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Gendered homes in theories of practice: A framework for research in residential energy consumption

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Abstract

A reduction of residential energy consumption is urgently needed, and gender is central in the performance of residential practices for this energy consumption. Thus, including gender is necessary for energy research. Theories of practice have proven to be a useful approach to the study of residential energy consumption. However, these theoretical approaches have only included gender to a limited extent. Building on contributions from gender studies, this paper presents an analytical framework for working with gender in theories of practice. The focus is on residential energy consumption in north-western middle-class homes, as most energy is consumed here. The paper presents the argument that gender can be conceptualised as ‘general understandings’ in theories of practice because ‘general understandings’ combines discursive and tacit elements of practices. Further, the paper builds on the practice theoretical understanding that the roles of materials, such as technology and houses, change according to specific associated practices. This also means that the practice as much as the materials are gendered. The paper concludes by indicating four ways to include gender in residential energy studies: 1) in all parts of the research design, 2) in the analysis of the surrounding institutions, 3) in the study of the performance of energy-related practices, and 4) in how gender is affected by and affects sustainable transitions.

Keywords: Gender studies; meaning of home; theories of practice; energy demand; energy transition; technology studies

Declaration of interest: None.

1. Introduction: Why Raise the Gender Question Within Theories of Practice and Energy Consumption?

It is widely acknowledged that the transition to a low-carbon society is vital and requires major changes in everyday life. Roughly one-third of all energy in developed countries is consumed directly within households, and a substantial reduction is needed [1]. Furthermore, the decarbonisation of the energy system includes more renewable energy in production, which calls for load-shifting and flexibility on the demand side [2]. This transition includes the domestic practices of cooking, cleaning, and washing as well as using technology for entertainment and information. Thus, changes in the performance of these practices are in question. This transition means that the whole idea of how we live and organise our everyday lives and what we find comfortable and convenient should be reassessed.

The broader social and cultural attention to home and housing, including major material alterations in buildings, infrastructure, and technology, and to the social organisation of everyday life is in question. From the literature, we know that everyday practices in the home and ideas on home and housing are highly gendered. Understanding these gender relations is important for the success of a sustainable transition in the energy system, and not including knowledge of gender in the uptake and everyday practices of new technologies may hinder the implementation of sustainability measures. For example, if communication, sales materials, and policy measures for new technologies are unconsciously written for male recipients, whereas women predominantly undertake many of the related everyday practices, this could be a major communication failure. Nonetheless, basing communication materials on stereotypical gender roles may also result in a message that is not well received. Substantial knowledge of gender roles and everyday practices is thus crucial.

Furthermore, the introduction of new technologies and new links in producer-consumer relations may also have unforeseen consequences for power relations and gender equality, which is important to be aware of when a gender-equal society is on the political agenda [3]. Examples could relate to prosumers who seek to adjust their consumption to their own production. Research suggest that men are more interested in following data on production and consumption [4], whereas making changes in consumption includes time-shifting practices, which may predominately be performed by women [5,6].

Questions of gender, which are related to energy-consuming practices and how these questions vary with socioeconomics, call for deeper investigations using both quantitative and qualitative methods. To create a sound theoretical foundation for such investigations, we must reflect on the relationship between home and gender. Such relationships are expected to vary with culture, race, geography, and social class. In this paper, our focus is on modern Westernised middle-class homes because these play a crucial role in the global transition to a low-carbon society. However, it is our hope that our framework on how to include gender in theories of practice and in energy studies can be of inspiration in a broader global context.

Creating such a foundation, Section 2 provides an overview of the emerging field in the literature on gender and energy consumption in which we distinguish different approaches for including gender in studies of residential energy. To develop these approaches further, a critical examination of gender studies is presented in Section 3. While acknowledging that gender studies, especially within the last couple of decades, have expanded into several subdisciplines, the focus is on canonised works, often cited across different empirical studies and theoretical contributions. Section 4 summarises the main contributions from the theories of practice with a focus on residential energy consumption. Based on the summary, these theories of practice are discussed against the insight from gender studies to further develop an analytical framework to include gender in residential energy studies. Finally, in Section 5, insight from the developed framework is summarised into points on how to best include gender in future studies of residential energy consumption.

2. Recent Studies on Gender and Energy Consumption

Within the last couple of decades, gender has become an important motif in energy research. First, gender serves as a tool for understanding diversity and inequality, especially in relation to energy poverty in developing countries [7–10] and for sustainable transition projects; for example, see the *Journal of Energy for Sustainable Development's* special issue on gender [11]. Studies have stated that gender plays a role in entrepreneurship and access to electricity [12,13], modernisation, potential economic growth [9], women's empowerment [14,15], energy policy, and marketing [16–18]. Though these studies identify pitfalls in the way projects affect men and women, they also reveal the potential of the empowerment of women in developing countries. Yet, the next step is to include a more critical understanding of gender and power. As Romy Listo stated in her critical discourse analysis on gender and energy poverty research, the field of research itself is dominated by gender myths, which work as ‘generalisations that operate in and shape development research, policy and practice’ [9]. An example of a gender myth in energy poverty research is, according to Listo, that woman's poverty is a direct result of energy poverty, whereas energy empowers women. Listo argued that a more critical investigation of gender and inequality should help to nuance assumptions like these.

