Review

A Review of Energy and Gender Research in the Global North

Harrie Mort

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Gender Issues in Energy

Introduction

To date, the relationship between gender, and energy use and planning has predominantly been seen as a topic of interest in the context of the global South. In non-industrialised nations, energy use is strongly linked to hard, physical labour, health risks, and an extreme absorption of women's time; issues which are not so pertinent in a Northern industrialised context. (Cecelski, 2004) For this reason, there was a general assumption that was no 'Northern perspective' (Carlsson-Kanyama & Lindén, 2007 pp. 2163) on the subject, and that energy in the context of the global North was essentially value-neutral. This has been increasingly challenged over the last twenty years, a challenge that has, in many ways, been prompted by the emergence of the 'low-carbon transition' or 'energy transition' on the global political landscape. Two main research agendas become apparent upon review of the literature concerning energy and gender. The first is strongly grounded in the growing drive to reduce energy consumption, and to achieve the 'energy transition,' and is concerned with how gendered analysis can contribute to the achievement of particular goals, whether this is reducing peak load on the grid or facilitating the transition to 'low-carbon' futures. The second strand instead turns to questions of gender equality, and a number of the questions addressed by this body of research are asked in the early analytical framework outlined by Clancy and Roehr:

> *'Are the lives of women and men affected differently in terms of the energy forms they use? If gender differences towards energy exist, are women and men able to exercise choices that reflect those differences about energy? Do women and men in the North have different preferences for energy policy? Are women able to make effective contributions as academics, as activists and as workers in the energy sector?' (2003, pp.17)*

These authors question the assumption that men and women in the global North have the same relationship to energy as it is now, and argue that these differences can be further increased as energy systems change. In cases where research is contextualised by the 'energy transition,' distinctly different issues come to the forefront: the 'energy transition' may still be presented as a desirable goal but it is looked at as a matter of social justice, a theme that has gained increasing importance with the recognition that energy transitions are accompanied by huge underlying social upheavals. (Miller, Iles & Jones, 2013) Gender equality demands that men and women have equal access to services and goods that have value in society, and that they have equal power to determine the shape of their own lives. In the case of the energy transition, this also means ensuring that the benefits and burdens of the change are not distributed unevenly. (Clancy & Roehr, 2003)

The literature concerning energy and gender in the Northern industrialised context is still sparse, and is theoretically divided in some important ways. This review will first discuss the different

theoretical approaches to gender that emerge in the literature and outline the standpoint of this review. The main body of the review will address the two key branches of literature that have been identified in this introduction: gender and its investigation as a factor for the success or failure of energy interventions, and energy and gender equality, discussing how they are in conversation. Finally, this review concludes by summarising the current state of the literature on energy and gender in the global North, and touches on literature in the global South to highlight some potentially problematic elements of the Northern body of gender and energy literature.

Conceptualisations of Gender

In the energy literature there has begun to be some departure from the construction of individuals as rational economic actors, whose choices and practices with regard to energy are purely shaped by economic considerations. Instead, an individual's relationship to energy is seen as emerging as a product of their material constraints, preferences, values, and the norms that are attributed to them according to certain socially constructed identities. (REF) This has opened up energy research to gender analyses and it is worth discussing the different theoretical approaches to gender that are used in the energy literature.

A large portion of the literature leaves gender un-theorised. This leaves implicit its understandings of gender and therefore any underlying assumptions that are being made regarding gender. This is particularly true of the quantitative literature that uses gender as an analytical category. The vast majority of the remaining literature views gender as socially constructed and rejects the conceptualisation of gender norms as biological or intrinsic 'truths.' A number of authors further deploy conceptualisations of gender as 'relational,' which acts to further break down the essentialization of gender. Conceptualising gender as 'relational' further emphasises the fact that 'male' and 'female', or the 'masculine' and the 'feminine' are only constituted with reference to each other, and have no independent meaning. The distribution of traits and capacities across this constructed binary, and the strictness of the separation between them are highly variable across time, and across cultures. Therefore, the actual meaning of what it is to be a 'man' and what it means to be a 'woman' is intrinsically unfixed, and unstable. (Flax, 1987) Analysing gender relations instead of gender roles can enrich analyses as this approach focuses on the connections between men and women's lives, and the power relations that exist between them. (Khamati-Njenga & Clancy, 2015) Presenting gender as relational is also seen as a way to incorporate the multiplicity of individual experience, as it acknowledges that each individual's experience of gender relations is shaped by other social relations like class and race. (Flax, 1987) Acknowledging the heterogeneity of gender in this way has also prompted a new, and small body of work that uses intersectionality as a methodology. Intersectionality further argues that the interacting effects of various sociodemographic factors means that one cannot be analysed separately from the others. Furthermore, the overlap of different power relations according to these factors can have a compounding effect on the experience of multiple interlocking forms of marginalisation.

The different approaches used in the various studies discussed here won't be addressed extensively throughout the body of the review; however, it is the perspective of this review that the results discussed here should be approached from a constructivist perspective on gender. The particular constructions of gender roles and gender relations can be stabilised over an extended period of time so are a worthy topic of analysis; however, any findings should not be taken to communicate something intrinsic and immutable about the characteristics of a particular gender. In this understanding, gender is something we *do* not something we *are* and is something that can be both done and undone.

