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More than filler: Middle actors and socio-technical change in the energy system from the "middle-out"

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A B S T R A C T

This paper concentrates on 'middles' and 'middle actors' in energy systems and introduces a "middle-out" framework for examining and supporting systemic change to a lower carbon society. We propose this "middle-out" approach as a complement to "top-down" and "bottom-up" strategies. Our approach suggests that two essential elements for successful systemic change are actors' agency and capacity, where 'agency' refers to actors' abilities to make their own free choices, and 'capacity' refers to actors' abilities to perform the choices they made. We argue that due to their position between top and bottom actors and between technology and implementation, middle actors play crucial functions in the transition process. Their abilities are based to their own agency and capacity which they can exercise to influence the agency and/or capacity of other actors. The paper discusses middle actors vis-à-vis 'intermediaries' and demonstrates the value of the middle-out approach. Through elaborated examples of three middle actors – congregations, building professionals, and commercial building communities – it shows how middles exert influence upstream (to top actors), downstream (to bottom actors) and sideways (to other middle actors) through mediating, enabling and aggregating both themselves and others. A few weaknesses of this approach are discussed as well.

1. Introduction – the missing middle

Keeping the 'lights on', the 'cars moving' and the 'economy growing' are seen by many as vital indicators for a thriving and healthy modern society. These rely on well-functioning energy systems, which we define as the set of technologies, physical infrastructures, institutions, policies and practices which enable the generation, delivery, and use of energy and its services. At the same time mitigating climate change requires a transition to a low-carbon society which entails fundamental and systemic changes to the technologies and practices of our existing energy systems.

Sovacool [1], in his mapping of the energy research field, points at knowledge gaps in existing literature and proposes a social science research agenda that may help filling them and thus improve our understanding of energy systems. One particular gap that Sovacool recognizes is the underestimation of social and socio-technical aspects that shape and construct energy production, use and consumption. This paper proposes a new socio-technical analytical perspective, the middle-out, and applies it to examine overlooked actors in the system and to highlight strategies that could promote and support transition to a low carbon society.

Although energy systems are complex and socio-technical by nature, they are often simplistically divided into suppliers and consumers in policy forums. Governments promote the transition to a low-carbon society by regulating energy suppliers, while small end-users are being mostly encouraged – economically and morally – to reduce their energy consumption and carbon-emitting behavior [2]. Another related and prevailing dichotomy in the policy discourse is between technology – or technological innovation – and its implementation by users. In this case, much attention (and funding) is given to the development of new technologies [3,4], with the assumption that once the technology exists, and given the right financial incentive, it will be instantly and widely adopted.

There seem to be two underlying assumptions underpinning these dichotomies: first, that the systemic change will be initiated and driven from the top-down, i.e., by government regulation, suppliers initiatives, or new technologies, and from the bottom-up, i.e., by civilians and grassroots (e.g., [5]); and second, that these 'tops' and 'bottoms' – i.e., government/suppliers and consumers or

technology and its uptake – meet at some point in the middle to deliver change. It seems that this middle point – or middle area – is often perceived by policymakers merely as 'filler' between the two levels. These assumptions are institutionalized by procedures and structures set by policies and practices, which emphasize the two edges – top and bottom – while often overlooking the 'middle.' This omission fails to recognize the roles that many middle actors could play in the transition, and the effect they could have if utilized wisely.

Here we suggest a new socio-technical conceptual analytical perspective for understanding the middle in energy systems. We frame our work according to the above mentioned top-down and bottom-up dichotomies to reflect over-simplifications of the system that are already in use. There are, of course, more nuanced and complicated ways of looking at the system. The literature on multi-level governance, for example, focuses on the various interacting authority structures acting at the local, national and international energy systems, connecting between levels of influence, and shaping governance and practices. This literature interrogates, among other things, the arrangement, distribution, and efficacy of power as embodied in various state and non-state actors or between institutions of various levels (e.g., [6,7]). For the purposes of this paper, we bundle aspects from the multilevel governance literature that explore the nuances of governance and related discourses about control and power in institutions into the 'top' and set it to one side. There is also a large literature on the shape and nature of consumers, individuals, citizens, and their active or passive participation in the energy system. For the purposes of this paper, we put this literature and related discourses into the 'bottom' and set it aside.

This rough segmentation of the existing literature allows us to focus on the 'middle' of the system, which we argue plays a more important role than currently recognized. We take notice of the growing and diverse literature on the role of 'intermediaries', which have recognized the potential of these actors to embody agendas of change in different areas and to promote it in various ways (e.g., [8–11]). Similar to the literature on intermediaries we argue that the middle is more than 'filler' between top and bottom, and that middle actors have many qualities and functions which are unique and essential for a durable systemic change. Yet, while our perception of middle actors overlaps with that of intermediaries, it does not duplicate it. Middle actors may operate in the same space as intermediaries but our conception of their influence and abilities sets 'middles' apart. Our perspective on the 'middle', thus, allows us to highlight some new and unique qualities of middle actors and points at strategies for action from the 'middle-out'.

Our general conceptions of 'middle actors' as well as 'middle-out' strategies for change can be applied to different social and socio-technical transition arenas (e.g., public health, energy security, crime eradication, etc.). We, however, demonstrate our argument by concentrating on aspects of 'middle-out' activities that reduce energy use and associated emissions now and in the future. Other significant actions (e.g., renewable energy generation) are important but not the focus of our current work. Readers should note that while we call this process a "transition", we do not specifically invoke transitions theory (e.g., [12]) and use the term connotatively to suggest a series of changes.