Second, gender has been identified as an important aspect in understanding the dynamics of a household in residential energy research; thus, it has contributed to the reconceptualisation of how we perceive a household, not as a unified social core, but as individual members with different roles within the dwelling [19–21]. This has led to insight into the different ways men and women approach, manage, and understand energy reductions and time-shifting projects in households [8,22–24]. Studies have shown that policies to reduce and change energy consumption have more influence on women than men [5] and that women are generally more likely to save energy because they often have the power to decide how to do so [6,7,17,25]. Furthermore, clear evidence exists that men and women undertake different practices at different times with different implications for energy consumption [26,27]. Studies like these emphasise the need to focus on the complex dynamics of two-gendered households.

Third, some studies have identified differences between how households execute the mandate of decisions and everyday tasks according to gender roles in southern and northern countries [5,17] and revealed the need to view the home as a space influenced by culture and context. Therefore, home in itself must be perceived as a co-constitutional factor of gendered practices and gendered materials [19,23]. In doing so, these studies have also demonstrated a well-established distinction between gender and the sexes within gender studies, suggesting that gender is not just a variable in statistical research. While the latter identifies the biological sex of a person, gender is historically constructed and socially and culturally embedded and produces certain conventional gender identities (self-perception) and roles (conduct and behaviour) in different contexts. As such, gender is dynamic and subject to change. In other words, gender is not something individuals are but is something individuals do [28,29].

Finally, the growing interest in gender in energy research has also resulted in reflections on how the energy system is gendered. A recent study has shown how utilities, governments, and smart technology, providing a utopian vision of the ‘perfect’ consumer, also frame a gendered discourse: a masculine figure who is able to unlock the potential of technology through knowledge and smart apps in pursuit of the ‘smart utopia’. Describing this figure as the ‘resource man’ and arguing for a ‘gendered orientation’, Yolande Strengers (2013) drew from more than 50 reports of utilities, governments, and technology providers concerning their visions of the smart energy grid and the role that the consumer plays in this development [30]. This corresponds to a study on the underrepresentation of female members in boards and management groups of large energy companies in Germany, Spain, and Sweden, which, as the authors argued, potentially has a

negative effect on risk aversion and investments in renewable energy [18]. A similar illustration is drawn from a Danish study, which places residential energy renovation ‘in the man’s domain’ [21], with the consequence that knowledge and interest from women are excluded from the initiatives to engage homeowners [21,31]. In doing so, Strengers, Carlsson-Kanyama, Thørring, and others [7,9,17] draw attention to the many ways energy politics, institutional perceptions, and discourse are gendered and how gender inequality has unintended consequences for the transition to sustainable energy consumption.

As some scholars have noted, the different approaches to gender call for more theoretical reflections and conceptualisations of gender within energy research [9,17,32]. As Thørring concluded in her study on gender differences, we need to examine the very methods by which energy consumption is studied, placing practices and ‘everyday life as a starting point rather than an end point’ to understand the complex organisation of gender [21]. Listo’s work on gender myths in energy poverty research also emphasises the need for a critical investigation in how research itself is gendered: ‘To date there has been little critical discourse analysis of the ways in which women and gender are constructed in a field that is notable for being multidisciplinary, and indeed, for being dominated by scholars from disciplines that are typically masculine and male-dominated, such as engineering’ [9]. Thus, by adapting more theoretical insight from gender studies to energy research, gender and energy research can ‘do more than simply include gender as a variable of study’, it can contribute to a broader dialogue ‘about resolving seemingly intractable gendered problems’ [17]. Turning to the concept of home in gender studies, it is perceived as an influential but complex gendered space, especially when consisting of a two-gendered couple [33,34].

3. Gender Studies: Link Between Modern Homemaking, Domestic Technology, and Dualism

If gender is not to be perceived as just another variable in energy consumption research but is understood as something that is historically embedded along with practices, social roles, and cultural norms, we need to examine how gender is produced and reproduced within households. This calls for a brief introduction to the historical development of gender dualism, gendered homes, and gendered technology and practices within gender studies.

3.1 Production and Reproduction of Gender Roles Through Dualism

International gender study was established in the 1960s when (radical) American feminists began to question the picture of the happy middle-class housewife in her suburban home [35,36]. Criticising a society that suppressed women in the domesticated suburbs in Westernised countries, feminists started the women’s liberation movement and the second wave of feminism. Whereas gender studies along with the third and fourth waves of feminism developed a more nuanced and theoretically complex understanding of gender and non-binary gender constructions (especially introducing queer theory and a deconstruction of the two sexes), studies show that many Westernised households still practise traditional gender roles [37]. As gender roles are historically embedded, we need to start here.

