising the municipality of Oslo and the county of Akershus), the population would grow during the period from 2012 to 2030 by 24.3%, which makes up a total growth of ~284 000 inhabitants. The EM scenario, following the present growth rates in the housing sector, would require 142 000 new dwellings for the year 2030. The calculations are based on the same housing distribution rate as today, which is 2.0 persons/dwelling. The future imagined for Oslo in the EM scenario is optimistic in the technology and imagines that even without challenging the current growth model, decoupling the environmental impacts produced by a growing housing stock would be possible.

5.1.1. Environment and technology in the EM scenario

In 2008, the stationary energy use per dwelling in Oslo was already high: at the rate of 1.88 toe. This decreased to 1.76 toe/dwelling by 2015. Considering the same level of consumption and the increase of dwellings required owing to the 24.3% increase of population by 2030, the total residential energy consumption would consequently increase by 17%. An increase in the per capita housing consumption in square

Table 2
Key figures of the contexts.

	MILAN	OSLO
Extension	1 575 km^2	5 000 km^2
Population	3 234 658	1 305 122
Domestic energy consumption	193 kW h/m^2 (in 2015)	172 kW h/m^2 (in 2012)
Square meter per person (dwellings)	41	50.5

meters could be assumed. However, the EM scenario aims at a reduction in energy consumption and environmental impacts, which would be especially performed by the introduction of technological measures and regulations to reduce such impacts.

To compensate for the population growth and reach a 0% increase in energy consumption by the housing sector, the energy consumption would have to be reduced to 1.42 toe/dwelling (Table 2). This value would stabilise the total residential energy consumption, even with the increase of 142 000 new dwellings from 2015 to 2030. An increase in square meters per person is assumed. Based on an increase of 1 m^2/person from 2009 to 2012, the total residential floor area per capita is estimated to be 56.4 m^2/person by 2030. This increase reflects the fact that the future imagined in the EM scenario does not imply a reduction in consumption per capita but instead allows for an increase. Thus, assuming an increase in population size, the number of dwellings and per capita housing consumption, stabilising the total residential energy consumption would mean a decrease of energy intensity from the current 172 to 124 kW h/m^2 by 2030 for the entire housing stock. Note that the latter figure should apply to not only the newly built dwellings but also the entire housing stock, which suggests the need for large-scale retrofitting of the existing buildings.

However, the latest building regulation for energy efficiency applied in Norway (TEK17) only suggests that buildings should reach an energy efficiency level of 158 kW h/m^2, which is much higher than what the stabilisation of residential energy consumption would allow. Consequently, following TEK17 would lead to a 28% increase in the total energy consumption.

5.1.2. Physical structure of the city in the EM scenario

In terms of spatial development, the metropolitan area will follow the already existing densification strategies by developing high-rise and high-density residential areas around the key public transportation nodes. This policy is already taking place, ensuring the further reduction of land consumption and the increased use of public and non-motorised transport. The Oslo city region spans 5036 km^2, including the Oslo municipality and the entire county of Akershus. It comprises 480 km^2 of urbanised areas, of which 199 km^2 of area is residential (4% of the total area). The current plans require an estimated increase of 29 km^2 in the residential area, of which 22 km^2 will take place in the outer municipalities and 7 km^2 in the Oslo municipality (based on program plans).

The way the land is disposed in the plans might include the construction of new low-density housing, especially in the municipalities in the outer areas and on the fringe of the metropolitan area. Fig. 4 shows the areas allocated for residential construction in the municipal plans of the Oslo metropolitan area. Even though many transformations are in line with the densification strategy, it is fair to question whether the transformations towards the borders and fringe of the metropolitan area actually serve the same purpose. The regional plan for the Oslo metropolitan area (Akershus Fylkeskommune, 2015) shows the green structures of the entire metropolitan area. The classification made distinguishes between three typologies: the protected forest areas (Marka), the biodiversity corridors and the farmland areas and their interconnections. According to our rough estimates, approximately 30% of the residential transformations in the Oslo metropolitan area will most likely take place on either farmland or biodiversity corridors. The rest of the transformations will occur on urbanised fringes or in underused areas.

In the EM scenario, we aim at further reducing the need for urban expansion by strengthening the densification strategy that is also applicable to the outer municipalities. The calculations we produced for the EM scenario show a different future image from the one shown in Fig. 4 (left). By 2030, a reduction in land consumption for residential construction will be observed. We assume a higher density than that estimated in the plans using one of the denser neighbourhoods of the Oslo municipality, with an average density of 13 913 persons/km^2. A centre-periphery gradient in density will still exist, with on average 50% higher density than the overall mean in the inner-city neighbourhoods of Oslo, on average 50% lower density than the overall mean in the outer municipalities of the metropolitan area and a gradual decrease in-between as the distance from the city centre of Oslo increases. The required space will only be ~20 km^2, a 30% reduction of the planned residential expansion (Fig. 4, right). The ratio of residential to urbanised area will be 46%. As visible in Fig. 4 (right), the areas will be reduced in the municipalities towards the border of the metropolitan areas and in the municipalities using valuable farmland.

An increased urbanization, of 20 km2 will lead eventually to an increase in the need for mobility. The EM-scenario considers increased mobility as progress, hence invests resources in providing better roads, trails etc. Even though the EM-scenario is able to limit the expansion towards farmland, it still requires effort and big distances for many inhabitants to reach their daily activities: work, leisure etc. The residents' travel to places they need to reach to carry out their regular activities represents an important part of the energy consumption and causes substantial greenhouse gas emissions.

Due to the much higher share of densification and a more centralized location of housing development in the EM than in the BAU scenario, estimated energy use for intra-metropolitan travel is lower in the EM than in the BAU scenario. Whereas the pattern of residential location implies an increase in estimated energy use per capita for intra-metropolitan travel increases by 32 % in the BAU scenario, the increase is 14 % in the EM-scenario. Because there is also population growth, the total energy use for intra-metropolitan travel is estimated to increase by as much as 42 % (with an even higher increase of 63% in the BAU scenario). Although some improvement in the average energy performance of vehicles is expected over the period 2015-2019, it seems evident that additional measures to promote sustainable mobility will be required in the EM-scenario, such as increased road pricing.

5.1.3. Housing distribution in the EM scenario

Oslo has a very vivid and active housing market, with rising prices per unit of floor area. In this setting, which has a high level of home-ownership, most people would access housing through financial channels (bank mortgages). In the EM scenario, neither the current consumption rates nor the distribution patterns of housing are challenged. In the case of the Oslo metropolitan area, using data from Statistics Norway, the dwelling occupation rate is estimated to be 2.0 persons/dwelling in 2012. The exact data for the distribution rate of inhabitants per dwelling is unfortunately not available for Oslo, which leaves open questions about the effective size of the households and whether they match the housing size.

A peculiar trend visible in the Oslo metropolitan area is the cohort of dwellings of size less than 30 m^2 (Fig. 5), which is in the number of 20 000. The TEK17 regulations for Norway (LOVDATA, 2019) do not set a specific minimum size for dwellings, which leaves open the possibility for smaller units. Municipalities usually set specific minimum standards, which, in new constructions, builders ought to comply to.

The EM scenario would continue following the increase in per capita floor area in a marketised housing sector. In the EM scenario, more dwellings would be available within the frame of the so-called marketed sharing economy.