Gender and Energy Interventions

How to achieve successful energy interventions has become an important question, as the need to 'decarbonise' our energy systems has become more and more urgent. This means phasing out fossil fuels and integrating other energy sources, like renewables or nuclear power. Moreover, the energy transition will likely demand changes in people's energy practices, not only in terms of absolute consumption but in terms of what types of consumption will be deemed more or less acceptable. (Fraune, 2018) What form the energy transition will take is by no means set in stone, but will inevitably require substantial efforts to gain public acceptance and behavioural changes. Assessing public attitudes towards particular energy interventions, and their willingness to change their behaviour has therefore become an important subject of analysis in service of successful energy interventions, as has the analysis of energy practices. Understanding energy practices, and the factors that lead to their obduracy, is seen as a means to shape the transition in such a way as to overcome the factors that limit the ability or willingness of individuals to change their energy practices. This can be through behaviour change, energy efficiency upgrades or the adoption of new technologies. In this body of literature, gender has largely been taken as a category of analysis to more successfully target energy interventions according to the attitudes, practices and obduracies of particular demographics; in particular, gender is seen as a key factor when looking at household energy consumption.

Analysing Attitudes: Technologies and Behaviour Change

Research in this area looks at attitudes towards different energy technologies, including energy sources: fossil fuels, renewables, and nuclear; as well as technologies like smart meters that are being integrated into the energy infrastructure. Attitudes toward changing energy-related behaviour is also an important, and often intertwined element. The methodological approach in this area is predominantly quantitative, which has its own strengths and is important for identifying broad trends; however, there has been some critique of the relative lack of qualitative research, which is argued to have greater explanatory strength for exploring the reasons behind gender differences. (Fraune, 2016; Henwood & Pidgeon, 2015)

Attitudes Towards Technologies and their Adoption

There is some evidence that there are differences in attitudes towards different energy supply

technologies between men and women; however, the evidence is equivocal in the majority of cases. The strongest evidence exists for gender differences in attitudes towards nuclear power, while for other technologies evidence is newly emerging or somewhat ambiguous. Women have consistently been shown to be less supportive of nuclear power than men, while the size of the gap varies, this is a trend that has proven to be robust over time, country and independently of other demographic factors. (eg. Dunphy, Revez, Gaffney, & Lennon, 2018; Gutschik & Sturm, 2012; Henwood & Pidgeon, 2015; Jäckle & Bauschke, 2011; Pampel, 2011; Solomon et al., 1989; Sundström & McCright, 2016; Visschers & Siegrist, 2014) This difference has been found to persist at the level of policy-makers in Sweden, (Sundström & McCright, 2016) and in other work that looked at five Nordic countries: Denmark, Finland, Iceland, Norway, and Sweden. (Jensen, 2000) However, these studies also found that this difference disappeared when controlling for party affiliation. For example, Jensen found that this difference persisted only in 'social democratic women,' and for this reason they found greater explanatory power in party ideology. (2000, pp.391) While the authors normalised for party affiliation, it is worth noting that other authors have found significant differences in the distribution of gender across different political parties. Gender differences in party affiliation can't automatically be attributed to gendered differences in ideology because other factors; for example, systems of women's recruitment will play a role. Nevertheless, this factor would benefit from further scrutiny. (Fraune, 2016)

Analysis of attitudes to other technologies is largely emerging, underdeveloped or contradictory. The reasons behind contradictory results are difficult to assess as the questions asked about the same technologies are varied in nature so may produce different results. In addition, these studies vary in terms of their scope, historical and cultural context and approach, which can each have their own effects. Hydraulic fracturing (fracking) has recently emerged as an energy source of interest, and there's some evidence different levels of support between men and women. Women are less likely to support fracking for shale gas and oil, and are more likely to think of it as an environmental risk than an economic opportunity. (Davis & Fisk, 2014; Thomas et al., 2017) There is also some evidence that they are less likely to support gas with carbon capture and storage (CCS). (Karlstrøm, & Ryghaug, 2014) In terms of attitudes towards mainstream fossil fuels, and renewable energies, findings are contradictory. Longstreth, Turner, Topliff & Iams (1989) found that women in the US were less likely to support fossil fuel energy paths, and that they were more or less supportive of renewable energies according to whether a univariate or multivariate analysis was applied. In contrast, Greenberg (2009) found that women were more supportive of both fossil fuels, and of renewable energies. Balta-Ozkan & Le Gallo (2018) also found greater support for fossil fuels amongst women; however, they were more likely to see renewable energies as the most important for the future, as well as seeing environmental protection as a key goal for both energy policy, and national policy overall. Other studies reported no significant difference in acceptance of renewables, (Dunphy, Revez, Gaffney, & Lennon, 2018; European Commission, 2003; Sardianou & Genoudi, 2013) and Dunphy, Revez, Gaffney, & Lennon (2018) found that fossil fuels ranked uniformly poorly in the energy preferences in both men and women, though there was slightly more variation in women's preferences.