Betty Friedan was a crucial voice in the establishment of international gender studies. In her ground-breaking work, *The Feminine Mystique* [36], she attacked American suburbanisation for creating an unproductive and oppressive separation culture between the sexes, in which modern homes had become ‘comfortable concentration camps’ for women [36]; also quoted in [34,38]. Basically, what Friedan and 1960s feminists were opposed to was the construction of gender dualism that started in the rise of industrialisation and was centred on the cult of the Victorian family in the UK in the 19th century [34,38–40]. Due to capitalism and the rapidly evolving urban life, the private life conceptualised by the family, childrearing, and motherhood was separated from the public life of commerce, politics, and urban life [41]. As American feminists argued, the splits between home and work, family life and capitalistic labour, and suburbs and the city were highly

gendered. Their argument was that these historically embedded oppositions between the sexes were legitimising a masculine subversive discourse on women’s lives, behaviours, and identities: the Westernised middle-class woman was linked to the private sphere of domesticity, childrearing, and home and, therefore, was marginalised from the history of importance [34,36,38].

Thus, identifying the entanglement of gender, spaces, and written history, post-war gender studies renewed the way academia traditionally perceived gender, power, and inequality. However, by focusing on ‘traditional models, rooted in the idea that gender identity is fixed’, it also formed new gender stereotypes, as Rezeanu stated in her critical review [42]. Recent studies have therefore focused on a more nuanced understanding of how gender dualism is produced and reproduced.

In fact, since the 1990s, masculinity studies have worked to unpack multiple masculine identities in modern (Western) culture, examining the historical, cultural, temporal, political, and psychological ways in which the definition of masculinity is created [43]. Several studies have shown that men were also drawn to Friedan’s ‘mystique’ of the modern suburban home not only because of its symbol of social status [44] but also as a site for place attachment, self-expression, and family life [45]. The general picture drawn in these studies is that the modern history of homemaking brought new masculine, domesticated roles. As Australian gender researcher Andrew Gorman-Murray concluded in his article on ‘Masculinity and Home’, the modern dwelling offers men several ‘masculine domesticities’, in terms of different masculine-coded spaces or activities in the home [45]. Gorman-Murray drew from the work of anthropologist Sarah Pink, who also pointed to the diversity of these ‘new domestic masculinities’ enacted in the modern home. Pink stated, ‘Different masculinities are constructed, lived and represented uniquely in relation to the structural, spatial, material, visual, sensory and social elements of men’s homes’ [46]. Therefore, the post-war stereotypical picture of the patriarch, which was identified by post-war feminists, has fragmented into a range of different ‘domestic masculinities’, such as the single bachelor, the dad, the gay couple in a suburban house [45], or the do-it-yourself (DIY) man [47,48].

In addition, the fixed description of the suppressed housewife has also been nuanced. British gender researcher Judy Giles described how modern domesticity offered woman self-esteem, pride, and a new form of privilege [34]. Giles argued that, for many women, modernity is not something they experience in urban spaces or at work (as argued by post-war feminists) but is embedded in their everyday lives at home in the suburbs. In addition to raising the average healthcare status of people, the shift towards a consumerist economy in the post-war phase also offered women opportunities to express their values and personal identity in a more individual and material way as consumers. This also contributed to self-awareness as women and as individuals, not just as caretakers of other’s needs [34,48]. Simultaneously, this individual consumerism turned the home into a public display of a personal lifestyle [44]. These and other related studies led to an overall deconstruction of the separation between modern domesticity as a ‘natural’ and female domain unattached to the outside world [39] and gave alternative insight into the complicated everyday lives of both women and men.

However, recent studies have also revealed how conventional gender identities are constantly evolving, reproducing the historical expression of gender dualism and, therefore, new expressions of gender inequalities. In masculinity studies, the ideas of ‘hegemonic masculinity’ try to explain how. Hegemonic masculinities mean that society can contain different interpretations of masculinities. However, these masculinities are ranked in a hierarchy that, overall, maintains the supremacy of men over women while creating a diverse and more open understanding of masculine roles and identities [49,50]. As such, masculinity differs according to segment and context, yet it can be grounded in the same gender stereotypes and the same conventional gender dualism as proclaimed by post-war feminists. While men have taken a

larger role in Western households [37], they have been unable to fully deconstruct and neutralise the female core of modern homemaking, at least not in traditional two-gender parental families. As Naomi Cahn stated in her review of gendered identities and housework, she defined modern homes as a woman’s ‘powerbase’ [33]. She claimed that it is only natural that women have negotiated some kind of power in the domestic sphere while fulfilling a role that was assigned to them, not chosen [33]. As such, women are reluctant to relinquish their privileges (control and access to knowledge and power to make domestic decisions) that they have been given with the invention of modern domesticity. As Chapman stated, masculinity in the home in all its forms is a matter that is fundamentally ‘out of place’ [37].