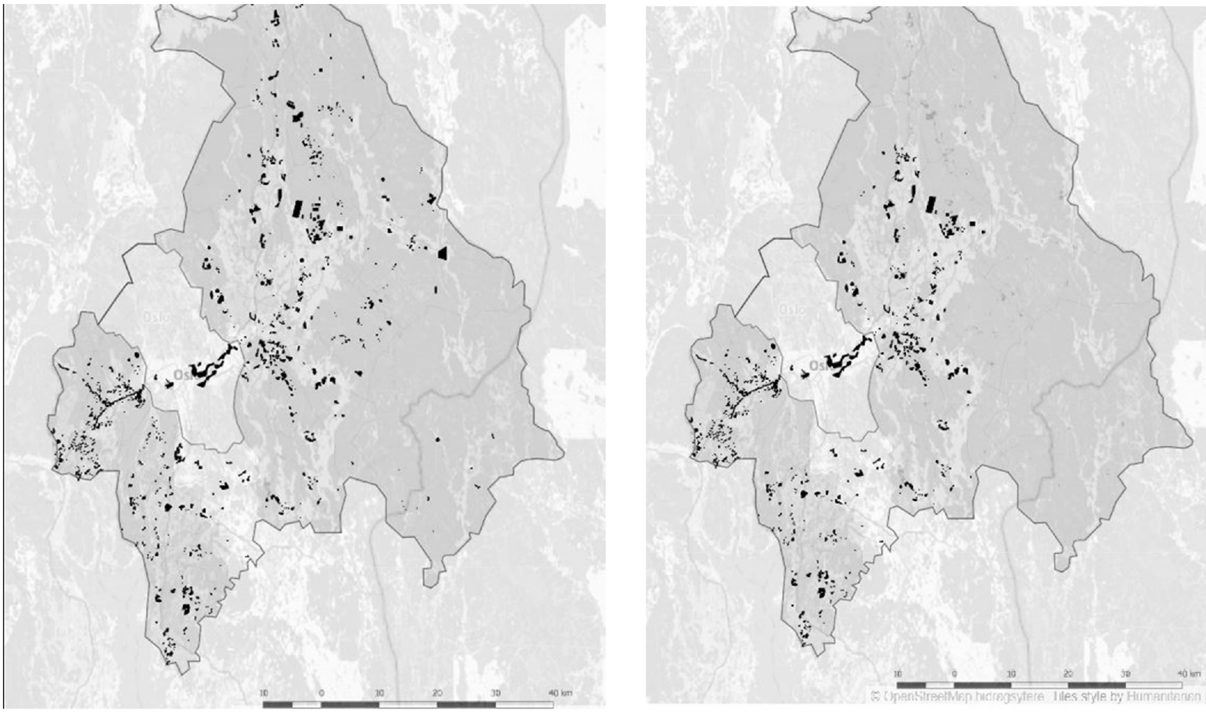

Fig. 4. New residential areas in the Oslo metropolitan area according to existing plans (left) EM scenario of new residential areas in the Oslo metropolitan area (right). Source: authors elaboration.

Regarding the social justice aspects of the EM scenario of Oslo, it is crucial to overcome what Andersen and Skrede (2017) have defined as a ‘reproduction of a segregated municipality’. Historically, the city of Oslo has been socially divided by the west–east axis. Among the measures to improve social sustainability and social justice, the Oslo municipality has promoted the densification plan and strategy. However, this densification strategy mostly takes place in the eastern area of Oslo, whereas the western part, which is more affluent and less dense, avoids much of the expected growth (Andersen & Skrede, 2017).

Following the concepts of ‘reflexive EM’ (Hajer, 1995), a broad change incorporates both the ecological concerns and economic structures of society through redistribution, social justice and democratisation (Gibbs, 2000). Therefore, the Oslo metropolitan city will boost the fair distribution of the densification strategies among the east and west and, above all, will provide a change through participatory actions involving different groups, especially the hard-to-reach ones. A more equal distribution also attempts at resolving the present lack of social justice in recent projects. The case of the waterfront regeneration is namely discussed (Andersen & Røe, 2016) as a failed attempt to apply the ‘just city’ concept. In reality, this recent development has aimed at attracting wealthy and creative classes instead of providing any social housing in this specific area. To resolve these flaws and the unjust distribution, in the EM scenario, the municipality will more actively engage in the construction phase by, for instance, promoting and regulating a percentage of affordable or social housing within new development areas and possibly the existing areas too.

In terms of environmental innovation for the buildings and neighbourhoods, these eco-tech measures will involve not only the wealthier neighbourhoods but also the low-income ones. As Gilbert (2014), the current ‘green neoliberalism’ concurs with aggravating the existing polarisations. She mentions that low-income neighbourhoods are very seldom the objective of innovation, which is typical of the green

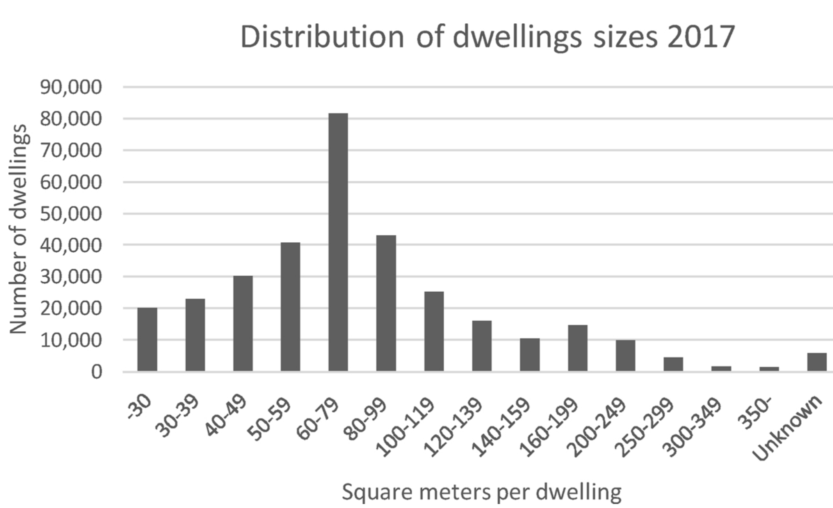

Fig. 5. Distribution of dwellings in Oslo.

agenda. To achieve social sustainability, the EM scenario in the case of Oslo will diffusedly promote eco-tech measures even in the social housing estates and in the low-income and high-density areas mostly located on the eastern side. This approach will promote social justice as well as environmental justice with the aim of improving the well-being of most inhabitants.

5.2. DE scenario applied to the case of Oslo

5.2.1. Environment and technology in the DE scenario

To achieve sustainable future housing development, a crucial difference of the DE scenario from the EM one is that the DE scenario limits per capita housing consumption in addition to employing eco-efficiency technologies. The DE scenario does not allow for growth in the total number of dwellings, thus posing challenges in the allocation of space and energy consumption and distribution. As shown in Table 4, the aim is to maintain a stable level of energy consumption from 2012 to 2030 and possibly to decrease it. For simplicity, we decided to set the value to 0%. We later analysed the data and imagined two different strategies to achieve the stabilisation of the total energy consumption.

The first strategy, as observed in the last row of Table 4, is to set the limit of square meters per person to the levels of 2012, which would still require some retrofitting to improve building energy efficiency. This would be viable if a reduction in the consumption per capita were not possible or if, for example, a transitional period towards a more radical policy is expected. The value of 50.5 m^2/person would still be quite high compared with, for instance, the case of Milan. Within the DE scenario, however, this first strategy would resemble a non-growth scenario, which stabilises the levels of per capita housing consumption.

The second, more radical strategy that would rapidly stabilise the total energy consumption would be to only set a limit on the square meters per person, which would mean reducing the current values to 44.2 m^2/person (Table 4, the second last row). This reduction in per capita consumption is quite demanding and would require both policies and regulations in place to encourage the current population to reduce their space consumption.

Nevertheless, this table quite clearly shows how high the energy consumption of our volume of housing consumption is. A reduction of 5 m^2 in our average housing consumption can have a significant impact on the environment. Moreover, this result does not include other forms of retrofitting or eco-efficiency improvements of the old housing stock. If, instead, the maximum housing consumption per person is set to the levels of 2012, the energy consumption would have to be reduced to 138 kW h/m^2, which would mean retrofitting 89 000 dwellings (12% of total dwellings). If we add to the reduction in energy consumption deriving from the retrofitting policy, the reduction in total energy consumption would be even more significant. Our investigation unfortunately lacks adequate data on the future application of clean energy and renewables in residential areas. Including these sources within the ones that we currently use and envisioning more efficient use of the energy resources is quite crucial and can be an object of a more specific future investigation.

5.2.2. Physical structure in the case of Oslo

According to our estimations, following the DE scenario, it is possible to imagine a future wherein there is a decrease in the per capita housing consumption. Such a decrease will allow avoiding new constructions for residential purposes beyond what is required to replace the existing dwellings demolished within the time horizon of the scenario. In the DE scenario, suburban dwellings at unfavourable locations from a sustainability point of view will be demolished instead of being renovated when they get worn down. The built environment in such neighbourhoods will then gradually be ‘given back’ to nature or, when soil conditions allow, will be converted into farmland. The neighbourhoods in question will partly be the residential areas in the outskirts of the metropolitan area with poor public transport access and/or the neighbourhoods that are fragmenting continuous natural and outdoor recreation areas. The dwellings to be demolished in the DE scenario will partly be those in villa areas adjacent to the inner city of Oslo, where existing single-family houses will be replaced with dense apartment buildings.

The new densities in these transformed areas will be similar to the average inner-city density in the EM scenario. As a result, despite no net increase in the housing stock, the dwellings in the DE scenario will on average be located closer to the city centre of Oslo and in denser neighbourhoods than in the present situation. Because the demolishing of environmentally unfavourable dwellings in the outskirts of the metropolitan area will incrementally take place over a longer period (tentatively, about 30 years) than the 2030 time horizon, only a few of the peripherally located residential areas will be completely depopulated and converted into non-urban land within this period, whereas the population density of several other unfavourably located residential areas will decrease as some of their existing buildings will be demolished. We therefore estimate that the size of the residential areas in the Oslo metropolitan area will be reduced by 0.25% by 2030 in the DE scenario (i.e. from 199 to 198.5 km^2), whereas the mean distance from the inhabitants’ dwellings to the city centre of Oslo will be reduced by 2%. Owing to the high population growth in the study period and the slight reduction in the size of residential areas, the average population density of the residential areas will increase by as much as 25%. (Similar replacement of older, unfavourably located office buildings with new, eco-efficient buildings in the high-density areas closer to the city centre will take place for specialised office workplaces in the DE scenario.)