When it comes to preferences for individual forms of renewable energies, results are similarly

contradictory. There is some indication that women are less supportive of hydroelectric power (Balta-Ozkan & Le Gallo, 2018; Karlstrøm, & Ryghaug, 2014; Visschers & Siegrist, 2014) but are more likely to have positive views towards bioenergy, (Karlstrøm, & Ryghaug, 2014) and solar power. (Sütterlin & Siegrist, 2017; Visschers & Siegrist, 2014) Despite reportedly having more positive views of solar power, there is some evidence that women are less likely to report intentions to install solar panels (Petrovich, 2018) or an intention to generate their own energy generally. (Leenheer, de Nooij & Sheikh, 2011) However, still other studies find that gender is not a significant factor. (Sardianou & Genoudi, 2013) Findings regarding offshore and onshore wind energy vary, with some reporting equal support for wind power. (Dunphy, Revez, Gaffney, & Lennon, 2018; Ek, 2005; Firestone & Kempton, 2007; Karlstrøm, & Ryghaug, 2014) Others find lower support among women, (Klick & Smith, 2010; TNS, 2003) and in some cases, lower support is found despite finding higher support for renewables amongst women overall. (TNS, 2003) Still others find that women are more supportive of wind power (Devine-Wright, 2007; Visschers & Siegrist, 2014) but prefer smaller installations to men. (Krohn & Damborg, 1999)

The research discussed above has largely been quantitative in nature, and while gender has been included as a singular category of identity, it has rarely been taken as the focus of studies and has generally not been meaningfully analysed. Overall, the very variation within study findings implies that more research needs to be done in this area, that not only seeks to bring clarity to the gender effects on attitudes, but also seeks to explain why these differences might exist and under what circumstances.

To date, and perhaps unsurprisingly, gendered differences in attitude to nuclear power are the only ones that have received real attempts at explanation. This can perhaps be explained by the fact that nuclear power is the only energy source that shows a clear and consistent difference in attitudes by gender. This difference is attributed to women having a higher perception of risk and concern for the environment, as women generally report greater concern for environmental and health risks that are posed by nuclear energy. Work that has attempted to more deeply engage with, and explain why women may perceive greater risk is dominated by quantitative survey methods that attempt to make judgements about underlying psychological or socio psychological causes. This literature has attracted criticism as being undertheorized and lacking real empirical support, and there are calls to engage with a number of further research avenues. (Henwood & Pidgeon, 2015; Wesser, 2012) These include analysing how cultural context can shape perceptions of risk in light of studies that non-white males expressed perceptions of nuclear risk that were much more in line with those of women. White males were found to contribute most of the difference in gendered perceptions of risk, something which has been termed the 'white male effect.' It has also been argued that it must be recognised that men and women do differ in terms of their vulnerabilities to types of risks, their ability to make decisions regarding risk, and have very different experiences in the aftermath of any form of disaster. It is proposed that this very practical difference between men and women can have important implications for how risk is perceived, and could represent an important way of meaningfully engaging with gendered perception of risk. (Wesser, 2012) Finally, it has been proposed that engaging qualitatively with the discursive construction of risk is important to understand how this is performed, and is

potentially gendered in context. (Henwood & Pidgeon, 2015)

It has been argued that gender is by no means a homogeneous category, and doesn't act to define an individual's attitudes or practices in isolation of other attributes: factors like socioeconomic status, sexual orientation and race come with their own privileges or inequalities, which interact with each other and are not easily separable. (Clancy & Roehr, 2003; Collins, 1999; Crenshaw, 1989) The intersection of these characteristics has received some attention in the energy literature, and there is evidence that attitudes towards different energy source can also be highly varied within gender categories, with characteristics like education and race having a strong role to play. (Greenberg, 2009) Dunphy, Revez, Gaffney, & Lennon (2018) aimed to gain clarity on how these different types of characteristics produced attitudes towards energy by conducting a qualitative intersectional analysis of people's attitudes to the energy system in six different communities. They interviewed men and women in communities in Spain, the UK, Ireland, Italy and France, to produce an analysis that took into account age, gender, and socioeconomic status. In their intersectional analysis, Dunphy, Revez, Gaffney, & Lennon (2018) argued that an individual is not defined by a single characteristic, and that understanding attitudes means conceptualising them as emerging from a complex interplay of multiple intersecting characteristics, and their interactions with wider social norms, institutions, and structures.

The authors found that, largely, attitudes towards renewables were uniformly positive across men and women, with any significant differences in attitudes emerging between the six communities, rather than within. The authors see this as indicative that the broader experiences and contexts of the communities themselves were the significant factors, rather than any gendered experiences. For example, a lack of agency and democratic process with regards to renewable installations was mentioned as a distinct negative, and was thought to result in more unfavourable attitudes in communities that had had them forced on them in the past. In terms of attitudes towards non-renewables and nuclear power, women demonstrated a slightly greater variation in attitudes towards fossil fuel sources than men, who showed a more uniformly strong dislike. In contrast, men were more likely to support state investment in nuclear power in comparison to women, with 5% of men and only 1% of women in favor; numbers which reflect trends reported in previous research. However, the attitudes of men and women were more similar than different: while there were some variations, support for both fossil fuel sources and nuclear were overwhelmingly negative across both genders. (Dunphy, Revez, Gaffney, & Lennon, 2018)

Attitudes Towards Changing Energy Behaviours

Attitudes towards technologies and towards behaviour change often go hand-in-hand in the context of energy, and this interdependence can be left somewhat implicit. Reducing energy consumption, and increasing demand flexibility are often presented as important goals in the energy literature. Renewable energy sources have intrinsically less controllable energy production rates and demand flexibility is seen as necessary for their incorporation into large-scale energy grids. It therefore argued that increasing demand flexibility is important for both achieving the 'energy transition' and for decreasing peak demand to increase grid stability and security. 'Smart

meters' and the accompanying 'smart grid' have been promoted in recent years as a means by which energy companies can successfully achieve these goals. Largely, this belief relies on the hypothesis that introducing 'real time pricing' will lead to load shifting, as using electricity at peak times will be more expensive. (Brodberg & Persson, 2015; Tjørring, Jensen, Hansen & Andersen, 2018)