Gender differences have multiple forms and shapes because of the various experiences that different spaces, roles, and discourse produce [50]. The ways men and women practice and understand their tasks and roles in the dwelling (and elsewhere) are multiple and are coded differently [3]. Viewing gender as something that is produced and reproduced within the binary dynamics of femininity and masculinity and, therefore, within a heterosexual framing has been highly criticised by scholars within queer theory and post-structural/post-colonial gender studies. However, in focusing primarily on two-gendered households in modern Westernised middle-class homes to understand why women and men perceive energy consumption differently, we need to understand how gender asymmetry is produced and reproduced while considering the floating categories of gender [28]; see the section 3.2.3 on doing/undoing gender).

3.2 Crucial Themes in Gender Studies

How can findings within gender studies serve as an analytical framework to work with gender as a social factor in the dynamics between changing energy systems and everyday practices? The overall purpose of including gender studies in the further investigation of residential energy consumption is, as shown above, to continue to identify and deconstruct gender as a part of everyday life and, thus, to scrutinise how power and inequality are related and co-produced [33,46,51]. Whereas the first section aimed to define why gender is important, this section identifies how gender studies can contribute to energy research and theories of practice. Thus, in stating the importance of gender as a social factor, three themes must be highlighted: gender and home, gender and technology, and doing/undoing gender.

3.2.1 Gender and home

Because gender is embedded in practices and is socially structured, is it also bound to specific time-bound and spatially bound situations and, therefore, to the construction of different material worlds. Thus, space is not an empty container of activity. It is a field of action and a basis of action [52], meaning that space, similar to social structuring factors (ideals, figures, and norms), frames the way individuals behave, perceive, and understand themselves and one another. In their article on anthropology of spaces, Low and Lawrence-Zúñiga defined gendered spaces as ‘particular locales that cultures invest with gender meanings, sites in which differentiated practice occur or settings that are used strategically to inform identity and produce and reproduce asymmetrical gender relations authority’ [53]. As shown, gender plays a significant but complicated role in relation to the home as a spatial site. In fact, it is a common notion that the separation between home and work and between female and masculine domains in the rise of post-war modern suburbs in Anglo-American countries has been identified as a key event in the establishment of international gender studies [34,38]. Moreover, the separation of spatial domains also frames some of the fundamental gender dynamics still existing in several canonised and recent publications, especially on issues like income, maternal and paternal leave, and history writing [33]. Yet, links between domesticity, gender, and homemaking are relatively new [45]. This has led to more nuanced insight into how everyday practice, gender, and power are displayed within the private sphere of the modern home.

Gender in domestic space, in everyday practices, and in our daily performances continues to evolve. As homemaking research has shown, home as a gendered space is mixed and complicated in ways that go beyond the conventional gender roles [54]. Consequently, concepts like place attachment [44], time and space [55], lifestyle decoration [56], and personal identification [57], must be included in the investigation of gender asymmetry and gendered practices in the home.

3.2.2 Gender and technology

Like home, technology is deeply rooted in Western gender dualisms and has been philosophically, historically, and socially constructed and validated as masculine [52,58]. The study in technology up to the 1980s was ‘gender-blind’ [59] because technology, like architecture [60], was considered gender neutral. The establishment of feminist science technology and society study (FSTS or just FTS) questioned this perception in the 1990s. As several researchers have argued [52,58,61], technology is part of one of the oldest Western dualisms, that of reason versus non-reason. Specifically, our perception of technology is related to the early modern philosophy of what Lloyd described in his figure of the Cartesian ‘Man of Reason’ [61], a figure who uses intellect to transform society. In this grand narrative of the West, science is a key driver of progress, and technology serves as ‘the application of science to [its] practical solution’ [59]. The resemblance to Strengers’ ‘resource man’ is obvious [30].

The purpose of FST is to investigate the material world that technology is creating, focusing on ‘technology’s role in shaping [the] local and global configuration of power, forms of identity, and ways of living’, as Bray [59] defined it. As such, FTS rests on the premise that technology and gender are mutually co-constructed in a dynamic process of social interaction, practice, and discourse. This means ‘we can never fully understand one without also understanding the other’ [62]. However, as Massey demonstrated in her study on high-technology workers’ perspectives on home and career, gender is often expressed in ‘the way life was organised and conceptualised, the unspoken assumptions’ [52] and in practice. Thus, FST has focused on how technology relates to gender asymmetries and inequality within educational systems and on the job market [59], whereas gender and technology in relation to domesticity and home are underrepresented, although not entirely ignored.

One study that had a huge influence on international gender studies in the 1990s, which is often cited within FTS studies, is Ruth Cowan’s (1983) extensive work on household technology in the post-war period: *More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave*. Cowan showed that much of the household technology that was sold to housewives with the purpose of streamlining tasks at home and increasing comfort for homeworking women did the opposite; it contributed to new standards of cleanliness. Instead of liberating housewives from trivial trials and tribulations, it made them struggle with new cultural ideals of a perfect house with the housewife as the key representative of the home. Second, Cowan demonstrated how unspecialised, trivial housework was manifested and depended upon ‘nonhuman energy sources’, and, as such, housework is closely related to industrial development and findings, as technology co-produces new ways of living, new domestic spaces, and new domestic practices [63,64]. As Cowan explained, ‘housework is more characteristic of our society than market work is. It is ... the form of work that each of us—male and female, adult and child—pursues for at least some part of every week’ [63].