This paper focuses on several different kinds of 'middle actors' and develops the theoretical underpinning for a 'middle-out' approach for understanding and enabling transitions. It further expands our previous discussion of a particular kind of middle – building professions and professionals [13] – by considering additional types of middle actors and the conceptual basis for a 'middle-out' approach. We argue here that two essential elements for a successful transition are actors' 'agency' and 'capacity'. The term 'agency' in our context refers to actors' willingness and capabilities to make their own free choices, while the term 'capacity' refers to actors' capability to perform the choices they made. We suggest that due to their position *in-between*, and due to their *own* agency and capacity qualities, middle actors are able to improve the levels of agency and capacity of *other* actors and increase the overlap between these two elements. Therefore middle actors could serve as important agents of change, performing crucial functions in the transition process that other actors either cannot or struggle to perform, and hence leading to a durable change. Yet, many middle actors are overlooked because policy makers tend to concentrate either on the big actors ('top') such as energy utilities, which have the capacity to make many changes but often lack agency, or the millions of small energy consumers ('bottom'), which have the agency to decide on many changes but often lack the capacity to exercise them.

Previous conceptual research [14–16] has already suggested that a 'middle-out' approach could assist in the process of systemic change toward a low carbon society. Parag and Janda [14,15] considered various 'middles' articulated in different academic fields, including sociology; sociotechnical studies and transitions; public policy and administration studies; public health; processes of production; and energy studies. Janda and Parag [13,16] focused on the energy field and conceptualized the 'middle' (vis-à-vis 'top' and 'bottom') in energy systems and, amongst other issues, discussed characteristics of bottom-up and top-down approaches to energy transitions. They suggested that middle actors could promote change in various directions: downstream, upstream, and sideways, hence – from the middle out. Here, we further develop this conceptual framework while highlighting middle actors as more than intermediaries between government and energy consumers and between technology and end-users: they are active participants in the system, capable of creating (and sometimes preventing) change above, below, and across other actors.

The paper begins with a theoretical introduction to the terms 'agency,' 'capacity' and 'middle actors' in the context of an energy transition and with emphasis on aspects of transition related to behavioral change. Next, it provides a brief review of the literature on intermediaries. Based on this review, we argue that middles are somewhat different from intermediaries and that applying the middle-out analytical perspective allows us to notice overlooked significant actors in the arena. The paper then continues with the development of the 'middle-out' framework. Three elaborated examples – on congregations, building professionals, and commercial building communities – focus on very different types of middle actors and demonstrate the functions they perform in a middle-out approach to transition. These functions include mediation, but also enabling and aggregation. To different extents, they also exert influence on other actors to change the system in which they all operate. Following the practical examples, we return to intermediaries to discuss the contribution of the middle-out perspective and the notion of middle actors to the literature on intermediaries and to highlight how 'middles' are indeed more than filler between other actors. The paper concludes with some practical implications for the middle-out approach.

2. On agency, capacity and change

In sociology, individuals' actions, behaviors and behavioral change are explained, among other things, by their 'agency' and by 'structure'. In short, 'agency' refers to the individuals' capabilities to act independently and make their own free choices, while 'structure' refers to factors that shape or limits individuals' opportunities to act on those choices. 'Structure' includes variables such as social

class, religion, gender and ethnicity [17]. For many years 'agency' and 'structure' were seen as alternative explanations to behavior and decision making. The 'structuralists' explained behavior of individuals mostly by the operation of the structure and superstructure (e.g., Marxism); those with opposing views stressed the capacity of individuals to construct and reconstruct their worlds (e.g., pluralism). An alternative, integrative option was adopted by modern social theorists [18–20]. They pointed out the balance between the two previous positions and suggested that structure and agency are complementary and interacting forces: structure influences human behavior, and humans are capable of changing the social structures they inhabit.

In relation to energy demand reduction, most individuals have some level of agency over their decisions, behavior and actions, and this agency is influenced and shaped by social norms, social order, regulation and established social practices, i.e., structural elements. A change in energy-related behavior is more likely to happen when individuals decide to make the change and when the structural elements in their society support and allow this change to happen. Elements such as communities, organizations, professions, and social networks to which the actor is attached, affiliated with or embedded in, shape many aspects of the social environment in which behavioral changes happen. These aspects include, for example, social norms of consumption and lifestyle, which are highly correlated with energy use (e.g., [21]). At the same time, individuals' values, actions and ideas about energy behavior can influence, shape and change social norms and many aspects of the communities, institutions, regulations and other forms of structure in which they are embedded [22]. Often, however, physical and technical constraints, such as infrastructure and available technology, influence individuals' actions more than social structure.

Psychology and behavior scholars have also examined factors and variables that lead to behavior and behavioral change (e.g., [23,24]) and more specifically – energy-related behavioral change (e.g., [25–28]). Determinants for behavior, beyond resource availability, usually consist of sets of variables which are either internal to the individuals (e.g., awareness, perception, knowledge, values, norms, attitudes and habits); relate to the social environment, (e.g., social norms, social desirability and lifestyle); and/or relate to the external constraints or physical environment (e.g., existing infrastructure and accessibility). The assumption is that once an individual is aware of the problem and once the barriers to behavioral changes are removed (i.e., personal and social norms are altered to support change; technological solutions are available, affordable and accessible; old habits are replaced by new ones, etc.) – the behavioral change will happen. The discussion, however, often stops at the point of identifying barriers and does not go on to examine who would be the most appropriate actor to remove them or what would be the most effective and efficient way to do so. The onus of change is often placed on the individual needing to know and care about energy [29], as if this knowledge and concern will render them suddenly capable of installing a range of energy efficiency measures without any further assistance.