There is some evidence of gendered differences in reported willingness to change energy behaviours. Women assign higher importance to reducing energy consumption in comparison to technological advancements, (Balta-Ozkan & Le Gallo, 2018; Röhr & Hemmati, 2008) and are more likely to state that they would change their practices in response to an increase in energy prices. (Carlsson-Kanyama & Lindén, 2007; Lee, Park & Han, 2013; European Institute for Gender Equality, 2012) Despite this price sensitivity, women are also more likely to express willingness to change to a green supplier of energy, despite higher pricing. (Empacher, Hayn, Schubert, & Schultz, 2001; European Institute for Gender Equality, 2012) Gender has also been used as an analytical category when investigating consumer willingness to adopt direct load control (DLC), whereby energy companies control a consumer's use of power directly. This is seen as an attractive means to circumvent the consumer and directly influence power demand. Generally gender was not found to be a significant factor, apart from women expressing more discomfort with having their energy consumption externally controlled during morning peak hours. The authors attribute this women doing a larger proportion of household labour; however, this was not meaningfully explored. (Brodberg & Persson, 2015) Differences in attitudes are no guarantee of differences in behaviour; nevertheless, this is an avenue worth investigating if only to begin to elucidate the reasons for any disparities between attitudes and behaviours. (Heinzle, Känzig, Nentwich & Offenberger, 2010)

Energy Practices: Gender and the Household

Previous research has found that there can be huge variations in energy consumption between families that are demographically similar, despite also living in similar homes. Studies have reported that the highest consuming households can be using anywhere up to ten times as much energy as their low-consuming counterparts, (Firth, Lomas, Wright & Wall., 2008) a large proportion of which, can be explained by the behaviour of the occupants. (Gill, Tierney, Pegg, & Allan, 2010) There has also been some concern expressed that the development and adoption of new technologies may prove to be insufficient to achieve the 'energy transition.' Increasing energy efficiency or incorporating renewable energies generally achieve lower reductions in overall consumption than predicted, due to households changing their energy behaviours. There is also a concern that increasing demand will mean that any reduction achieved by these technologies is eventually erased. (Aydin, Kok & Brounen, 2017) These two factors have prompted an increased interest, in both the policy and research spheres, in understanding individual's energy practices, so that interventions for changing these behaviours may be better targeted. The focus on targeting interventions for reducing energy consumption, and changing consumption patterns in the home made gender a category of interest in this field of research. To date, the majority of the somewhat sparse research into the differences in energy practices by gender has focused on the

household arena, with some attention paid to other arenas such as transport, and indirect forms of energy consumption.

Gender and Energy Consumption

There are few studies that seek to analyse how individual or household levels of energy consumption might be influenced by gender. These studies also very according to what types of energy consumption are included. In their analysis of direct and indirect energy consumption, Räty and Carlsson-Kanyama (2009) found that the average single man consumed more energy than the average single woman. In terms of direct energy consumption, recent findings in the US have found that female dominated, or female 'headed' households consume more energy, and particularly gas, per capita than their male dominated, and male 'headed' counterparts. (Elnakat & Gomez, 2015) Female-dominated ZIP code have also been found to have higher rates of energy consumption, shifting the focus from the somewhat poorly defined social figure of 'head of household' to a more individual figure. (Elnakat, Gomez & Booth, 2016) The authors invoke a number of possible explanations for this, including that female-headed households tend to occupy older houses, perform more energy-consuming activity to do with cleanliness, or prefer a higher thermal setting. Another potential factor mentioned was the greater amount of time spent in the home by women, particularly by older women who make up a higher proportion of the population than older men. (Elnakat & Gomez, 2015; Elnakat, Gomez & Booth, 2016) In addition, evidence emerged that household composition according to gender and employment status can affect energy consumption within the household, with two income households consuming more energy than both 'stay-at-home' females and single, working females. The suggested explanation for this disparity invoked the gendered division of household labour, arguing that the higher energy consumption found in two income families is attributable to women juggling work, and household responsibilities, which means carrying out tasks which are often geographically dispersed. (Clancy & Roehr, 2003) These studies give further weight to the importance of analysing the interactions between gender and energy, and performing deeper analyses of the reasons behind any differences that emerge.

Gender and Household Energy Practices

The studies on gender and energy practices within the household that have been conducted to date, have focused on the traditional 'nuclear' family and there is little data to be found on other household arrangements. Studies on 'nuclear' households have found that household labour is still strongly divided according to traditional gender roles, with women undertaking the majority of the cooking, cleaning and laundry. This means that women use the most energy intensive appliances and perform the tasks within the household that are responsible for the largest proportion of energy consumption. (Bell et al., 2015; Dunphy, Revez, Gaffney, Lennon, & Aguilo et al., 2018; Ellegård & Palm, 2015; Standal et al., 2018; Tjørring, Jensen, Hansen & Andersen, 2018) Men are instead responsible for the maintenance of the home and the home energy consumption that is attributed to them is consumed through use of the TV or the computer. (Bell et al., 2015; Carlsson-Kanyama & Lindén, 2007; Dunphy, Revez, Gaffney, Lennon, & Aguilo et al., 2018; Ellegård & Palm, 2015; Tjørring, 2016; Tjørring, Jensen, Hansen & Andersen, 2018)

Dunphy, Revez, Gaffney, Lennon, and Aguilo et al., (2018) also found gendered differences in energy practices with regards to, what they termed, 'creating home.' They found that in their qualitative interviews, women were much more likely to talk about energy use in terms comfort that they supply to other people, whether through heating or ambient lighting. For example, one mother reported warming up her child's pyjamas in the dryer, and a grandmother always kept her house warmer when her grandchildren were visiting. This need or desire to create a comfortable home, often for the sake of others, meant that it was deemed acceptable to consume energy for this purpose even to individuals who were very conscientious about their energy use in other areas.