Cowan’s study [63], Cockburn and Ormrod’s *Gender and Technology in the Making* [65], Cockburn and Fürst-Dilić’s *Bringing Technology Home* [66], and Pink’s *Home Truths* [46] show how femininity and masculinity are encoded in particular technological artefacts, such as the microwave and vacuum cleaner, and in skills associated with domesticity, such as washing and online banking. Studies on smart technology in the home,

such as the automatic vacuum cleaner, demonstrate how visions of a clean home could be counterproductive to energy reductions because of the context, and what it does to an already gendered practice [67]. Each case study provides insight into how technology and gender are socially constructed between individual use and group socialisation (institutions, marketing, religion, and class). As noticed by Gram-Hanssen and Darby, domestic technology in all its forms can never be grasped without understanding home [68] and the vision of ideal homes that form our practices [69]. This emphasises the importance of the way we understand, promote, and use technology because technology is a historically masculine-coded artefact, while the home, at least in the modern Western context, is essentially female.

3.2.3 Power relations of ‘doing and undoing’ gender

Gender roles may be expressed in many forms, from the construction of gender-prescribed behaviour and work practices to the constitution of ‘a process of bodily submission, as evidenced in postures, gestures and movements’ as defined by Cockburn and Fürst-Dilić [66]. Therefore, it is equally important to consider that gender, home, and technology are not just formal features but are subjects of negotiation and positioning and are subject to questions on power and gender. This means that gendered domestic practices and the use of technology in the home may occupy conventional gender positions and serve as an opportunity for negotiation and revolt against traditional gender identities. This review of gender studies has shown that, among other factors, such as class, nationality, and religion, gender is a structuring factor for how people live, practice, and understand their lives. Gender is not something individuals are but something individuals do. Consequently, the agency to interpret and act upon an optional display of conventional conduct is about individual disposition [42,45,70]. Individual practices (or subjectivity as defined within gender studies) is closely related to investigating how people are ‘doing’ or ‘undoing’ gender identities, according to the conceptualisations of performative aspect of gender identities by Butler [28], West and Fenstermaker [71], and West and Zimmerman [29].

The idea of ‘doing’ gender builds on the premise that people tend to perform their gender identity as ‘naturally’ as possible according to gender ideals, discourse, intuition, history, and social acceptability. ‘doing’ is a mutual, active negotiation of actions, speech, appearance, and listening [29,70]. Butler’s concept of ‘undoing’ gender adds to this premise by arguing that ‘performing’ gender can also be an active resistance (conscious or unconscious), as it can question the conventional gender roles of masculine or feminine identity. Undoing gender is therefore a basic element in queer theory, which insists on non-binary gender identities: that gender is not an option between the two sexes but can be fluid, dynamic, and in-between. In both cases, doing and undoing gender is about performativity, which is an act. It is part of one’s personal disposition, embodiment, and experience and often results in multiple contradictory gender articulations in the acts of one person [42]. As Pink has shown, class, gender, education, nationality, and individuality are embodied in our sensuous experiences of tactility, olfaction, vision, and sound and in our activities and tasks in the home. This explains why different people experience household tasks, such as vacuuming or doing dishes, fundamentally differently according to the specific cultural discourse on gender and the ability to conform, transform, or revolt against these gender identities. As Listo has argued in her critical discourse analysis on gender and empowerment in energy poverty research, it shows why we need to more critically examine the concept of power [9].

4. Towards a Further Developed Practice Theoretical Framework

If homemaking and everyday practices are dominantly and historically inscribed as feminine and if technology is mostly masculine, then what happens when we focus on a low-carbon transition of society and of residential energy-consuming practices and new technology? Based on the concepts of home, technology,

and power of doing/undoing gender, we present the main ideas from theories of practice, which can serve as analytical concepts for including gender in residential energy research. This can facilitate understanding the potential advantages and pitfalls in transforming residential energy consumption and technological systems into a more sustainable low-carbon system.

4.1 Main Ideas from Theories of Practice

As already noted, theories of practice have proven to be valuable when analysing residential energy consumption because, among other reasons, they include materiality and focus on the routinised aspects of human conduct. An essential part of the theories of practice is that they decentralise the point of analysis from the structure, discourse, individual agent, or technology and argue that practices should be the basic unit of study when analysing the social world [72]. Furthermore, relating theories of practice to the subject of consumption, Warde argued that consumption is not a practice in itself, rather it is a moment in most practices [73]; thus, energy is not consumed for its own sake but as part of accomplishing various social practices in everyday life [74]. To understand residential energy consumption, the focus should be on the various practices that are performed in everyday life and on how these practices are interlinked [75]. Practices are performed by individuals who contribute to the repeated maintenance of the practice as an entity while performing these practices. Thus, the individual can be considered a carrier of practices and the unique crossing point of many different practices in the individual's everyday life [76].