Fig. 6 is a clear contrast to the EM scenario (Fig. 4, right) and the residential expansions of the current plans of the Oslo metropolitan area (Fig. 4, left). The DE scenario is based on a more urban and dense development of cities. As mentioned earlier, different from what has been advocated by some DE proponents of decentralised human settlements, our DE scenario emphasises a centralised and dense urban structure as the environmentally sustainable spatial structure. Because no non-developed land is appropriated for residential purposes, the DE scenario leaves farmlands and biodiversity corridors available for their current use.

The approach we chose for the physical and territorial aspects of the DE-scenario also lead towards a different future in transportation policies. Instead of facilitating mobility, policies in the DE-scenario revolve around proximity and sufficiency in the mobility practices. The strong urban containment resulting from not developing any new residential areas in the DE-scenario contributes to considerably lower transportation energy use and emissions than in the EM-scenario. Nevertheless, the DE-scenario would need more investments in the current infrastructures, given that a population increase is assumed. This would result as well in increased consumption, but would also aim at transportation policies with an eye for proximity and vicinity of services, works, leisure.

In the DE-scenario, no further urban expansion takes place and there is also no growth in the housing stock. However, as mentioned above, there is a replacement of unfavorably located peripheral dwellings and low-density dwellings in neighborhoods close to the city center with dense apartment buildings in the latter areas, resulting in a slight reduction in the metropolitan residents' average distance to the city center of Oslo (as well as to lower-order centers). Other things equal, the per capita travel distance by car is estimated to decrease by 1.5 % and by transit to decrease by 1.1 %. Overall per capita energy use for intra-metropolitan travel is estimated to be reduced by 1.4 %. Compared to a 7.9 % increase in the BAU scenario and a 3.6 % increase in the EM-scenario, this is a more favorable result, seen from an environmental perspective. However, due to the presupposed population growth, the estimated total energy use for intra-metropolitan travel still increases by 22.6%. As mentioned in the discussion of the EM-scenario, improvement in the average energy performance of vehicles is not

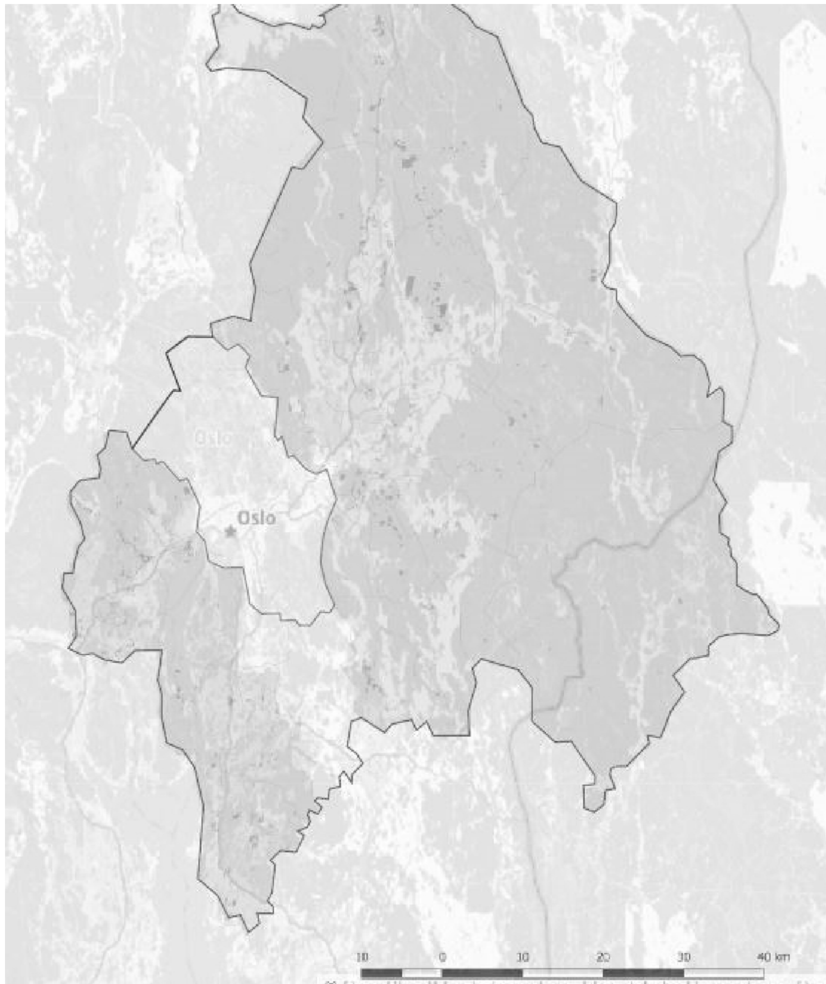

Fig. 6. DE scenario in Oslo. Source: authors elaboration.

taken into consideration in these estimates. With expected vehicle energy improvements, the DE-scenario may be able to keep energy use more or less constant. However, in order to obtain a substantial reduction in transportation energy use, additional measures will be required, such as more extensive road pricing, reduced parking availability, awareness campaigns, and maybe quota for maximum car driving distances.

Housing distribution in the DE scenario

Housing is not considered a right by law in Norway (Andersson et al., 2010). There are different degrees of assistance provided to the poor and of obligations that municipalities need to comply to. For instance, municipalities must respond in case of housing emergency or when the situation is acute or extreme. Some of the units from the social sector therefore are intended for the sole use of people facing critical situations. In the EM scenario, no specific measures are aimed at containing the housing prices in the capital, which make the market inaccessible to some groups. The mismatch between income and housing prices has increased over time (ibid.). Even though interest rates might be stable, with the incomes growing slowly and housing prices growing fast, the market becomes prohibitive, especially for single parents and young adults.

The marketised housing sector is challenged in the DE scenario that aims at changing the structure of housing and its finacialised aspects. The main aim of the economic aspects revolving around housing is to ensure the well-being of the inhabitants and accessibility to housing to all groups. In the DE scenario, economic measures will be in place to equalise the incomes and the consumption per capita of square meters through taxation and consumption cap for housing.

In this scenario, the city region will have a distribution in which household size more fittingly corresponds to the dwelling size, thus reducing the risk for unfair distribution and overcrowded situations. This will be achieved by regulations imposing a cap on consumption per person. These measures will allow a broader mix of inhabitants in the different neighbourhoods and could potentially help in solving the historical pattern of segregation (Andersen & Skrede, 2017) existing between the eastern and western parts of Oslo. Oslo presents a financialised housing market wherein some areas of the city are exposed to the risk of investment finance, making significant part of the stock unavailable for rent or sale. Within the DE scenario, housing will become a part of the welfare care and a right by law, differently from today and the EM scenario. In this context, housing units will not be kept as financial objects, and supposedly, this will be a further step to gain more social justice in the city.

Similarly to the EM scenario, the social justice aspects meet the environmental justice ones: eco-tech measures to improve the performance and ecological standards of the housing stock will be available for all types of neighbourhoods ranging from low-income to wealthy ones.

6. Housing development scenarios in the Milan metropolitan area

6.1. EM scenario applied to the case of Milan

Within the EM scenario, Milan will attempt to keep its economic growth rates rising. The growth rates will apply to the economy at large but will most certainly have repercussion on the housing market, which will be growing. The EM scenario will follow a middle demographic growth projection, with a population growth of 4.8% by 2030 from 2015 (extrapolation data available from 2001 to 2022 for the Milan metropolitan area). Within this scenario, the housing stock will keep growing, meaning that new constructions are welcome to meet the need deriving from the projected population growth. In the EM scenario, housing will be still a commercial, tradable good having significant financial implications. Housing will represent a significant share of the internal economy of the city in terms of both economic values in the building sector and in its real estate values. A housing sector dependent on physical growth assumptions means the addition of an important variable: no limits will be applied to the per capita housing consumption in the EM scenario and will therefore keep growing.

6.1.1. Environment and technology in the EM scenario

The Italian Ministry of Economic Development (MISE), in accordance with the Ministry of Environment, has adopted the European Commission's proposal for environmental constraints for 2030. The goals are clear: 1.5% of total energy annually needs to be spared, emissions need to be lowered by 33% compared with the 2005 levels and renewable energy sources need to reach 27% of the total energy use (MISE, 2017). What is crucial is that this level of reduction in energy consumption (1.5% annually) implies a reduction of 9 MToe by 2030. The Italian MISE very clearly indicates that the residential sector is indeed the sector that needs to reduce its current energy consumption the most. In the estimates, the residential sector will need to take on 34%–38% of these reductions.