Although individuals are important, there are other levels of analysis including organizations and communities that are important in promoting social change [30]. It is widely recognized in the organizational behavior and public choice literatures that organizations, firms, and social groups do not behave like individuals [31,32]. Instead, they exhibit their own dynamics that may contribute to the low level of energy efficiency implementation [33–36]. Based on findings from an empirical study that examined organizational responses to the energy crisis in California, Lutzenhiser, Janda et al. [37] suggest a model of organizational action in which the crucial variables for energy conservation action are internal to the organization and consist of 'concern',

'condition' and 'capacity'. 'Concern' refers to the organization's awareness and attention to the need for change, while 'capacity' refers to the organization's knowledge about what it can do and its ability to take action. The term 'condition' refers to the 'real world,' i.e., the very concrete conditions, constraints – but also opportunities – which the organization faces, such as building structure and energy-supply contracts. When concern and capacity exist within an organization in relation to energy crisis, and when the conditions support it, energy conservation is more likely to take place.

2.1. Middle actors

Building on elements mentioned above, we suggest here a new socio-technical analytical framework for the examination of actors' action, behavior and behavioral change. This framework focuses on two variables: *agency* and *capacity* and the relations between them. Similar to the sociological definition, we define 'agency' as the willingness and ability of actors to make their own free choices. Similar to the definition of Lutzenhiser [37], we define 'capacity' as the ability of actors to execute or perform these choices. The unit of analysis in our framework is 'actor,' which, in some contexts, is an individual, and in others, a group, organization, institution or any other relevant unit given a specific context. Similar to the behavioral literature, both agency and capacity in our framework are interrelated to structural elements, which consist of physical and social constraints, such as facilities, infrastructure, laws, institutional arrangements, contracts, norms and culture. According to this logic, a change is more likely to happen when levels of both agency and capacity related to specific action are high. Levels of agency and capacity of the same actor may vary between tasks and issues.

We also recognize that often, specific actors are in better moral, financial, technical or social positions to enable and facilitate the action of *other* actors. We call these actors 'middle actors.' Compared to top or bottom actors, middle actors might not have the highest level of agency to decide on a change, nor the greatest capacity to perform it. But the middle actor's own qualities and expertise, in addition to its position in respect to other actors, puts it in a key position to prompt changes to happen.

2.2. Middle actors versus intermediaries

What we call here, and attribute to 'middle actors', is closely associated with what the sustainable development and energy literatures call 'intermediaries'. Examples of such intermediaries include formal and informal government and semi-government energy agencies, NGOs, agencies and organizations sponsored by utilities, energy services companies and providers (ESCOs) (e.g., [38]), local communities, grassroots and networking platforms (e.g., [39,40]), research and technology organizations, chambers of commerce, innovation centers, industry associations and partnerships (e.g., [41]).

The growing and diverse literature on intermediaries suggests that they are well-positioned in the field to facilitate connections and collaboration between various levels and actors, to introduce and promote innovations, and to structure and support effective and functioning multi-level governance [6,10,11,39,40,42–44]. So what are the similarities and differences between 'intermediaries' and 'middles'? We begin our discussion of these questions with a brief review of the literature on intermediaries (we are aware that this review is partial and thus limited, but a complete review of the literature is beyond the scope of this paper). For this, we draw mainly upon Van Lente et al. [41] for an overview of the field and Hodson et al. [38] and Backhaus [44] for two different approaches to energy intermediaries. We do not claim to fully represent the

literature on intermediaries. Rather, this review aims to set the stage for our argument that 'middles' are somewhat different from intermediaries and are more than filler. We will return to this topic in Section 7.

Van Lente et al. [41] provide a useful overview of the many different types of organizations that can be classed as 'intermediaries.' This particular paper focuses on defining 'systemic intermediaries' as opposed to 'traditional intermediaries'. Both types of intermediaries serve as 'brokers' between various parties in innovation systems. Van Lente's intermediaries, both systemic and traditional, exist to play those broker roles, which are mainly connecting, translating, and facilitating flows of knowledge. The difference between 'traditional' and 'systemic' intermediaries has to do with how many different connections they form, with traditional being 'one to one' transfer and 'systemic' being those that function in networks. The authors argue that intermediaries play important roles in the system, and find that this is particularly true of the emerging 'systemic intermediary' on which their paper focuses. Their systemic intermediary is a new institution that was called into being to fix some broken elements of the Dutch agricultural system.

Compared to our conception of middle actors, we find that van Lente's characterization of intermediaries (both traditional and systemic) largely precludes them from having any independent agency or capacity. Their roles are as go-betweens, rather than actors in the system. In this case, intermediaries are more than filler, but not a lot more.

Hodson et al. [38] focus their paper on the evolving disconnect between the "symbolic representations of a low carbon future" and its "material manifestation [. . .] in particular places" (p. 1404). They explore the capacity and capability to act at the urban level by focusing on the creation of 'new' urban energy responses. They define 'urban energy intermediaries' as a "suite of 'low carbon' governance fixes at the interface of city and energy systems" and discuss four modes of urban energy intermediation. These modes of intermediation are based on variation in two dimensions: (1) episodic responses vs. systemic responses and (2) priorities that are externally produced or context-specific. Like van Lente et al., these authors note that there are many different kinds of intermediary. However, their paper focuses only on the 'new' ones that have been designed to 'fix' the problems cities have in managing their energy systems. As in van Lente et al's characterization, the intermediaries in Hodson et al. do not seem to have very much agency as actors. Their priorities are shaped by others: either from 'outside' the immediate context, or from local factors within that context. From a middle-actor perspective, Hodson et al's characterization does not sufficiently capture the notion that middle actors can develop their own endogenous priorities.

Backhaus [44] discusses the support needed for intermediaries doing demand-side management work. She sees these intermediaries as playing innovative roles that can be described as 'bottom-up' policy implementation (p. 88). However, as elsewhere, 'intermediaries' are defined broadly as groups that operate in the space between three other groups: policy makers, energy providers, and consumers. Backhaus sees energy intermediaries as arising in response to the UK liberalization of the energy market in the 1990s, which created a space for "different types of energy intermediaries [to emerge] in different sectors and at different scales" (p. 90). What they have in common, she claims, is their 'in-between-ness'. Similar to van Lente et al. and Hodson et al., Backhaus's particular subjects of study are relatively new inventions (roughly two decades old) that fill in the space between other actors.