This approach of theories of practice corresponds well with understanding from the review of gender studies, even if theories of practice, as they have been developed in recent years, have only included gender to a limited extent. As seen in the review, with historical and local variations, some practices have been inscribed differently in bodies and according to meanings in relation to different gender identities. Different practices also relate to each other, and how gender is inscribed in one practice has consequences for how gender is inscribed in other related practices. From a practice theoretical perspective, the meanings, rules, materials, bodies, and competences are always woven together, and the changes in one of these elements mean changes in all of them. This also indicates that gender is inscribed in meanings, rules, materialities, bodies, and competences, and our interest in gender in theories of practice should include all of these. Thus, gender influences the inner workings of single practices, the connections between practices, and the larger constellations involving a multiplicity of practices. Gender can be considered one of those larger phenomena that thread through or suffuse practices [77]. Gender is something we do, as shown in the review. However, gender should not be considered a practice in itself. Rather, gender is performed while we carry out the diverse practices that make up our everyday lives, according to the concepts of doing and undoing gender [28,29,71].

4.2 Gender as Threading Through a Multitude of Practices

Conceptualising gender as something that is threading through a multitude of practices, gender can be viewed as discourse, as has been prevailing within gender studies [78,79]. Discourse analyses are seldom used within theories of practice; however, Schatzki discussed how certain types of discourse analyses are more compatible than others for inclusion in theories of practice [80]. This includes those discourse analyses that do not focus on discourse at the ontological level but rather view discourse as part of the meaning of what holds practices together, thus continuing to focus on practices rather than on any overarching structures. From this perspective, gender becomes something we do rather than a ‘free-floating’ discourse, which resonates well with the review of gender studies. Keller and Halkier worked with discourse analysis in practice theoretical empirical studies of contested consumption. Based on their analysis, they argued that ‘understandings of practices can draw on media discourses, procedures for practices can be inspired by or

mimed from media discourse, and engagement in practices can be argued on the basis of normative contestation of consumption’ [81]. Relating this to gender implies how media discourse or more general discourse of masculinity or femininity can be argued by, drawn upon, mimed, or mirrored in specific performances of a multitude of practices. When people perform household practices, such as cooking, men and women may draw on a multitude of different types of discourse about what cooking is and how it should be done, including how it should be done related to gender.

Another way to understand larger phenomena that thread through practices is through the concept of ‘general understandings’ proposed by Schatzki [82]. General understandings, according to Schatzki, are commonly shared beliefs, enterprises, concerns, or fates, and as an example, Schatzki mentioned religious understanding and communitarian understandings. Schatzki introduced general understandings as a concept in his book from 2002; however, he does not use or further advance it later. In 2017, Welch and Warde take up the concept and further discussed it. One of their examples includes the question of how masculinity can be an ‘ideational element common to multiple practices’ [83]. However, Welch and Warde did not further develop the idea of conceptualising gender as general understandings. According to Welch and Warde, general understandings are formulated both in sayings and in doings, and they emphasised how general understandings relates respectively to discourse and to the tacit – and how it combines the two. This seems a good argument for conceptualising gender as general understandings, rather than merely seeing gender as discourse threading through different practices. Gender is as much in the tacit, unspoken, bodily, and material aspects as it is in the conscious and verbal acts [46].

Thus, we propose that gender in theories of practices is treated as a general understanding because it combines tacit and discursive elements. Furthermore, we emphasise that general understanding and discourse should not be considered part of a distinct ontological level but should be considered to intersect with specific formations of practices, and we should not misunderstand it, implying that general understanding directly explains actions. This also resonates well with the discussion of flat ontology as proposed by Schatzki, advocating that there should be only one level in our understanding of social aspects and that this is at the level of practice [84]. Thus, gender is not an overarching structure guiding the world; rather, gender is considered to be general understandings threading through multiple practices. Gender never explains how practices are performed; instead, gender interacts with meanings, rules, competences, bodies, and materialities in the formation of practice.

With reference to the work on general understandings by Welch and Warde [83], gender as a type of general understanding can provide insight into the larger phenomena because general understandings take part in teleoaffective formations of complexes of practices, sociocultural groups, or other slices of praxis. Furthermore, Welch and Warde suggested that general understandings exhibits three functions, which we argue also makes sense according to gender: (1) it has an organising function, (2) it sits across pre-reflexive and discursive aspects, and (3) it enables intelligibility.

In the review of gender studies, power is at stake in the formation of and relations between genders [28]. The concept of power has not had a prominent place within recent developments in theories of practice; however, Watson proposed some useful reflections and started by emphasising that ‘power must be understood as an effect of performances of practices, not as something external to them’ [85]. Translating this to the understanding of power in gender relations, power in gender relations can be considered an effect when performing practices where gender as general understandings are involved in shaping performance. Power is co-produced when performing practices rather than being a property or object related to gender.