In Milan, the energy efficiency level for residential use has worsened from 171 kW h/m^2 in 2008 to 193 kW h/m^2 now (Odyssee-Mure, 2019). These figures do not include secondary energy uses linked to housing: for instance, transport energy consumption resulting from the residents' need to travel as well as the energy needed to renovate a dwelling, let alone to build it. Given the fluctuations in the per capita housing consumption (m^2/person), the total energy consumption might possibly be even higher than the estimates.

Under the current conditions, in Milan, the average number of persons per dwelling is 2.04 (Dati Open, 2019). Hence, by 2030, following the demographic projections and the current trend of distribution of population, we estimate that the Milan metropolitan area will need ~172 000 new dwellings to accommodate the surplus. Given no specific changes in terms of technology, the total energy consumption owing solely to population increase will thus continue increasing by an additional 5% by 2030. In addition to the need of housing for the projected new population, there will be an increase in the consumption per capita (m^2/capita). According to statistical trends, we considered that in 10 years, the consumption per capita will increased by 4.5 m^2/person; therefore, a continued trend will allow a final estimate of housing consumption of 46 m^2/person by 2030.

The EM scenario for Milan needs to meet the ambitious goal established by the European Commission and ratified by the Italian MISE. Given the increase in dwellings described above, this will require a reduction of toe/dwelling from 1.40 in 2015 to 1.20 by 2030. This reduction in domestic energy consumption will be achieved by introducing measures to eco-proof the dwellings, thus reducing as much as possible the energy consumption and energy losses. The threshold value that ensures no energy consumption increase even if all the new dwellings are to be built is 163 kW h/m^2. A consumption of 1.20 toe/dwelling will mean a reduction of 14% in the energy consumption per dwelling and will ensure a reduction in the total domestic energy consumption (Table 5).

6.1.2. Physical structure of the city in the EM scenario

The EM scenario requires increased and significant land consumption to meet the demand of housing owing to population growth. As discussed in the housing distribution section, the household composition is not challenged. As we anticipated in the previous section, under present conditions, more and more households comprise single inhabitants owing to cultural as well as social changes in society. In the EM future of Milan, the physical repercussions of these demographic changes would first occur through a more intensive use of the present housing stock. The policies for densification would aim at increasing the high-rise housing in the city center and in the areas of major pressure. The city and its metropolitan region would need to develop the currently underused areas. The metropolitan plans would develop the areas already assigned to growth along with the development areas in the municipalities, which compose the greater metropolitan area of Milan.

Reflecting further on the land consumed for new residential areas, we gather significant data from the Strategic Plan of the Metropolitan City institution of Milan (Città Metropolitana Di Milano, 2016). The strategic plans provide insights on the size of future residential transformations and their location and proximity to natural areas. Today, the total residential area of the Milan metropolitan area accounts for 274 km^2. According to the plans, the new residential transformations will be conducted over a total area of 26 km^2, 60% of which will be on already urbanised land and 40% on natural land. The total residential area will account for 19.1% of the total metropolitan area or 47% of the urbanised area.

The EM scenario will assume higher land use efficiency, as demonstrated in the plans. We set the average density of all new housing to the levels of the inner core of Milan, which presents a density of 12 649 persons/km^2, but with higher densities in the more central and lower densities in the more peripheral parts of the metropolitan area. With this high density, only 11.6 km^2 is needed for the new residential

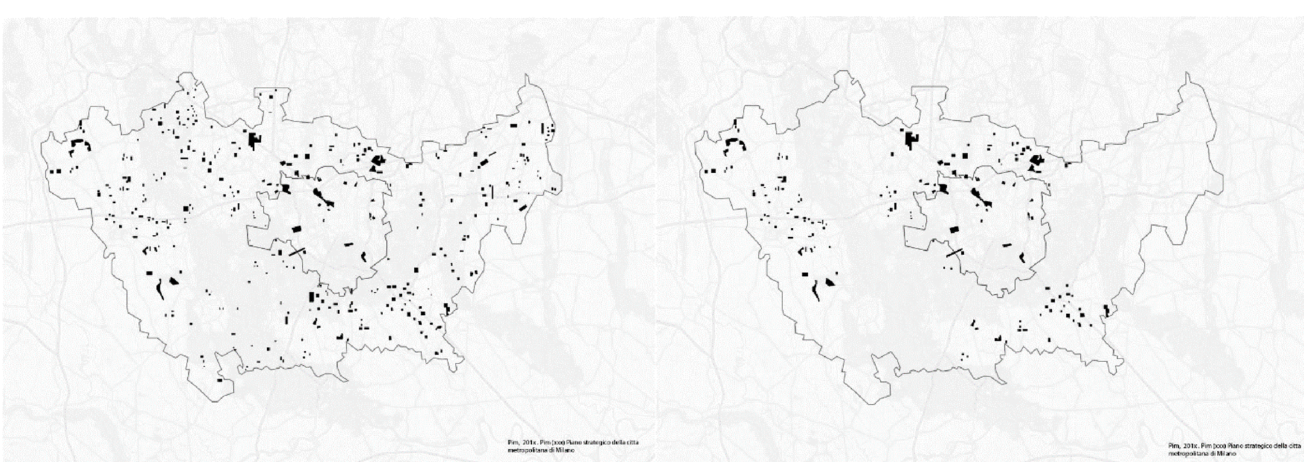

Fig. 7. Current plan (left) and EM scenario (right). Source: authors' elaboration on the Piano Strategico Metropolitano (Città metropolitana di Milano, 2016).

areas. This is less than 60% of the 26 km^2 configured by the municipal plans and strategic plan, which means the residential areas can all be constructed on urbanised land (Fig. 7, Figureright). The 11.6-km^2 increase will increase the total residential area to 286 km^2 by 2030. The residential area will account for 18.2% of the total area and 45% of the urbanised area. This increase will first take place in the underused areas within the core municipality or in already urbanised areas in the metropolitan suburbs. The high density strategy and the consequent reduction in required residential areas will allow us to exclude from the map all the areas that require the use of natural land.

According to the current estimations made by the Strategic Plan for the Metropolitan Area (Città Metropolitana di Milano, 2016), ~10 km^2 of the total 26 km^2 of new residential expansions will indeed happen on the so-called available land. This available land is a mix of underused urbanised areas and farmland. Maps clearly show that transformations towards the outer parts of the metropolitan area tend to mostly affect the farmland. These transformations appear to happen on the borders of the small municipalities, thus expanding villages and small cities far from the centre. This will result in a threat for the farmland, which is already quite impacted by urbanisation processes. On the contrary, regional parks and protected areas are excluded and protected from this process. Nevertheless, the impact of urban transformations on farmland is quite significant. The EM scenario aims at reducing such a threat and, by requiring ~11 km^2 of new residential areas for the future, it can indeed condense the need for new housing within the already urbanised areas. This is possible based on the figures shown by the strategic plan that has mapped a residual sum of urbanised areas, which can benefit from renovation processes.

The EM-scenario for the Milan area requires also an assessment of transportation and mobility for the future needs of the inhabitants. Because new dwellings constructed over the period 2015-2030 make up a much smaller proportion of the existing housing stock in the Milan than in the Oslo case, the differences between the scenarios in terms of energy use for intra-metropolitan travel are smaller in the Milan case than in the Oslo case. The EM-scenario is still characterized by a considerably higher emphasis on densification and a more centralized location of new housing construction than in the BAU scenario. Therefore, motorized travel distances per capita by car as well as by transit, and the related energy use for intra-metropolitan travel, could be expected to be somewhat reduced in the EM-scenario compared to the BAU. And since population growth is moderate, only a slight increase from 2015 to 2030 in the total energy use for intra-metropolitan travel could be expected.

6.1.3. Housing distribution in the EM scenario

Regarding the distribution aspect of the housing sector, in the EM scenario, the authorities will not promote housing policies targeted to reduce consumption and to promote better distribution of the housing stock. On the contrary, they will not intervene in the market but may provide housing for the people in need and the groups that are unable to enter the market. Authorities will encourage, or at least not stop, marketed forms for sharing economy, such as the Airbnb model and other public or private initiatives. The public sectors can make development agreement with developers to guarantee certain share of social housing in new housing projects, which is partially ongoing in the current state.