Such strong differences in time spent on particular domestic tasks, particularly cooking, are not apparent in single adult households. (Dunphy, Revez, Gaffney, Lennon, and Aguilo et al., 2018) However, Clancy and Roehr (2007) found that single men and women tended to own different types of appliances, and that therefore there is some indication that they may have different energy practices. (Clancy & Roehr, 2003) Currently, studies on non-nuclear households are all but non-existent; however, gaining greater insight into the gender differences in energy practices of different types of households is likely to become more important as the number of these types of households grow. (Fokkema & Liefbroer, 2008)

Gendered energy practices within households are frequently treated as entirely independent of each other, and the household treated as a 'black box.' However, there are a number of authors who point to the importance of considering household dynamics for meaningfully developing policy interventions. (Bell et al., 2015; Tjørring, Jensen, Hansen & Andersen, 2018) The utility of this approach has been argued for in light of findings that the attitudes of both the male and female partner more accurately explain household energy use behaviours than those of a male or female only. (Yang, Shipworth, & Huebner, 2015)

Bell et al., (2015) take this approach in their study, and argue that it is the social dynamics within and across households that are key to understanding energy practices. In their analysis, energy practices emerge as a result of household member's positioning to, and interactions with each other, as well as their material surroundings and socio-economic factors. The dynamics within the household are then informed by and connected to wider social and economic systems. They see this type of analyses as important for informing policies and techniques that will achieve a reduction of household energy consumption by moving away from a focus on technical methods and towards responding to socio-cultural practices that exist both within and across households.

In their analysis Bell et al., (2015) found that division of labour occurred according to traditional gender roles in 61 of the 131 households visited, noting; however, that this could be a cultural relic of the history of heavy industry and mining in the North of England, where the data was gathered. Women were largely responsible for cooking and washing, while men engaged in practices like mowing the lawn or DIY. While labour was commonly divided in this way, the authors argue that this does not necessarily represent a facile means of targeting interventions,

and precipitating a shift of energy consumption patterns. Instead the timing and amount of energy consumption is highly contingent upon other members of the household, who may, or may not be in continuous residence, as is the case with adult children who return to the parental home. Therefore, energy practices are not defined wholey according to the individual who is responsible for the labour, but the needs and practices of other members of the household, and how household members construct their responsibility to, and accommodate each other. This is reflected in the 'home making' practices of women that were discussed by Dunphy, Revez, Gaffney, Lennon, and Aguilo et al., (2018). It is not just a case of asking who is switching on the appliance, but of asking who they are doing it for and why. The 'why' can be seen as highly symbolic in nature and as intimately linked to the construction of individual identities, which is perhaps reflected in their highly gendered nature. Heating the home, doing laundry, and maintaining personal cleanliness become the means by which individuals build their identities as 'good' grandmothers, mothers, fathers etc. (Dunphy, Revez, Gaffney, Lennon, & Aguilo et al., 2018) Engaging with this 'messiness' is necessary for producing effective energy interventions for reducing peak demand, and achieving wider environmental goals (Bell et al., 2015)

Gender and Changing Household Energy Practices

Ultimately, the research into energy practices has generally been conducted with the aim to change these practices, and there is some evidence that women more frequently change their energy behaviours in response to various energy interventions. Women with smart meters installed in their homes were found to check their in home displays more frequently than men, and were more likely to encourage friends and family to change their energy practices. (Clancy & Roehr, 2003; Department of Energy & Climate Change, 2013) They were also more likely to engage in neighbourhood 'Eco-Teams,' which met periodically to discuss ways of reducing consumption. (Carlsson-Kanyama & Lindén, 2007) In addition, Tjørring, Jensen, Hansen and Andersen (2018) found that reminders to shift energy consumption to certain times of day were much more likely to achieve an actual change in behaviour when sent to women. This was thought to be attributable to gendered divisions of labour in the home: sending the text to the person responsible for a task is generally more effective than reminding someone who is not. Tjørring (2016) also found that 'energy reminders' in the form of smart meter displays had the potential to cause conflict in the household in cases where the individual monitoring energy consumption and making demands for energy reduction was not the one engaging in the energy practice. There is also some indication that women are willing to engage in energy-saving behaviours, despite them leading to increased personal discomfort and workload. (Carlsson-Kanyama & Lindén, 2007)

Women therefore appear to be the most responsible for changing energy behaviours within the home, and encouraging others to do so. However, men are predominantly responsible for reducing energy consumption through energy efficiency measures like investing in thermal insulation, boilers and hot water installations. (Clancy & Roehr, 2003) This is consistent with findings that men generally identify themselves as responsible for the renovation and maintenance work around the home, and the grounds in which it is situated. (Bell et al., 2015; Carlsson-Kanyama & Lindén, 2007; Dunphy, Revez, Gaffney, Lennon, & Aguilo et al., 2018; Ellegård & Palm, 2015;