The above cited literature on intermediaries (in line with the wider literature, such as [8–11]) seems to agree on one thing: there are lots of different kinds of intermediaries. The intermediaries cited in van Lente et al., Hodson et al., and Backhaus are different, even though all three authors use the same terminology to describe them and their functions as mediators and connectors.

The literature on intermediaries in the energy field seems to overlook actors that are already placed in the field on their own right and with their own pre-existing agency, function and agendas. This is the dominant difference between our reading of the 'intermediary' literature and our conception of the middle actors. We make additional comparisons between middles and intermediaries later in the paper, after providing some additional conceptual and concrete examples of middles.

3. Middle actors and energy

Energy systems present particular challenges for policy and governance as they tend to reflect long-term historical forces and crisis events, and tend to lead to lock-in rather than change [45]. Transforming energy systems requires coordinated efforts and changes amongst numerous actors and institutions [7]. Coordinated efforts are also needed in order to meet the challenge of changing the energy behavior of end-users.

The type of interventions needed to mobilize and support such changes in the energy system cannot be delivered only through the current centralized, top-down governance system [46]. To illustrate, the energy used for heating domestic buildings in the UK contributes significantly to the UK's overall emissions: 40% of residential carbon emissions are generated by households' heating systems. Improving the housing stock energy efficiency (and in particular heating efficiency) requires millions of homeowners to refurbish their homes and thousands of building professionals to develop relevant skills. Policymakers have identified the relatively easy carbon savings that could be achieved through simple behaviors, such as lowering the thermostat settings (in heating seasons), and simple cost-efficient technical changes to the infrastructure of the home, such as improving wall and roof insulation. These changes, however, are not likely to happen by dictate from above. Rather, in most cases, the agency over housing and living standards lies at the bottom, with the homeowners or home users.

In the example of the thermostat, the link between an individual's agency and capacity is simple: if people are aware of, and accept the need to reduce emissions, and if reducing home temperature is perceived as desirable and physically possible, then levels of agency and capacity are high and overlap and the change is likely to happen. Awareness, educational campaigns and economic incentives could assist in matching agency and capacity in this case. However, we acknowledge that people's home comfort choices depend on many factors [47], so changing them could be difficult for a variety of reasons.

One challenge, or barrier to change, is to increase the levels of actors' agency and capacity and bring them together, in a meaningful way, in cases where more fundamental changes are required. For example, in the case of improving home infrastructure, there seems to be a mismatch between individuals' agency and capacity: while agency is often high (i.e., this is a domain where individuals are relatively free to make their own behavioral decisions), in many cases the capacity is low. This low capacity could be due to a variety of factors, for example lack of money to improve infrastructure; lack of knowledge about why and how to do it; lack of social support for the change. This mismatch decreases the likelihood the change will happen. The prospect to introduce many of the energy saving measures and devices to bottom actors, the skills to actually install them, and the opportunity to provide users with instructions on how to use the measures 'properly', often belongs to actors

located in the middle, such as builders and building professionals [13,48–50] as well as others.

4. Middle-out approach and strategy

Similar to the literature on intermediaries, middle actors serve mediating functions between the top and the bottom. We argue that in addition, middle actors might be better 'equipped' than intermediaries with qualities that top actors lack (or are perceived of lacking) and bottom actors appreciate, such as trustworthiness, legitimacy, and ability to shape social norms and practices. They might also have resources essential for action, which the bottom lacks, such as pre-established procedures and information channels, available funding, administration and coordination skills, specialized tools and know-how, and/or the ability to influence and shape behavioral norms and practices.

The middle-out strategy is a *normative* approach which recognizes those actors who are already performing various roles in society and are neither at the top nor the bottom, examines their agency and capacity characteristics (or potential) with reference to the various aspects of change and/or barriers for change, explores the various directions they could act (upstream, downstream, sideways) and examines ways to empower them in order enable change to happen. The empowerment could take various forms for example, financial, institutional or technical, depending on the context. The middle-out could be used as a strategy to initiate, motivate, support and upscale change (similar to what is suggested by the literature on collaborating actors and intermediaries, e.g., [7,40,42,43]), but also to introduce innovative and overlooked ways to unlock lock-ins or overcome path dependencies. It is likely that ideas coming from the middle, or motivations provided by middle actors (depending on the context) could be better tailored to downstream needs, better communicated upstream to decision makers, and could have a sideways impact as well (i.e., influence similar organizations and other middle agents).

Fig. 1 represents one configuration of this idea, where 'the top' of the system contains a few actors and 'the bottom' contains many. We suggest that in the context of a transition to a low-carbon society, the middle-out approach has the potential to increase public engagement with policy recommendations, harness those who are not already involved to the collective effort, and improve implementation rates on the ground. Depending on the context, middle actors may also have their own agency and capacity to make changes in their own behavior and practices, regardless of top or bottom actors.

It is important to note that the category of middle actors vary depending on the context, situation and their position with reference to other actors. Likewise, top and bottom actors are not always a fixed and predefined group. It might be that in one context an actor would be regarded as top actor while in a different context the same actor would be referred as bottom or middle actor. Local government, for example, could be regarded in one context as top actor and in other as middle actor. In some cases it is easier to define the relative position of an actor with reference to 'upstream', 'downstream' and 'further downstream' of the energy system.

We would like to be clear that we are not suggesting here that a middle-out strategy could or should replace top-down or bottom-up ones. Rather, this is an additional, supportive, and potentially more effective way of delivering some aspects of change and overcoming barriers that top/bottom actors might find hard to tackle without the support of the middle.