According to further statistical analysis on the Italian census data (ISTAT, 2018), the average square meters per person in Milan is 41.46. Some peculiarities are evident in the distribution of inhabitants per dwellings. Fig. 8 shows that in all the size categories, houses with only one inhabitant are common. This per se does not indicate a mismatch between the housing sector and households. Nevertheless, towards the right end of the graph, for the larger sized dwellings (80–150 m^2 and more), the share for one or two inhabitants can indicate a potential for a more equal distribution. Of all the dwellings larger than 80 m^2, 31% are inhabited by a single person. For the dwellings smaller than 80 m^2, 54% are inhabited by a single person.

Building regulations for Milan (Di Milano, 2016) set a minimum size of 30 m^2 per dwelling and do not consider basements that are below the ground level as dwellings. Moreover, regulations in the past for bathrooms have imposed the presence of a window for ventilation, denying the possibility of smaller bathrooms and blind toilet units. These specific regulations for the dwellings have contributed to increasing the minimum legal size, expressed in square meters, of a dwelling.

The EM scenario aims towards a more participative and democratic approach. This is part of the typical EM approach to social justice. Inclusion and participation are in fact part of procedural and process justice. Regarding the goals of EM, the achievement of an equal and socially just housing future needs to acknowledge the importance of matching the housing structure with the population structure as much as possible. This means recognising the households' sizes and the dwellings' dimensions to avoid overcrowded situations or, on the contrary, excessive use of space.

The trends under current conditions point towards an increased share of single-parent families, more people living alone and scarce policies towards the adaptation of the current housing stock to societal changes (i.e. remodelling of the dwellings). The existing housing stock also presents an interesting share of adequate- to large-sized dwellings (in the range of 60–79 m^2) inhabited only by a single person, as observed in graph 3.

The EM scenario aims at a just housing sector by applying measures to discourage the disparity at the edges of the chart (graph 1). In particular, the EM scenario intervenes by implementing and increasing welfare policy measures targeted towards vulnerable people and the homeless. Thus, the EM scenario will implement further measures to reinstate more interventions of the institutions within the social housing stock by increasing funds and rehabilitating empty dwellings. Measures may include taxation instruments, incentives, regulations and policies. Moreover, the EM scenario will extensively include the forms of 'marketed' shared economy that may help in resolving the mismatch. This will give more incentives to the subdivision of bigger units and to renting parts of it. The negative externalities of the distribution trends will be reduced by the intervention of government and public institutions to prevent and solve homelessness, overcrowded situations, energy poverty, etc. However, the institutions will not prevent the private market from growing or producing dwellings that do not meet the societal needs of the inhabitants.

6.2. DE scenario applied to the case of Milan

6.2.1. Environment and technology in the DE scenario

As shown in the EM scenario, the goal of reduced energy consumption in the residential sector is achievable only if the parameter of 157 kW h/m^2 is met (Table 5). In the DE scenario, technological innovation is not the sole intervention that the achievement of the goal would rely on.

In the DE scenario, to illustrate the effect of redistribution of housing, we have kept the numbers of dwellings and average dwelling size in 2030 equal to those in 2015. The result of the DE scenario is a 14% reduction in the total consumption as opposed to the 4% reduction in the EM scenario (Table 6). The DE scenario entails a reduction in square meters consumption per capita. In the case of Milan, we decided to perform some simple calculations to hypothetically show what maximum square meters per capita redistribution will nullify the need for the construction of new housing according to projected population growth. This exercise, which is in no way to be taken as very accurate, shows that by decreasing the per capita consumption from 40.8 to 39.0 m^2/person, the housing stock will allow to take in even the projected population growth in the existing housing stock.

Without additional housing construction, the DE scenario gives the chance to roughly diminish the total energy consumption by 14%. Moreover, the additional energy burden caused by other impacts of

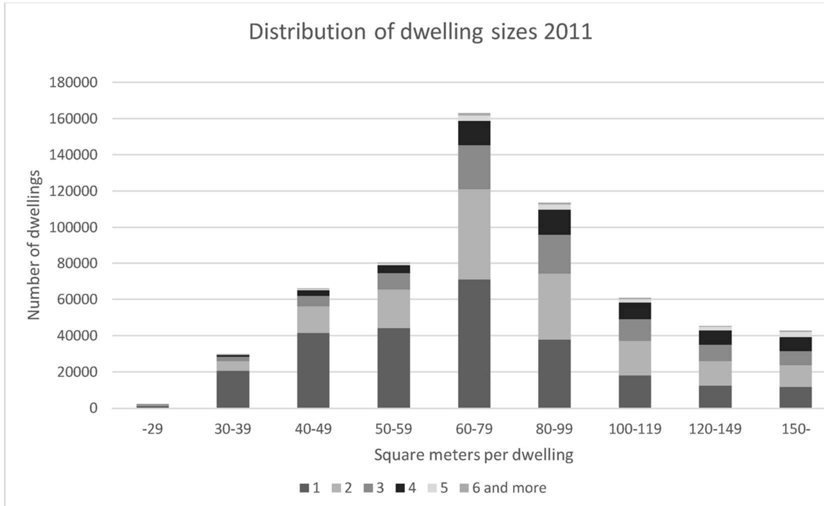

Fig. 8. Residents in different dwellings sizes.

housing – in the building phase, during renovations and in its final demolition phase – as well as other impacts (biodiversity loss and impacts from the construction of housing materials) will be completely eliminated if the future stock will not increase. Further, in addition to a cap in consumption, we consider that retrofitting and ecological efficiency measures will result in more energy saving in a relatively short time span.

6.2.2. Physical structure in the case of Milan

Through reduction in the per capita housing consumption from 41 to 39 m^2, the DE scenario nullifies future expansion of residential areas. Within this future image, the total areas used for housing in 2030 in the metropolitan areas of Milan will stabilise at the level of 2015, which was 275 km^2 with no increase. In this way, the estimated residential area completely avoids the 4% growth estimated in the EM scenario or the 9% growth given by the original municipal plan. Similar to the Oslo DE scenario, existing dwellings that are environmentally unfavourably located and have reached a stage where they would need to be significantly renovated will not be modernised or replaced with new buildings on the same plots. Instead, such relatively worn-down dwellings will be replaced with new, energy-efficient dwellings in the urban core (such as the areas shown in Fig. 9, right), resulting in additional environmental and social benefits. Because the to-be-demolished dwellings are scattered on individual plots in many different residential areas, only a few and small areas will be 'given back' from urbanised land to natural areas or farmland. We therefore estimate that the total size of the housing areas will only slightly decrease by 0.25% (as in the Oslo case) – that is, from 274 to 273.3 km^2. Thus, this scenario, as we designed it, does not require new expansions. Hence, the risk of threatening the biodiversity by building processes and urbanisation is significantly reduced. In addition, some small areas at the urban fringe are converted from urban land to forest areas or farmland.

Since the DE-scenario implies that no increase in the building stock and only small changes in the residential location patterns take place compared to the 2015 situation, the inhabitants' average distances to the city center of Milan as well as to lower-order centers will only be slightly reduced, compared to 2015. Other things being equal, energy use for intra-metropolitan travel therefore will also be only slightly reduced. Due to population growth, energy use for intra-metropolitan travel will still be higher than in 2015. Moreover, since the EM-scenario but probably also the BAU scenario implies a somewhat more centralized pattern of housing construction than in the 2015 situation, the DE-scenario of Milan implies, other things equal, a higher amount of motorized intra-metropolitan travel than the EM-scenario and probably also than the BAU scenario. There will be a clear need to compensate this by measures such as road pricing, reduced parking opportunities, quota for maximum car driving distances, and general awareness raising.

6.2.3. Housing distribution in the DE scenario

The DE scenario requires a discussion on the distribution of housing itself and the way we consume and produce housing today. The challenges of today's housing distribution in the context of Milan are multiple and complex.

In the DE scenario, the unbalanced and unfair distribution characteristics of the current housing sector would be tackled. This primarily means addressing the needs of the poor and addressing in general the present mismatch. In this regard, the state, through the Milan metropolitan area institutions, would need to primarily resonate on the current share of social housing available. The average share of 9.8% can be enhanced without necessarily adopting new building sites. Actions and policies aiming at renovating the old housing stock would help

Fig. 9. Maps of planned housing scenarios in Milan. Planned transformations (LEFT), transformations in the DE scenario (RIGHT).

bring back a valuable share of units. As previously mentioned, according to the estimations of the Regional Council (Regione Lombardia, 2018), 10 900 social housing dwellings are currently vacant in the Milan metropolitan area. Social housing units that do not meet basic quality standards cannot be rented out by law.

In the DE scenario, distribution is rethought and aligned with the main goal of seeing housing as a welfare right, together with the right to health care or education. Hence, the goal would be achieved by mainly rethinking the current way of distribution of the housing. The redistribution of the housing stock according to specific policy actions and regulations would only be possible under circumstances that are specific to the context of active DE. Differently from the EM scenario, a policy of active DE in the housing sector aims at the redistribution of the existing housing stock.