Tjørring, 2016; Tjørring, Jensen, Hansen & Andersen, 2018) This division has also been found to extend to home upgrades that involve renewable energy systems like solar panels, (Henning, 2005; Standal et al., 2018) and sustainable home heating systems. (Offenberger & Nentwich, 2009) Household dynamics remain an important area of analysis when looking at changing practices in the household as both behaviour changes and home renovations occur as a process of negotiation, and joint decision-making. (Henning, 2005; Offenberger & Nentwich, 2009; Standal et al., 2018) Decisions are made according to the needs, priorities, and values of the different members of the household. However, decision making power is gendered and who has greater decision making power is highly influenced by who's area of responsibility the change to be made falls into, and to what space alterations are to be made. (Henning, 2004; Standal et al., 2018; Tjørring, 2016) In their study of prosumers across several European countries, Standal et al., (2018) found that these types of gender roles and relations within the household had implications for the uptake of home solar systems. Men were generally the driving force behind the adoption of the system, and were more likely to check and keep notes of energy production. The smaller number of women that were the driving force behind solar panel installation were generally employed in the energy industry and also monitored energy production. Henning (2005) reported similar findings with regard to gender differences in engagement with solar systems, but instead reported that women who wanted to install solar systems tended to act indirectly through their husbands.

Standal et al., (2018) probed this divide by interviewing the individual prosumers. In the interviews, all parties stated that gender was irrelevant to becoming a prosumer, and while prosumers were more commonly described as male, respondents advocated for the competency of both genders when asked directly. Generally, interviewed prosumers painted the gender divide as a matter of personal interest: men were more interested in technology, and it was imagined that they would engage with solar power as a result of financial, technical or environmental motivations. In contrast, women's imagined interests were generally confined to the environmental. However, the degree to which motivations and interest were attributed differently according to gender varied across the different countries investigated: gendered imaginations of prosumers as men were most apparent in the Ukraine, while interviewees in the UK stood out as particularly avoiding, and even actively resisting dividing motivations and interest by gender. While interest in the technology was not really stated by women to be an important motivation for them, imagined interests and motivations were not necessarily in line with the actual reasons given for engaging in prosuming. Financial reasons were often given by women, which was at odds to how their motivations were often imagined, and this motivation was in some cases stated more often by women than by men. (Standal et al., 2018)

This kind of classification of certain objects as 'technical' and therefore as 'masculine' is conceptualised as a form of 'gender script' in other work on energy and gender. (Heinzle, Känzig, Nentwich, Offenberger, 2010; Henning, 2004; Offenberger & Nentwich, 2009; Prietl, 2017) In this context, the concept of 'gender scripts' centres around the idea that objects, preferences or interests are coded as being intrinsically the purview of the 'masculine' domain. It then becomes inappropriate, inauthentic or simply odd for women to engage with these objects or express certain preferences and interests. Important examples that have been highlighted in this field

include 'hard' energy paths (fossil fuels, nuclear, masculine) and 'soft' energy paths (renewable, feminine); economic or technical (masculine) and environmental (feminine); technical (masculine) and non-technical (feminine). It is argued that kitchen appliances are no less 'technical' than solar panels; however, they are not defined as such because they are associated with femininity. Nor are different parts of heating systems more to do do with 'facility management' or 'home making' than any others. (Offenberger & Nentwich, 2009) In gender scripts, dealing with technologies in this way represents a means by which individuals discursively maintain 'feminine' (non-technical) and 'masculine' (technical) as coherent identities. (Heinzle, Känzig, Nentwich, Offenberger, 2010; Offenberger & Nentwich, 2009) However, while gender scripts are presented as capable of shaping behaviour, ultimately they are conceptualised as discursive constructions through which individuals attempt to make sense of their own behaviour. This means that they can reconstruct gendered interests and behaviours as being different, despite the fact that the underlying practices these constructions are based on are actually very similar between men and women. Within the household, Offenberger and Nentwich (2009) found that women and men both involved themselves with the 'technical' and 'aesthetic' concerns that would normally be placed in the domain of the other gender. A female interviewee were found to have expertise and experience in using biomass stoves effectively, while a male interviewee concerned themselves with the aesthetics of lighting. However, both were resistant to these framing of their actions and attempted to discursively associate or dissociate themselves from the 'technical.' Women and men don't by any means always conform to gender norms, and the gendering of objects, domestic activities and areas can lead identical behaviours to be perceived differently. It is argued that gender scripts and their potential masking effects should be taken into account when considering the question of gender in the energy context. (Offenberger & NentwIch, 2009; Prietl, 2017)

These findings represent the little evidence on gender differences in energy behaviours; however, the findings of Carlsson-Kanyama and Lindén (2007), and Tjørring, Jensen, Hansen and Andersen (2018) are nonetheless significant for this field of research. Women are still primarily responsible for household chores, which are the most energy intensive household practices; therefore, investigating the obduracy of these energy practices is an important task (Bell et al., 2015; Dunphy, Revez, Gaffney, Lennon, & Aguilo et al., 2018; Ellegård & Palm, 2015; Tjørring, Jensen, Hansen & Andersen, 2018) The intersectional analysis of Dunphy, Revez, Gaffney, Lennon, & Aguilo et al., (2018) added some nuance to the image of the division of labour that appeared to occur along traditional gender lines. The authors found that younger fathers generally expressed that they spent more time with tasks like cooking than older men, and generally did not so strongly perceive these tasks to be women's work. This suggests that there are some differences in how practices are divided between the genders according to age, and this is seen as demonstrating that gender roles are not set in stone and may change over time. Therefore, the changing of gendered divisions of household energy practices is also worthy of attention, as is how divisions of labour could potentially be shifted or reinforced by particular interventions. (Dunphy, Revez, Gaffney, Lennon, & Aguilo et al., 2018; Tjørring, Jensen, Hansen & Andersen, 2018)