4.3 Gendered Technology in Theories of Practice

Especially within energy research that uses theories of practice, the question of materiality and its role in forming practices has been investigated. Shove et al. argued that materiality is one of three elements holding practices together [75], whereas Schatzki viewed materiality as part of the network within which practices are performed, which can prefigure practices in certain directions [86]. Either way, there is an agreement that materiality in its different forms takes part in shaping practices. In pursuing this agreement, various authors have drawn on various STS (Science and Technology Studies) approaches to technology and materiality, including the actor-network theory and other ideas from Latour [87,88].

Most energy studies working with practice theory approaches have either focused on specific practices and technologies or more broadly included the role of materials, which includes all types of technologies, buildings, infrastructures, and human-made and natural objects. Thus, the focus has been either on the specific material item or on the general concept of materials. An attempt to go further into specifying materials in practices was made by Shove who argued that materials of practice can be distinguished according to the role the material has in practices [89]. Shove distinguished between three types of roles for materials:

1. Resources are used up or completely transformed through the performance of the practice.
2. Infrastructure is necessary for the conduct of the practice but is not directly engaged in it.
3. Devices are directly engaged in practices.

Shove emphasised that materials may change the role they have in different practices. Thus, a boiler may be a device employed in a heating practice, whereas it may have a more infrastructural role with the house as a background for all the practices performed in the home. Combining this with ideas of gender and technology, or gender and home, what is important is that masculinity and femininity are not definitely attached to each materiality. Instead, it may change with the role the material has in practice. Thus, the performance of the practice is gendered as much as the materials involved in it. As our gender review shows, a house in late 20th century Western society may be more associated with masculinity when it is built or renovated, whereas it may be associated more with femininity in the background of performing practices, such as childrearing and cooking [37]. In the case of the house, this change could also be viewed in the choice of the terminology of *house* or *home*; a house is a device we interact with directly when building and renovating, whereas a home is a background for the performance of our everyday practices. In this way, the home should be considered infrastructural according to Category 2 above, according to Shove, which may offer some opposing associations because infrastructure resonates with hard, masculine, urban technology, whereas home is perceived as a soft feminine atmosphere surrounding our everyday lives [33]. This indicates that the terms used by Shove (resources, infrastructure, and devices) have some undesirable gendered connotations. This should not prevent us from being inspired by the important insight that the roles of materials, such as technology and houses or homes, change according to the specific practices they engage in and that the practice as much as the materials are gendered.

4.4 Conceptualising Gender in Theories of Practice

Gender can be understood as a general understanding, which can then be found in the performance of practices, materiality of practices, histories of practices, meanings of practices, and power relations among practices and practitioners. As such, we argue that gender can be considered a larger phenomenon that threads through or suffuses practices [77]. More specifically, we argue that the notion of general understandings from Schatzki serves the purpose well. Gender can be analysed and included in studies of

residential energy consumption in other ways than focusing on how men and women perform different practices in their everyday lives or have different interests related to home and technology. Focusing on the differences between the two sexes may still be relevant, although problems of stereotyping gender may occur when doing this rather than including how gender changes with the introduction of new policies and technology. Because gender, from a practice theoretical perspective, is what we do rather than who we are, theoretical and methodological approaches should also be open to ways in which gender is dynamic from a temporal perspective of how practices change towards a low-carbon future.

5. How to Include Gender in Future Energy Research

The starting point for this paper was that a transition to a low-carbon future is vital and implies changes within the everyday practices in our homes. As both everyday practices and homes are highly gendered, we have argued that, to achieve this transition without contributing to further gender inequality in society, gender should be included in future energy studies. Building on insight from previous energy and gender studies and from the gender review and theories of practice, as provided above, the following paragraphs distinguish four different approaches for future energy studies.

First, gender should be thought through in all aspects of designing a research project. Framing the research question, designing the methodology (including specific questions), and performing the analysis are all part of research practices that are gendered, as Ryan has stated [17]. This does not mean that men and women necessarily do research in different ways. Rather, it means that some types of research questions link better to aspects of either home or technology, which are historically either feminine or masculine coded. Asking household members about their energy retrofitting projects is placed in ‘a man’s domain’ [21], excluding everyday life as the starting point. However, asking questions about retrofitting can serve as an introduction to the different tasks and roles in the household, if these questions are combined with questions of household perception on retrofitting and the quality of everyday life, on the aesthetics of the home, on household ideology towards (energy) sustainability, and so on. Acknowledging that gender is embedded in all relations of home and technology may facilitate reframing or supplementing questions better to include a gender-balanced perspective, as some scholars have already shown [5,17,21].