The current distribution of the housing sector can possibly be improved by reducing the average residential space per person. For example, a rough estimation shows that by increasing the average number of persons per dwelling to 2.5, the need for new housing according to the population projections eventually would be nullified. This value does not represent an accurate or absolute figure, but it has the purpose of exemplifying the possibility given by the reduction in housing consumption. Reaching this figure would require incentives, for example, for co-housing and reducing the share of vacant apartments. Such measures would, however, depend on specific social and technical processes: a major willingness to share and dwellings fit for the purpose (the remodelling of dwellings and their retrofitting would help in this sense). The measures could include the subdivision of spacious dwellings into smaller units according to the number of inhabitants and needs. At the same time, there would be a risk of even more severe marginalisation of the housing for the poor if specific policies are not in place. It could increase the risk of overcrowded and inadequate forms of housing, thus increasing the share of homeless people. According to the ETHOS typology (Edgar, 2012), inadequate housing and overcrowded conditions correspond to a first form of homelessness. If policies to ensure minimum housing standards as well as policies for improving the overall quality of the dwellings are not in place, risks for the poor might increase.

According to our estimations, a maximum cap in per capita consumption could also reduce the need for the construction of new housing. If the cap is extended to all inhabitants, the risk of creating more marginalised groups and people at risk of homelessness would significantly decrease. The same applies to setting a minimum standard, which is another way to secure the welfare right of the poor. The estimate that would nullify the need for new housing is 39 m^2 on average per person in the Milan metropolitan area, which could be quite controversial. This figure would need to be considered in a context in which the housing sector would be decommodified from the current market logic.

7. Discussion

Based on a strong normative assumptions regarding the future of housing development, we have developed two explorative scenarios in each case (Milan and Oslo). The EM scenario has been demonstrated to be the conservative one, whereas the DE scenario represents a radical approach. The two types of scenarios present some similarities in certain aspects but also significant differences, limitations and challenges. In this section, we will briefly reflect on the general limitations, challenges and potentials of materialising the two scenarios within the current socio-economic and political contexts. This reflection is not meant to be extensive but aims at discussing the potential implications for societal reforms or transformations.

First, we present some general considerations derived from our analysis and scenarios. In general, we observe some significant differences in the housing sector and the consumption habits of the population of the two city cases. The Milan metropolitan area does not present a particularly high projected population growth. According to our data interpolation, the scenario for 2030 will present a plausible population growth of around 5%. The population of Oslo, on the contrary, according to the projections of the national statistical institute, could increase by 24%. The population figure is an interesting and significant element in both cases. In Milan, the discussion on the real housing needs leads to a discussion on the better use of the current stock and eventually a decrease in new construction to avoid the risk of vacant units. In Oslo, apart from a reflection on the needs for housing for the expected increased population, the scenarios have helped define how the per capita housing consumption matters and how a decrease in today's housing consumption could drastically reduce the need for new construction.

A reflection on the environmental impacts of the two scenarios is compelling, given the differences in the per capita housing consumption in the EM and DE scenarios. As shown in Table 4 and Table 6, the best results in terms of reduction of environmental impacts are given by the DE scenarios both in Oslo and in Milan. In the context of technological optimism, as in the EM scenario, which is a future in which technology is supposedly able to decouple to its best ability the environmental impacts of residential energy consumption, it is interesting to observe whether technological improvement is sufficient to counteract the environmental impacts. We will start with the potential and limitations of the EM scenario, followed by those of the DE scenario.

7.1. Potentials, limitations and challenges of implementing the EM scenario

7.1.1. A stricter and higher building energy standard than today is necessary

Even though housing consumption is not encouraged in the EM scenario, the trend will remain the same as today. This means that up to 2030, the average per capita housing consumption will keep increasing by 13% in Milan and 17% in Oslo (Table 3 and Table 5). In the case of Milan, the reliance on technological progress to stabilise residential energy consumption while accommodating a growing housing stock (owing to growth both in population size and per capita housing consumption) will require considerable decrease of energy consumption per square meter to meet their goals of energy saving. Note that this decrease in energy intensity has to be applied on the total housing stock, including the existing housing stock, and not only on new residential buildings. Enforcing higher building energy standards for real estate developers to comply with and initiating large-scale rehabilitation processes for existing residential buildings may pose enormous challenges. These challenges apply to Oslo too. To achieve zero growth in total residential energy consumption in Oslo, the average residential energy intensity has to be reduced to 124 kW h/m^2 compared with

Table 3
EM scenario in the Oslo metropolitan area

EM scenario	Population	Energy intensity of residential buildings	Square meters per person	Increase in total energy consumption from 2012 to 2030
Year	persons	kWh/m^2	m^2/person	%
2012	1 169 539	172	50.5	
2030 (0% increase)	1 453 335	124	56.4	0
2030 (TEK17 on new buildings)	1 453 335	158	56.4	28

172 kW h/m^2 in 2012 (Table 3). However, even applying the most up-to-date building standard, TEK17, that requires an average energy intensity of 158 kW h/m^2 for new buildings is not sufficiently efficient to achieve the goal. A stricter and higher building energy standard is necessary.

Underlining this result is important because it shows that even a consistent and continuous effort in applying eco-tech measures, such the TEK17, will not be sufficient in the long run to create a sufficient level of energy reduction. To achieve zero increase by solely applying the TEK17 standard, 71% of the housing stock will need to meet the requirements. Hence, the sole application of the TEK17 standards to new dwellings will not be sufficient. An alternative for decreasing the total energy consumption involves retrofitting the existing housing stock. Considering the total of 71% of the housing stock that will meet the requirements, ~376 000 or 64% of the 2012 housing stock in the Oslo metropolitan area will have to be retrofitted. Within the time frame of 2030, such extensive intervention on the existing housing stock in the Oslo metropolitan area seems unreachable, thus putting at risk the goal of the EM scenario.

The dominance of the private sector may hinder the implementation of stricter environmental policies

Achieving higher building energy efficiency may technically be possible. The challenge may lie in the implementation of the technology on a larger scale and within a short time frame. In the EM scenario, the market is considered to play the central role in innovating and disseminating eco-technologies, enabled by the public sectors. It is, however, questionable whether the private sectors are sufficiently ambitious and motivated for, and capable of engaging in a rapid transformation process. In particular, when neoliberalism dominates the political system, as is the case for the two cities, the government lacks effective mechanisms in implementing actions that are urgently needed. The rising power of private sectors in the negotiation with the public sectors often prioritises profits over environmental concerns. In Oslo, for example, housing developers refuse to build climate-friendly residential buildings in locations where they consider this to be unprofitable (Andersen & Skrede, 2017).

7.1.2. Long-term energy efficiency improvement is technically challenging

The challenges for fully implementing the EM-scenario for environmental sustainability may not only lie in reforming the institutional settings to mobilize private sectors as discussed above, but also the entailed continuous efforts in enhancing building energy efficiency so long as the housing stock is increasing. Although the scenarios in this study have a time horizon of 2030, growth in the housing stock is expected to continue. Hence, attempts at further increasing energy efficiency will be necessary. However, further improvement in efficiency is argued to be more technically and institutionally challenging than picking up the 'low-hanging fruits' at the outset of a low energy efficiency. Moreover, it is not sufficient merely to stabilize total residential energy consumption at the level of 2012/2015. Reaching a sustainable future requires reduction in total energy consumption. As shown in the case of Milan (Table 5), to reduce the total energy consumption by only 4% would require a much higher efficiency improvement than that with a zero-growth goal.

7.1.3. Limitations of eco-efficiency technology in protecting land, materials and biodiversity

So far, our scenarios have only focused on residential energy consumption as an indicative example of environmental impacts. In comparison, other housing-related environmental impacts, such as land loss, biodiversity loss and raw material consumption, are more difficult to be decoupled from a growing building housing stock using efficiency measures. The physical existence of buildings has to rely on materials and land, regardless of how eco-efficiently they are built. Any environmental gains from a more efficient way of using land and building materials are in a relative sense, compared with a sprawling and resource-demanding development. Moreover, associated infrastructure and services related to residential buildings will eventually increase. New constructions will in any way put more strains on resource extraction and land consumption.

7.1.4. Dilemmas between environmental sustainability and social justice in housing in a neoliberal context

As mentioned in section 5, the theory of EM has mainly approached the justice issue from a procedural dimension. However, a just process will not necessarily lead to the just outcome that is our concern here (Fainstein, 2010; Purcell, 2009). With a point of departure that distributive justice in housing is to be achieved in the EM scenario, we aim at inequality reduction in housing distribution and security of everyone's access to housing. Nevertheless, increased housing consumption in Oslo and Milan might be compatible with the environmental sustainability goals for a certain period ahead but hardly for 100 or 200 years into the future. Moreover, the EM approach, relying on the trickle-down effect plus a social security net, may secure welfare for the Oslo and Milan inhabitants, but the consumption of finite resources of wealthy cities might have a repercussion on poor people.