5. Middle actors: creating change from the middle out

So far our discussion on agency, capacity, middle actors and the middle-out approach has been rather theoretical and conceptual. Below we apply these concepts to the examination and analysis of three specific examples of middle actors – congregations, building professionals, and commercial building communities – in terms of their agency, capacity and middle-out roles in changing energy systems. The middle actors discussed below are not the 'usual suspects' when it comes to energy policy. Religious congregations, for example, are not perceived by governments or energy consumers (or the literature on intermediaries) as 'energy' or 'climate' actors and they do not have any formal role in any energy system transition. Building professionals are often considered to be 'intermediaries' (e.g., [8]) rather than actors with their own agency and capacity (see also [13,48–50]). Commercial building communities are still in their formative stages, with some of their connections being formulated more by benchmarking tools than
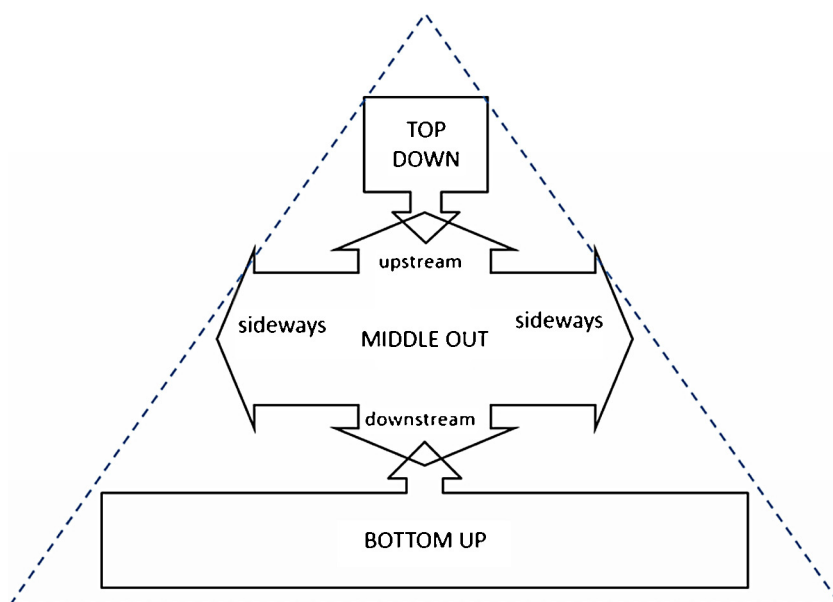

Fig. 1. Middle-out change: directions of influence.

Table 1
From the middle out – direction of middle actors' influence and impact.

Actors	Action		
	Influence upstream (toward the top)	Influence downstream (toward the bottom)	Influence sideways (toward other middle agents)
Congregations	Government	Members of congregations	Other congregations
Building professions	Local government, national regulations	Building owners and tenants	Other building professionals and professions, supply chain
Commercial building communities	National government, international energy policies Energy utilities, supply chain	Small and medium size businesses	Other real estate firms and building types

by human actors. However, we argue and demonstrate below that each of these groups play important 'middle-out' roles with potential policy implications. Table 1 summarizes the influence that these middles exert on themselves and other actors.

5.1. Congregations

Consumers' energy choices and behavior are influenced by many variables, including attitudes, values, knowledge and social norms [51]. Top actors, such as governments and utilities are often not in a good position to influence consumers' environmental values and norms, while other actors might be in a better position to do so. One type of such middle actor is congregations, which are deeply historical actors and powerful agents of socialization [52].

Religious–environmental groups that engage in environmental work from a spiritual perspective are becoming more widespread [53]. These groups recognize that while science, policy and technology are instrumental in promoting environmental protection, the environmental crisis cannot be effectively addressed without a change in individual and societal ethics that guide how humans relate to earth (e.g., [54,55]). Over the last fifteen years, an increasing number of religious environmental movements have stressed environmental stewardship as a moral imperative. They call for lifestyle changes and seek to provide their community with a framework within which to view their responsibility to the other and to the natural world [53].

Religious congregations have their own agency and capacity which were developed during decades or even centuries of social engagement: they have established communities that share beliefs, history, values and traditions. They have some moral authority over their members and thus are in a relatively powerful position to influence their followers' behaviors and practices. Congregations are usually part of a larger, well-established organizational structure with hierarchy and resources (i.e., a local Episcopalian church is part of a broad faith that includes millions of people worldwide). Hence, these organizational structures are often powerful enough to have a greater influence on local and global decision making and politics than individuals would have. This position makes them middle actors that can influence the bottom, i.e., individuals' behaviors and choices; the top, i.e., practices and politicians; and sideways, i.e., other like organizations and congregations.

The Unitarian Universalists (UU) in California exemplifies the influence a congregation can manifest with regards to carbon emissions reduction. In 2007, the UU had set for itself the challenge to lose 1,000,000 pounds of carbon emissions by Earth Day 2009. In order to meet this goal it formed 'carbon rings' in 50 of its California congregations – composed of circles of 5–8 UU households (and non-UU friends). The circles met for eight sessions to build community, and help each other identify carbon-generating behaviors, and make lifestyle changes that would result in the reduction of 5000 pounds of greenhouse gases per household.

The rationale behind the carbon ring concept was that "making lifestyle changes is difficult to do alone. A supportive group from one's faith community, can help you reach your goals to make your carbon footprint more congruent with your values" [56]. The congregation used its moral agency and institutional capacity to facilitate the creation of the carbon rings and monitor the progress of meeting the challenge. Ring leaders were provided with guides ("Global Warming: Changing CO2urse" and "Low Carbon Diet: A 30 Day Program to Lose 5,000 Pounds"). In addition, the ring leader could join an e-mail list where leaders shared progress and asked questions, or could talk in person to someone who has already completed the challenge. To encourage members to participate, the Ministry offered a prize for the most successful community. The downstream and sideways impacts these carbon rings had could be seen in the Unitarian Universalist Society of Sacramento, one of the 50 congregations. This congregation, in addition to acting with its members to reduce their own carbon footprint (resulted in households losing a total of 117,477 pounds of carbon emissions), also acted to improve energy efficiency of public buildings in the community and performed outreach education activities for the general public [57].