Second, based on Strengers’ ‘resource man’ and similar studies, the focus should be on the institutional construction of gender through policy, marketing, and dissemination material [18,30]. Thus, even when the focus is on what is occurring inside the home, the focus should consider that practices in the home are structured differently from professional practices outside the home. As FTS has already established a nuanced tradition for critically examining gender bias and structural gender discrimination in science, technology, engineering, and mathematics (STEM)-related education and policy and, through this, has contributed with relevant changes, we can also expect that gender-based studies of energy policy, marketing, and so on can contribute to improving policy. Knowledge about which gendered competences and sociocultural environments are constructed by different institutions (authorities, utilities, research, installers, and industry) can be valuable to improve these same institutions. More knowledge about the consequences of the fact that primarily men work as installers and work in the energy sector may facilitate relevant changes. Specific energy campaigns targeting women may be relevant but are also candidates for gender studies interested in how gender is constructed within a sustainability perspective [6]. To understand what is occurring within the home, we need to examine the entire system surrounding the home from marketing and installation, competences, and technical skills to social factors of various institutions because they contribute to constructing practices in the home.

A third approach focuses on how ‘energy’ is more generally ascribed to gender. What happens with energy in relation to gender as it works through the infrastructure, plugs, and pipelines all the way to different everyday practices? Such a study could further develop the approach of viewing gender as general understandings of practices, and the ideas of different roles for materiality in practices [89] could be used to follow how materials change gender in relation to the role of the material in different practices. Furthermore, this could include more empirical knowledge of how the same practices are performed differently in relation to gender. We can assume that the masculine versions of cooking and childrearing are different from the feminine versions [45]. Additionally, we need to ask how and why ‘energy’ is perceived according to different activities in the home. As Pink has shown for vacuum cleaning, gender is performed in different ways when performing different practices in the household [46], which again may open up new aspects on motivation, empowerment, and construction of one’s gendered social identity. Such approaches could be the focus of general energy studies.

Following the idea that practices and materiality relate fluidly to gender and that practice and materiality change according to different power relations leads us to the fourth and final approach for future energy studies. In the near future, a transition to a low-carbon energy system is expected, and this may include the introduction of new technologies in the home and new roles for the consumer. Following the lines of this paper, it will be relevant to analyse how this relates to gender. While studies show that women are more likely to engage in new energy-saving practices than men [5,6,25,90] we know very little about how this contributes to an already established division of household roles and women’s empowerment. As Ruth Cowan has shown in her study on the adaption of new technology to post-war American households, gender may work counterproductively to the intention of technology [63]. We must further examine women’s roles in the transition towards sustainable energy consumption regarding whether the transition will lead them to take on more responsibility in the household and therefore reinforce a traditional gender role or whether it will liberate them from conventionally ‘feminine’ tasks in the home. Moreover, we need to examine it from a masculine perspective in terms of men’s access to homemaking. One of our motivations for becoming interested in gender and energy is that a future energy system with more renewable energy may include consumers becoming producers of energy and, in the affluent part of the world, could include the introduction of new smart technology in homes to manage and time-shift energy consumption. How will these transitions in everyday life be entangled with gender? Old gendered practices of masculine DIY in the home may be challenged by new digital solutions and practices, and this may imply renegotiations of gender roles and decision-making as well. Questions of how new technology enters the home can also be analysed against how the home as a marker of identity is gendered and how new technology systems, such as photovoltaics or smart control systems of energy, interact with established gendered identities. In addition, with new generations of households establishing themselves as families, this could introduce a new understanding of gender and homemaking. These types of studies, however, must also include some type of baseline studies. To answer questions of what effects a low-carbon transition can have on gender, we need to know more about the ‘baseline’ in household energy consumption. Gender studies of home and technology exist, and statistical analyses to document variations in the performance of practices can supplement these. Part of the baseline for gender in everyday life and home may also include analyses of how decisions, arguments, and conflicts are handled in homes with two partners. As some studies have already shown [21,23,24], household decisions do not occur in a vacuum. However, decisions on new technology or retrofitting projects not only are a matter of who decides what but are also argued along other lines of debate. This means that we need to further expand the concept of a household not only as containing different members but also as containing conflicting and overlapping practices, priorities, and considerations from different members. As Carlsson-Kanayma and Lindén [5] have shown, a gendered interpretation of

hygiene may affect women’s reluctance to quit taking long, warm baths while at the same time showing a willingness to change other energy-reducing practices. In addition, men and women can have the same intention to save energy or adapt to flexible energy consumption in a household, yet the execution may be different [25], which calls for an investigation into the temporal aspects of motivation and practice. Along with such baseline studies, studies of how gender works in everyday life when new technology enters the home are required.

With these four approaches on how to include gender in work on residential energy, we hope to have contributed to the establishment of the foundation for future energy studies to include gender in more ways than previously seen. We have also argued that including gender in residential energy studies is relevant to achieving a low-carbon future and gender equality. Finally, we have shown how the combination of gender studies and theories of practice, which have been a basis for considerable recent research in residential energy consumption, goes well together. Gender is performed; it is something we do, rather than an attribute or something we are. Thus, gender is practised, and the dualities and powers related to gender roles must be understood in relation to this performance.

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