To guarantee that everyone reaches a basic housing and living threshold, the EM scenario has drawn on the trickle-down mechanism so that the benefits from a growing economy will eventually 'fall down' to the least well-off. This will be achieved through limited welfare policies targeted only towards the homeless people and vulnerable groups. Arguably, the trickle-down mechanism widens the gaps between the rich and poor through accruing more benefits to the rich (Woodward & Simms, 2006). This suggests an internal contradiction between achieving inequality reduction and security of basic needs satisfaction through a trickle-down mechanism. For the EM scenario to achieve a more equal housing consumption, more active redistribution policies have to be in place. However, if housing distribution sticks to a neoliberal principle, as what is currently applied in Oslo and Milan, the public sector has limited room to play an active role in intervening in the distribution process. Returning to the Keynesian approach that designates a strong state interventionism will more effectively tackle the inequality issue, but this is contrary to the currently dominant political ideal. In addition, improving the housing conditions of the poor while maintaining or even increasing inequality can only be possible on the premise of economic growth. A higher economic growth rate will pose more challenges in decoupling it from the negative environmental impacts through eco-efficiency improvements.

7.1.5. Easier to be accepted politically and by the wider public

Despite these challenges, the implementation of the EM scenario is advantageous in terms of a high level of cultural, political and institutional acceptance. Increasing the energy efficiency of buildings (e.g. through better insulation) requires smaller behavioural changes of consumers than shifting to live in smaller dwellings. In Oslo, the generational shift in residential preferences from suburban single-family houses to inner-city apartment buildings provides a favourable cultural condition for the implementation of densification and the promotion of dense living. Furthermore, taking housing mainly as a commodity does not challenge its symbolic character as a social status good, which is in line with the basic rationality of a competitive, capitalist market society.

7.2. Potentials, limitations and challenges of implementing the DE scenario

7.2.1. More efficacious in achieving environmental sustainability by reducing consumption level

Compared with the EM scenario, as suggested in Table 4 and Table 6, the DE scenario is more efficacious in achieving the goal of stabilising residential energy consumption because it includes reduction in per capita housing consumption in addition to energy efficiency measures. In the case of Milan, a decrease in per capita housing

Table 4
DE scenario in the Oslo metropolitan area.

Scenarios	Population	Energy intensity of residential buildings	Square meters per person	Increase in total energy consumption from 2012 to 2030
	persons	kWh/m^2	m^2/person	%
2012	1 169 539	172	50.5	
2030 (Limits to square meters per person)	1 453 335	158	44.2	0
2030 (Limits to square meters per person & retrofitting to TEK17)	1 453 335	138	50.5	0

consumption from 40.8 to 39.0 m^2 will nullify the need for new housing construction. In Oslo, changing the per capita consumption from 50.5 to 44.2 m^2 will nullify the need for new housing and thus maintain the same level of total residential energy consumption. If reduction in housing consumption is combined with energy efficiency improvement in buildings, it will be even more efficacious in reducing the total residential energy consumption. Other advantages of achieving environmental goals through addressing 'sufficiency in consumption' include the relative ease in tackling other types of environmental impacts such as the aforementioned raw material consumption and land consumption. Strains on resource extraction and land conversion will be largely minimised.

The DE scenarios of the present study imply that there is no increase in the number of dwellings in either of the metropolitan areas; instead, the average number of inhabitants per dwelling is increased. In addition, the DE scenarios slightly reduce the size of the current residential areas by replacing the unfavourably located peripheral dwellings and low-density dwellings in central neighbourhoods with dense apartment buildings in the latter areas. Although tearing down old buildings and constructing new ones involves material and energy consumption in the short term, the spatial redistribution of the non-growing housing stock will have long-term environmental benefits including not only reduced residential energy consumption but also reduced residents' average distance to the city center and regenerated natural land. Nevertheless, the demolishing of old buildings will not take place before they get worn down, which suggests that the building of replaced dwellings will not pose unnecessary extra strains.

Whereas the EM scenario might foresee an increasingly heightened challenge in accelerating technological innovation in the long run to counteract the negative environmental impacts of a growing housing stock, the DE scenario will attenuate this challenge through eventually moving to a steady state. Nevertheless, reducing the per capita housing consumption represents a considerable challenge because the hindrances are deeply rooted in the existing economic, political and cultural structures.

7.2.2. The market logic is antithetic to capping consumption in housing

Housing, in both Oslo and Milan, is to a large extent treated as a commodity. As such, the consumption of it is mainly determined by market logics. To reduce consumption levels is, therefore, in contradiction with the basic market rationality that seeks ever-increasing profits through stimulating effective demand and higher levels of consumption. Strong regulations might have to be imposed on real estate developers, building and financial sectors to constrain their dominance in housing provision, if a reduced housing consumption is to be achieved. Such regulations will need to highlight housing as a welfare right more than a commodity.

Today, since the access to housing is primarily an individual responsibility and dependent on purchasing power, the attached social meaning of it is often related to individual social status. Housing, with its type, size, standard and location, is symbolic of wealth and social class. In Oslo, the class division between the eastern and western part is significantly manifested through housing conditions (Andersen & Skrede, 2017). Affluent western residents typically live in spacious villas with spectacular views; while middle to high-rise apartment buildings dominate the landscape of the poor east. To equalize housing consumption among residents through putting a cap on housing consumption violates the mainstream cultural understanding of housing as a reward of individual economic success. Especially, reducing housing consumption among those who have an 'overconsumption' will meet strong resistance. It is indeed not meaningful for a person to become affluent if he/she cannot be rewarded by e.g. buying and living in a luxury dwelling.

7.2.3. The growth-dependent economic structure and ideology are deep-rooted barriers

The possible resistance from the market and individuals as discussed above stems from an ingrained economic structure designed for growth and the associated political ideology of economic growth. The housing sector is a key driver and booster of global, national and local economy. It contributes to economic growth through driving the development of upstream and downstream industries (e.g. construction, finance), absorbing large amount of labor force and surplus capital (Harvey, 2011). Under present political-economic conditions, it is hard to imagine the existence of a political will to reduce housing consumption since it will lower the rate of economic growth. Without abandoning the growth ideology, it seems to be politically unfeasible to implement policies targeting for reducing housing consumption.

The removal of these hindrances for realizing the DE-scenario demands structural transformations rather than mere reforms. It appears that implementing the EM-scenario will meet less resistance, but it is no less challenging to achieve the environmental goals through technological innovation and application, if we take the goals seriously. Our studies suggest that we can be more assured of goal achievement if we opt for the DE-scenario than for EM. In this sense, reduction in consumption is more of an imperative than an option, given that we have to acknowledge and respect environment limits.

Table 5
EM scenario in the Milan metropolitan area.

EM scenario	Population	Energy intensity of residential buildings[a]	Square meters per person	Increase in total energy consumption from 2015 to 2030 (%)
Years	persons	kWh/m^2	m^2/person	%
2015	3 077 556	193	41	
2030 (0% increase)	3 224 318	163	46	0%
2030 (goals of reduced consumption)	3 224 318	157	46	−4%

[a] conversion factor of 11630 kW h/toe (STATISTICS RESOURCES, 2019).

Table 6
DE scenario in the Milan metropolitan area.

		Population	Energy intensity of residential buildings *	Square meters per person	Increase in total energy consumption from 2015 to 2030 (%)
	Years	persons	kWh/m^2	m^2/person	%
Degrowth	2015	3 077 556	193	41	0%
	2030	3 224 318	166	39	−14%
	Percentage increase	5%	−14%	−5%	−14%

7.2.4. Stronger redistribution mechanisms are needed to avoid potentially heightened inequality risks

According to Piketty (Jackson & Victor, 2016), slow growth rates lead to rising inequality. This is true in a passive DE situation, which was the case after 2008 financial crisis in southern European countries. No growth or degrowth in total housing consumption poses serious challenges to achieving equality and human needs satisfaction if those who already overconsume housing further increase their consumption levels. Securing social justice is a more demanding enterprise in the DE scenario than in the EM one because no growth can be trickled down to the poor even with an unproportioned share. Constrained by a limited consumption level, wealth redistribution from the rich to the poor is the only way to prevent the likely heightened inequality.