There are also many cases of congregations using their agency and capacity and influence top actors as well as bottom end-users. For example, in 2006 the Anglican Church in the UK, took upon itself the mission to push the government to take actions to prevent climate change [58]. In 2011 the three UK Christian organizations – Christian Aid, the UK Christian relief and development agency (Tearfund) and the Catholic Agency For Overseas Development (CAFOD) – organized a march in Manchester in which a thousand supporters participated. The stated aim was to influence upstream actors and persuade the coalition government to work harder to deliver climate justice [59]. Disappointed by the decarbonization targets for the UK in the Energy Bill draft which was published on December 2011, Christian Aid urged the public "Please ask your MP to support a more ambitious Energy Bill with a target to take the carbon out of our electricity by 2030" and provided the internet platform for the public to email their member of parliament [60].

More recently, during the 'sustaining hope in the face of climate change' conference held in May 2013 in Washington, D.C. representatives of the Episcopal Church, the Evangelical Lutheran Church in America and the Church of Sweden (Lutheran) stressed their commitment to use their institutional strength to promote climate action. In a joint statement they recognized both their agency and capacity to promote change and stated: "As international churches with congregations in many nations, we can and will use our global networks to promote a political framework to limit climate change, while in a unified voice we speak to the world about the urgency of committed climate work" [61].

These examples show the influence that different congregations have upstream, downstream, and sideways to other churches. The congregations discussed above believe they must have a position on climate change, and feel a moral imperative to push their communities to take action. They use their resources and moral authority,

in other words, their own agency, to influence individuals' decision making and change their members' agency and capacity. The above illustrations also demonstrate the ability that established organizations have to deliver knowledge and to initiate actions. They use their established channels of communication (i.e., their own capacity) to deliver knowledge and raise awareness in an organized and unique way, and to channel some of their resources to actions that will reduce energy use. These qualities and position allow them to reach people who otherwise might never have even known about these issues. The examples also highlight their roles as enablers and facilitators of individuals behavior change, and as aggregators of bottom actors and other middle actors to have a better impact upstream.

5.2. Building professions and professionals

Building professionals are often considered to be 'intermediaries' in the technology adoption process, and as such are expected to provide low carbon new build or refurbishment if their clients demand it. However, ethnographic research and situated work studies have shown that along the history these groups have developed their own habits, practices, ways of thinking about problems, and ways of working that affect their ability to provide (and interest in promoting) low carbon buildings. This effect has been identified in supply chains [62], property agents [63], chartered surveyors [64], builders [49,50], and architects and engineers [65,66]. In our terminology, then, these groups are 'middles' because aside from the relatively new role they play (or could play) in enhancing energy and emission reduction from buildings, they provide many other – and sometime contradicting – functions which shape the built environment. Additionally, they have agency and capacity to do work and perform services that other actors in the system do not.

Building professionals and practitioners – who plan, build, and refurbish buildings – are particularly important middle actors for initiating, delivering and promoting buildings' infrastructural changes [13]. Janda and Parag [13,48] conceptualized the direction of this 'middle's' influence: upstream to government, downstream to clients and customers, and sideways within and between the various groups working in this area. They also described modes by which these middles manifest their influence: by enabling technology adoption, mediating policy goals, and aggregating technical opportunities. Using examples from both the residential and non-residential sectors, they gave examples of each mode of influence. Here we focus particularly on the agency and capacity of builders in the refurbishment market, which currently serve a relatively weak but potentially important middle role. While recognizing their potential sideways and upstream influence, we highlight their downstream influence on end-users.

Most people do not refurbish their homes primarily in order to improve its energy efficiency [67]. While it is easy to appreciate a new kitchen or enlarged space, improved energy efficiency is not visible, as people cannot see the insulation in their walls, lofts, or floor. In fact, many are not even aware of the various options, potential and possibilities to improve efficiency and reduce emissions. This makes their agency to effect change low.

Building professionals in the refurbishment industry are in a good position to increase home and building owners' agency by informing and advising their customers of the energy efficiency improvement options, new technologies and materials. They can improve customer capacity by providing them with efficient infrastructure and explaining to them the importance of their use of the energy upgrades [68]. Therefore, builders are crucial to mediating between consumers and technology and to enabling the physical changes needed to meet carbon-reduction targets [69].

While being in a good position to increase bottom actors' agency (e.g., improve their knowledge and willingness) and capacity (e.g., provide them infrastructure that will allow them to reduce energy demand), there are some challenges that impede builders from fulfilling their middle-out potential. One challenge concerns their own agency and capacity: different builders have different levels of knowledge about carbon, energy efficiency, new technologies and material, as well as varying skills and practical expertise [70].

Educating, training and empowering builders – or in our terminology, developing their agency and capacity – is the first step to improving their potential to increase the overlap between these qualities in other actors, particularly downstream to their clients. However, unlike engineers and architects that go through a long and formal education and accreditation processes and many of them are often affiliate with some sort of 'umbrella organization' (e.g., association, society) which keep informing them on new technologies and practices after their formal education concludes, many builders, and in particular in the refurbishment sector, go through a much shorter training (or trained on-the-job) and their ties to their 'umbrella organization' (e.g., the Federation of Master Builders in the UK or the National Association of Home Builders in the US), are often weaker. In addition, many builders work mainly in small and medium enterprises that are locally oriented and widely distributed. These characteristics make builders more difficult to reach.