Energy and Gender Equality

The studies discussed above demonstrate that men and women may differ in their attitudes towards certain energy technologies, and in their willingness to change their energy practices. More clear, are the differences in their energy use behaviours, both with regards to the amount consumed by men and women, and the energy-consuming practices they engage in. This is true both outside of, and within the household, where household labour and engagement with energy technologies remain strongly divided along gender lines. These divisions remain when we approach changing energy consumption in the household. Men are predominantly responsible for energy efficiency upgrades in the home, or the installation of energy technologies like solar panels, while women are instead responsible for changing their practices, and those of the other members of the household. These differences are important when considering the equality of the genders, from the perspectives of procedural and distributional justice. (Fraune, 2018) Firstly, when considering procedural justice, and as argued by Clancy and Roehr (2003), what becomes important is not the differences in attitudes and needs themselves but the relative abilities of groups to shape their lives according to these preferences. A central aspect to this is the ability of men and women to influence decision making, whether in their personal lives, through energy research, in the energy sector itself, or in the policy sphere. When considering distributional justice, we instead look at questions regarding the relative distribution of the benefits and negative effects of energy systems. The division of energy practices by gender, and the different degrees of engagement with energy renovations and technologies exhibited by men and women already imply that any energy interventions or policies will not be gender neutral, and are going to affect men and women differently. Scrutinising how the benefits, limitations, and burdens of these interventions are apportioned only becomes more important as increasing attention is paid to targeting energy interventions according to gendered divisions of energy practices. (Tjørring, 2016; Tjørring, Jensen, Hansen & Andersen, 2018) More broadly, the literature addressing energy and gender equality recognises the different vulnerabilities and constraints experienced by men and women, and the resulting patterns in participation, advantage and disadvantage that emerge.

Procedural Justice: Women's Participation and Representation

The reasons behind women's lower participation in STEM research and industries, and in the political sphere is an ongoing research area that won't be addressed directly here. However, what will be addressed is research that delves into how differences in participation between women and men may affect decision making and policy outcomes, and also how the underrepresentation of women in energy related spheres, as well as the ways they are represented, might affect their ability to take advantage of opportunities offered by the 'energy transition.'

Gender and Participation in Decision-Making

Differences in the ability of men and women to make decisions regarding energy becomes readily apparent in the distinct absence of women in managerial roles in energy companies, and their

underrepresentation in the policy sphere. (Anfinsen & Heidenreich, 2017; Carlsson-Kanyama & Röhr, 2010; Clancy & Roehr, 2003; European Institute for Gender Equality, 2012; Fraune, 2016) Representing both genders equally in decision-making spheres is seen as important to ensure that decisions are not made solely according to the 'norms and values' of one gender. The argument has also been made that beyond providing procedural justice, an important goal in and of itself, the inclusion of women in the decision making sphere may benefit decision making; particularly in the field of energy. For example, Carlsson-Kanyama and Röhr (2010) suggest that the greater involvement of women might shape, and even improve decision making in the context of the 'energy transition' due to their greater perception of risk, and their, on average, greater concern for the environment. Women's greater focus on environmental issues, is also apparent in energy-related research, and female scientists also strive to include social issues into their work to a greater degree than men, rather than focusing exclusively on technological aspects. (Clancy & Roehr, 2003; Offenberger & Nentwich, 2010) Overall, these findings imply that increasing the participation of women might be positive for achieving environmental goals. (Clancy & Roehr, 2003) However, the question of whether women's participation in research, industry or politics leads to different outcomes remains understudied, and this lack is even more stark when focusing on the area of energy. (Carlsson-Kanyama & Röhr, 2010)

Fraune's (2016) comparative analysis of gendered difference in energy policy-making in Germany and the US, is an attempt to address exactly this question. Fraune asks 'does a greater representation of women result in a genuine change or does nothing become fundamentally different?' (pp.134) Essentially, do the different values, attitudes and needs of women become reflected in their legislative choices and the resulting legislature? This is an important question when we consider the body of literature that laments women's lack of representation in decision making bodies, as there is an underlying belief that their integration will lead to significant change, and to outcomes that are more closely aligned with women's values and interests. This is a belief that has yet to be validated, and there is some suggestion that women who do manage to enter into male-dominated spheres tend to act according to the institutionalised 'masculine' norms that characterise them. (Magnusdottir & Kronsell, 2015) Therefore, there is a danger that prioritisation of participation could fail to integrate women's interests while other potential pathways are neglected. Furthermore, advocating solely for representation can act as a 'get out of jail free card' that releases decision-makers in the field of energy from the responsibility of investigating and attempting to represent women's interests. This is a danger that emerges when representation becomes a means by which the female 'other' is painted as completely unknowable by anyone of a different gender.