As exemplified in the two cases, redistributive mechanisms could include recovering underused or vacant dwelling units, compartmenting too spacious dwellings, capping individual or household housing consumption, providing social housing for the ones in need, levying progressive tax on excessive housing consumption, encouraging sharing and co-housing schemes and implementing rental control. Although these strategies appear radical and contradictory to the individual liberty promoted in the current neoliberal society, they are by no means alien. For example, progressive income taxation is common in many countries and thus has the possibility to be extended to the housing sector. Norwegian housing policy before its liberalisation in the 1980s managed to limit the size of new dwellings and control the price and rent to make housing affordable through financial incentives (Stamsø, 2009). The reminiscent welfare elements in the Norwegian housing policy may render these policies acceptable by the public to a greater extent. However, the current political setting dominated by neoliberalism is unfavourable for reinvigorating strong redistributive policies. In Milan, reutilising empty dwellings can be an effective strategy to providing affordable housing for those excluded by the market. This measure could be expanded, given the high share of empty social housing units. Other measures to counteract the effect of financial crises and the impacts of financialisation on social justice could be to implement rental control in some areas and to limit the access of international capital within Milan's housing sector. Financialisation of the housing market, especially in some central locations, has become a significant trait of the market.

8. Conclusions

This paper has explored the possible scenarios for future housing development until 2030 under normative and theoretical assumptions. The normativity of the study is mirrored in the future goals expressed in the scenarios: both scenarios aim at a socially just and environmentally sustainable future housing development. The theoretical basis is also reflected in the scenarios and is derived from two sustainability discourses: EM and DE. On such premises, throughout the paper, we contextualised the future development of two metropolitan areas, Milan in Italy and Oslo in Norway.

The article shows that all the scenarios can successfully score in terms of substantial betterment of the environmental and social aspects of housing in the future for Oslo and Milan if certain conditions are met. However, realising these conditions in the two types of scenarios implies different challenges. The EM scenario ensures that technological improvement applied to the housing sector leads the way to a more sustainable future. At the same time, however, in the EM scenario, the energy consumption in the building phase will still be an environmental impact and will only partially be reduced if eco-friendly measures are in place. The allocation of new areas for urban development will burden the environment, thus threatening biodiversity. Moreover, associated infrastructure and the services related to residential buildings will eventually increase. Technology can reduce a variety of environmental impacts but only to a certain level, and the reduction in the domestic consumption of energy alone, even if significant, will not be able to cover for all the environmental impacts.

Higher building energy efficiency than today's is possible, as shown in the EM scenario for both Oslo and Milan. This kind of implementation within the given time frame might be challenging. In particular, the innovations required are often typical advancements produced by the private sector. In this sense, it is difficult to imagine that within a short time frame, the private investors, tech companies and building sector can provide such a rapid transformation. A large-scale and rapid implementation of the theoretical potentials for energy efficiency will probably require a degree of public coordination and control (NORDIC COUNCIL OF MINISTERS, 1999) that does not sit well with the current neoliberal conditions.

Among our most interesting findings is that reduction in energy consumption can be achieved only to a certain degree, after which only a decrease in the square meter per capita is efficacious in ensuring an environmental sustainable housing future. The EM scenario in this sense scores low because it does not allow the possibility, in the current growth model, to ensure a reduction in square meter per capita consumption. Here we discover that the tenets of EM theory, if applied to a real-world case, might not hold up when discussing the ability of technology for fully decoupling environmental impacts. This is attributable to the fact that according to our calculations, the technological progress applied to the housing sector, if not supported by policies to reduce the actual housing consumption per capita, is simply not sufficient. According to our estimations, for both city cases, the decrease in housing production seems to play a major role in decreasing the environmental impacts, far more than the application of eco-tech standards and eco-friendly measures in housing development.

A change towards a non-marketised housing sector, such as the one designed within the DE scenario, if supported by overall economic changes, will result in a more environmentally friendly housing development. In this perspective, the existing housing stock does not need to be increased but needs to be improved, retrofitted and adjusted to the needs of the population and the underused or vacant units and areas of the city need to be recovered. If a maximum cap to consumption is considered, the current housing stock might possibly be able to include the groups that are currently excluded by the market mechanisms. Even though the viability of such extreme measure needs to be discussed, the DE scenario will rely on similar reductions in consumption to function. The DE scenario in both cities will easily achieve a result in terms of reduction of environmental impacts because the designed scenario itself will occur in a non-consumeristic housing future.

One of the key questions arising from our study is whether technologies alone are sufficient in reducing the environmental impacts in the future. This supposedly is the starting point of the EM principles and the strategies we discussed when designing the scenarios. The remaining open questions are indeed whether we can develop these technologies, have sufficient time to do so and can do so on a large scale. We mentioned that the environmental impacts of housing construction and the housing sector in general are not only linked to domestic energy consumption. Housing construction has impacts on land use, material production, transportation, accessibility, etc. The location of housing affects travelling distances and modes as well the need for energy to cover the daily travels.

Regarding the land consumption for housing, we made estimations in the different scenarios, which show how much territory is consumed by different future images. In the case of Oslo, following the current municipal plans of the metropolitan area, an increase of 29 km^2 in the land consumption for residential areas is expected. This kind of increase has effects on natural land, the environment and biodiversity. The EM scenario for Oslo lowers this level to 20 km^2, whereas the DE scenario leads to 0 km^2 increase in residential expansions. The case of Milan, similarly, shows the tendency of increasing land use in the current plans: 26 km^2 of expansions for residential purposes are currently expected according to the strategic planning documents. Of this 26 km^2 of expansion, almost half (10.4 km^2) is supposed to happen on natural areas and farmland. These areas converted into sites for housing construction will threaten the biodiversity corridors and the biodiversity and will lead to other consequences. In our EM scenario for Milan, the area needed will be reduced to 11.6 km^2, nullifying the need to build on natural areas and farmland. The DE scenario for Milan does not entail new constructions.

Similar considerations can be made for transportation and accessibility. Following a path of housing growth entails improved and increased accessibility. As in the EM scenario, increased accessibility is considered as a sign of progress; hence, the mobility levels do not present limitations. The EM scenario will focus on accessibility rather than mobility per se and will improve accessibility through proximity rather than through increased mobility. In the DE scenario, on the contrary, a sufficiency limit exists because mobility is considered to have has serious environmental consequences. Because our DE scenarios will not entail new residential expansions, mobility will be developed under the principles of sufficiency. On the contrary, in the EM scenarios, the densification potential within the urban demarcations might eventually be used up, requiring new constructions as outward urban expansions even if the policies indicated by planners pursue a compact city strategy. These expansions will require more motorised transport, often car travel. This represents an important part of energy consumption and causes substantial GHG emissions.

Regarding social justice, some questions of redistribution and equity need to be addressed. As previously discussed, the EM scenario provides a future in which the basic needs of more marginalised groups and the more extreme housing deprivation situations are solved, but inequality in terms of housing consumption might be widened. EM also ensures that there is process equity and that decisions are taken in a democratic manner. Moreover, the implementation of the EM scenario is less challenging when it comes to acceptance because it is based on today's growth premises. DE addresses redistribution and social justice as a final goal; therefore, redistribution measures from who owns the most to who owns the least could indeed resolve and create a more just housing sector.

Through presenting and comparing the two types of scenarios that follow different paradigms and pathways, our study opens the discussion on possible housing futures. The achievement of either scenario will require a deviation from the BAU. Our principal finding is that although the DE scenario is more effective in achieving the social and environmental goals than the EM scenario, it is less feasible than the EM scenario owing to the existing dominant socio-economic and political conditions. By decommodifying the housing sector and designing it around a set of needs, obtaining a higher level of justice is possible. Limiting the dwelling construction for the future and ensuring better utilisation of the current stock, as in the DE scenario, gives more effective results in terms of decreasing housing-related environmental impacts than employing technological measures, as in the EM scenario.

Declarations of interest

None.

CRediT authorship contribution statement

Silvia Mete: Conceptualization, Methodology, Formal analysis, Data curation, Writing - original draft, Visualization, Investigation, Writing - review & editing. **Jin Xue:** Conceptualization, Writing - original draft, Writing - review & editing.

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Appendix A. Supplementary data

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Silvia Mete is a PhD Candidate at the Faculty of Landscape and Society at the Norwegian University of Life Sciences. Her research field is that of housing policies and housing sustainable development. She worked with challenges and issues related to populations unable to enter the housing market (Young adults, migrants) and she previously did research on homelessness, methodologies, and policies to tackle it. Currently works with housing sustainable development, future studies, and new models to achieve just and environmentally sustainable housing sector.

Jin Xue is Associate Professor in the Department of Urban and Regional Planning at Norwegian University of Life Sciences. Xue's research interests are in urban and housing sustainable development, interface between environmental and social sustainability in urban regions, degrowth and urban development and planning, urban futures based on scenario planning, and critical realism. Her reserch builds on comparative studies between Nordic and Chinese city regions. Since 2016, Xue has been a member of Urban and Regional Planning education program council at NMBU.