Through networks of formal contracts, professional affiliation and informal relations with other building professional, this group of actors have impact sideways: on the supply chain of material, on building practices and on other building professionals [71], mostly in their close by environment. It is likely that their upstream potential impact would be closely influenced by their affiliation with an umbrella organization.

Leaving the role of builders unexamined and unplanned could result in disabling (rather than enabling) carbon reduction targets in the built environment.

5.3. Commercial building communities: portfolios and partnerships

In this section, we look at two different kinds of middles in the commercial property market: energy portfolios within organizations and cross-firm partnerships. In both cases, benchmarking tools provide a platform for 'building communities' [72] to develop within and across the commercial property market. These communities might be seen as intermediaries, but since they are composed of incumbent organizational actors themselves we also classify them as 'middles'.

5.3.1. Energy portfolios

There are many different ways to divide the building stock from an energy perspective. Government energy agencies typically gather statistics by usage types, separating energy use into industrial, commercial, and residential wedges to reflect different policy sectors. A utility lens, on the other hand, turns the building stock into customers of different sizes, based largely on how premises are metered and who pays the bills. A large customer is a sizable operation with a big bill from a single meter. However, there are other ways of aggregating energy-saving opportunities. Large customers can also be composed of a number of smaller buildings owned by a single organization. This creates a different kind of middle, a cluster of buildings treated as a portfolio for energy purposes. On their own, the agency and capacity of each of these small or medium premises are relatively low, due to lack of knowledge and lack of resources. Yet, the aggregation opens new options to increase both qualities.

The U.S. Department of Energy's 'Energy Star' buildings program is one example of an effort to aggregate opportunities. Instead of conceiving buildings as separate discrete units, a tool called a 'portfolio manager' enables organizations to assess the energy performance of a fleet of buildings [73]. This organizationally comparative benchmarking process helps organizations see their buildings in context with both each other and a national average. Participants in this program include many owners or managers of multiple buildings in different sectors, including government, healthcare, higher education, hospitality, industrial, schools, commercial real estate, retail, small businesses, and congregations.

Although the framework for this aggregation comes from the top (the federal government) the impetus and financing comes from the middle. Energy Star is a voluntary information and recognition program, and it does not fund any physical or technical upgrades. Instead, it creates a lens through which actors (e.g., organizations of many different types, in different sectors) can see and analyze the energy performance of buildings across their fleets. In our terminology, this increases actors' agency. After organizations enter the data for each building individually, this lens creates an aggregating frame that allows these organizations to understand the energy performance of a number of properties through a single portal. If this new understanding of energy performance encourages organizations to divert resources toward energy efficiency strategies, their capacity to upgrade their property portfolios may also be increased.

This new lens also provides a clearer – and potentially insightful – picture to top actors, such as utilities or policy maker. This, in turn, increases these top actors' capacity to form policies that better suit bottom actors' needs.

5.3.2. Cross-firm partnerships

In accordance with the European Union's Energy Performance of Buildings Directive (EPBD), large public buildings in the UK are required to have a "Display Energy Certificate" (DEC) [74]. Although, DECs are not currently required in other UK building types, a 2010 recast of the EPBD requires energy use to be displayed in large private sector buildings "frequently visited by the public" by the middle of 2015 [75].

In March 2011 the UK Government published a carbon plan that pledged to "extend display energy certificates to commercial buildings" by October 2012. However this requirement was not put into law [76]. The UK Green Building Council has written an open letter to Government to encourage the extension of DECs to the private sector and has garnered support from some 80 companies for this action [77]. In this initiative, the UKGBC has served a useful middle agent role by aggregating the voices of its members and communicating them upstream to Government.

However, another organization has taken the UKGBC's efforts one step further. The Better Buildings Partnership (BBP), which is a collaboration of the 17 leading commercial property companies is developing a voluntary 'Landlord Energy Rating' certification system aimed at those parts of a development controlled by landlords [78,79]. It is based on an Australian model developed in New South Wales government. The project is in the pilot stage with priorities being defining the benchmark and how it is presented. The early results of the BPP pilot show that a combination of value and reputational drivers make a labeling scheme desirable. Although it is initially focused on multi-let premises, there are intentions to address other sectors over time.

The BBP's decision to develop a 'DEC for Landlords' in advance of UK Government action in the commercial sector indicates a high level of agency that comes from its members' extensive knowledge of and powerful position in the market. Its ability to fund the development of the tool, pilot test it, and plan for a roll-out in other markets, indicates a capacity to create change both within the BBP member companies as well as across to other property companies (sideways). These efforts to differentiate the market will no doubt affect both Government policies (upstream) and the choices that occupiers make (downstream) in the future.

6. More than filler: middles versus intermediaries

In a previous section, we reviewed some of the literature on intermediaries, drawing particularly on van Lente, Hekkert [41], Hodson et al. [38], and Backhaus [44]. We noted there is an overlap between middle actors and the literature on intermediaries. In this section, we argue that our concept of 'the middle' is also distinct from that literature. Based on our examples of congregations, building professionals, and commercial building communities, we argue the case for using middle and middle-out terminology where appropriate. Some researchers or policy makers may find that 'intermediaries' are a better fit for their interests. However, there are semantic, practical, structural, temporal, and functional reasons to focus on middle actors.

From a semantic perspective, the word 'intermediary' means 'go-between.' Our concern is that the word itself signals there is no 'there' there. Intermediaries are meant to act as brokers between actors, and are therefore one step removed from active participation. They may provide an essential service, but fundamentally, the agency and capacity lies in the actors, not in the intermediaries. As described above, middle actors are active and often pre-existing participants in the system. Semantically, 'middle' conveys there is a 'there' there better than 'intermediary' does. By adding 'out' onto 'middle', we further indicate there is a purposeful direction associated with the activities of middle actors relative to top and bottom actors.

Practically, the terms 'top-down' and 'bottom-up' are familiar ones. 'Middle-out' calls attention to the role of middles (and, by extension, intermediaries) in a way that sits between existing terms widely used in common language and builds upon them. It is directly intelligible, even outside academic circles engaged in discussions of intermediaries and multi-level governance. This gives 'middle-out' a practical advantage.

Both intermediaries and middles are vague terms, and their definition depends on the context. However, it seems that any group that is 'in between' two or more other actors can be seen as an intermediary (e.g., [8]). While there are also many different kinds of middle actors, and we have only looked at a few here, we think that their structural context is clearer than what we have seen in the literature on intermediaries. We see middles as independently operating between a 'top' and a 'bottom' rather than any number and type of other group.

Some of the intermediaries studied seem to serve potentially short-term functions, e.g., the many community energy groups that have sprung up in reaction to government funding. Hodson et al. [38] give a time span of 6 months to 10 years 'or more' for their middle actors. In contrast, the middle actors in our studies have much deeper roots. One of the churches we discussed, the Unitarian Universalists, formed in 1961; the Anglican Church dates back to 1534. Individual trades and professions in the building industry have organized to different extents, but they are institutionally embedded in formal structures of licensing, training, and education which are about a century old. One of the property firms involved in the Better Buildings Partnership – Grosvenor – has been engaged in residential property development for three centuries [80].

Middle actors, as pre-existing groups with often deep historic roots, have evolved on their own and will likely be performing their

various societal functions even after a transition to a 'low carbon society' has (hopefully) occurred. Intermediaries that serve 'bridging' functions may disappear when this transition occurs. Middles have developed their own reasons for existence which include, but are not limited to, the mediating and connecting functions ascribed to intermediaries. Moreover, they affect not just the process of decisions that they are involved in, but some actively strive to bend, challenge, and reshape other actors as well.

For these reasons, we argue that middles are more than filler. Although there is almost certainly overlap between middles and the concept of intermediaries (depending on who defines them and how they are defined), we submit that middle agents are actors in the system and have more agency and capacity than intermediaries.

7. Summary, discussion and policy implications

In a time when urgent and large scale changes are called to stabilize the climate, we should take advantage of all the routes in which new ideas, behaviors and practices might be introduced. Policies that focus either on top-down or bottom-up approaches are often introduced, while the full potential and roles of the middle and middle actors tend to be overlooked. Similar to but more strongly than the literature on intermediaries (e.g., [11]) we argued and demonstrated here that the middle is more than 'filler' between the top and the bottom. Middle actors have unique qualities that allow them to play important and sometime crucial roles in the transition to a low-carbon society. We discussed middle actors' own agency and capacity, the impact they may have on other actors' agency and capacity, and the various roles they fill as action enablers, mediators between actors and between technology and people, and as aggregators. We introduced the middle-out approach to transition and emphasized the middle actors' abilities to make change downstream (to bottom actors), upstream (to top actors) and sideways (to other middle agents).

Policymakers, as well as energy utilities and other actors who seek to enable a swift (yet orderly), public supported transition to low-carbon society, may find our conceptualization useful, as it provides a new lens for (a) analyzing the qualities (agency and capacity) of various actors (top, bottom, middle) that are important for delivering change (b) identifying underestimated and often overlooked actors in the transition arena, and (c) planning additional transition strategies.

In this paper we further developed Janda and Parag [13] and Parag and Janda [14,15] earlier work of setting the foundations for the notion of middle actor and for the middle-out framework. Yet, this framework is still in its nascent stages of development and more critical thinking as well as empirical research are needed for it establishments and validation. Thus, it must be noted and acknowledged that we applied here a normative point of view. A more critical approach, which considers for example politics, self-interests and power relations would recognize that middle actors and/or intermediaries are not always the most appropriate agents to deliver and support change. Likewise, the middle-out approach has some weaknesses that should be examined.

First, as with the literature on intermediaries, what constitutes the middle is relative, subjective, and not easily defined. Methodologically, it is easier to conceptualize the ends of the spectrum rather than what lies between, so the existing emphasis on top-down and bottom-up is likely to continue. In a policy context focused on evidence-based research, it is simpler to treat people as discrete, rational units than try to understand the overlapping webs, social practices and networks that they build. Recognizing the various relevant middle actors requires a contextual and case-specific analysis and framing. From a policymaker's viewpoint this implies further administrative burden. It could mean building a supportive infrastructure that cooperates with various middles differently. For example, the US EPA has created an array of Energy Star programs and tools, but some areas (e.g., commercial real estate) are easier to target than others (e.g., small and medium enterprises) because of their size, resources, and accessibility. Additionally, the selection of which 'middles' to work with first and how much attention to devote to one middle rather than another could be politically problematic.

Second, while in some cases middle actors support an energy transition, they might also promote other values, practices, social and professional norms which contradict the ones energy-conscious policymakers are trying to encourage. In this context, religious congregations, in particular, need to be carefully examined.

Third, middle actors, even if empowered by policies, could fail. Many of the small-to-medium building refurbishment professionals, for example, are highly distributed and neither organized nor coordinated. These facts make it hard for policymakers to approach them with educational or training programs. This also hinders sharing of information and mutual learning which are important in particular for the utilization of new building products, practices and processes [71]. Hence, a challenge for policymakers is to target this group of middle actors in order for them to fill their potential and support the transition from the middle-out.

Despite these weaknesses, further critical development of the concept and research into middle actors (vis-à-vis intermediaries) and the middle-out approach would help to reveal its potential. In particular it would be useful to explore the 'sideways' element of the middle-out: what middle actors are within reach of other middle actors? Is there a network of middle actors, and how would middle actors within it make decisions and exert their influence, through what instruments? What would be the most effective ways for middle actors to influence each other? Is this 'business as usual' or an emerging form of governance? An investigation of the relationship between 'middle-out' activity and multi-level governance would be a useful further study.

Acknowledgements

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