Fraune (2016) sought to gain insight into the effect of women on energy policy making by analysing two factors: voting, and number and length of speeches on particular topics. She found that women and men voted differently according to their gender. These results were consistent when controlled for country; however, this differences disappeared when controlled for by party affiliation. Fraune suggests that this may indicate a lack of difference in preferences for energy policy by gender, or might instead indicate that men and women exhibit different preferences for party affiliation. Nonetheless, she argues that this would need to be investigated more thoroughly

before it could be attributed to gendered differences in attitudes, as factors like party recruitment policy will have their own effects. With regards to number of speeches, Fraune found that in both cases, the number of speeches given was proportional to the representation of gender. However, in Germany, women gave speeches that had a lower word count than in their male counterparts, while in the US there was no significant difference between the men and women. Fraune posits that this might represent a manifestation of previous findings that women tend to attempt to compensation for their underrepresentation by increasing their speech making activities. The US and Germany differ greatly in their energy policy paths, with renewable energy pathways being given a much higher priority in Germany than in the US and are generally of more importance to women. Fraune argues that women's greater presence in speech making in the US could be seen as an attempt to instead compensate for the underrepresentation of their policy interests and priorities regarding energy. As noted by Fraune, these quantitative results only give an indication that there are gender differences between speech giving behaviour, and that this kind of quantitative analysis is not well suited to meaningfully explaining why these differences might exist. However, it offers a basis for conducting further qualitative analysis, which could give a greater insight into the substance of the difference, and the reasons behind them. This study could therefore represent a starting point for what could prove to be a fruitful area of research.

Presently, there exists some very preliminary evidence that the participation of women in energy related spheres might influence the priority given to the environment, the social and considerations of risk. (Carlsson-Kanyama & Röhr, 2010; Clancy & Roehr, 2003; Fraune, 2016; Offenberger & Nentwich, 2010) However, further research is needed before any real conclusions can be drawn. Furthermore, any findings will need to be analysed in light of evidence that points to the constraining effect of the masculine norms of the energy sector, which also needs careful consideration. This work suggests that increasing women's participation may not be sufficient for significantly altering decision-making outcomes. (Magnusdottir & Kronsell, 2015) Instead, there will need to be a conscious uncoupling of 'masculinity' and 'femininity' from certain types of concern and forms of problem solving, or, failing that, a deeper scrutiny of how their legitimacy is assessed. Otherwise the 'masculinisation' of energy overall, and of certain types of energy technology over others, will continue to dictate, and constrain how problems and their potential solutions are identified, valued and prioritised. (Anfinsen & Heidenreich, 2017; Magnusdottir & Kronsell, 2015; Prietl, 2017; Ryan, 2014; Standal et al., 2018) Finally, the link between increasing women's representation in these spheres, and any differences that emerge in their choices with regards to men cannot automatically be equated to the representation of 'women's' interests. Not only has research on 'women's' attitudes and preferences remained inconclusive, but 'women' are not a homogenous group. Therefore, it is important to recognise that women's experiences, and therefore needs and interests are produced as a result of other intersecting factors like class and race, and are likely highly diverse. Acknowledging, and understanding the nature of these diverse experiences, needs, and interests is essential if 'women' are to be represented in any meaningful way. (Clancy, 2003)

Representations of Gender

How men and women, and their respective relationships to energy are represented in policy documents, promotional material, and other media, has also been presented as a key consideration when discussing gender equality. It has been argued that media that reproduces stereotypical gender roles in relation to energy technologies can inhibit the adoption of energy technologies, and the transition to more environmentally-friendly patterns of energy consumption. Therefore, the analysis of this kind of material is seen as an important avenue for further research, as is investigating how it may be used as a resource for reducing gender imbalances. Standal et al., (2018) explored how women and men are presented in policy documents, promotion material for home solar power plants (HSPPs), and in media content about HSPPs and prosuming. In policy documents, they found that language was gender neutral and that all needs, values, constraints and capacities were considered to apply equally to both genders. In promotional material and the wider media, they found that women featured much more rarely than men, and the presentations of gender largely reflected stereotypical gender roles. Women were more often pictured in the private, and particularly the household sphere, and generally were presented as engaging in prosuming as part of the family, and as the 'wife.' Their motivations were also limited to environmental concerns. The presentation of men and their motivations and skills were more varied, and could be environmental, technical, or financial. In these materials, those presented as having expertise or interacting with solar panels were nearly exclusively men. Standal et al., (2018) argue that such limited and stereotypical forms of representation can lead to the exclusion individuals who don't find themselves represented, and therefore can act to reinforce gender norms. Despite these findings, the authors also expressed optimism that the diversity of the presentations of gender and values were increasing as bigger multinational companies like IKEA entered the market.

Distributional Justice: Benefits and Vulnerabilities

So it's currently not possible to say if, how, and to what extent women influence decision-making in the energy sphere, and therefore how changes in participation might affect women's status as a group who benefits from, or is disadvantaged by energy policy, research, and industry. These remain important areas for further research. Nonetheless, there is a small body of research that has begun to analyse how men and women have been differentiated in terms of their vulnerabilities with regards to energy, as well as their ability to take advantage of the opportunities and benefits offered by the energy sector.

The Energy Transition

The fact that women are underrepresented in the energy sector means that they are less likely to benefit from new jobs created in this sector, as evidenced by the fact that women's low participation has continued as the renewable energy sector has grown. (Fraune, 2018) This is perhaps not a groundbreaking realisation; however, the lower representations of women in STEM

is an expression of, and can perhaps perpetuate the limiting effects of gender norms. A lack of engagement in STEM fields, and the characterisation of energy technologies as 'masculine' can further constrain women's choices in the respect that women may then be less likely to adopt and engage with energy technologies. For example, in the case of solar panels, Standal et al., (2018) found that professionals who are employed in technical industries, or those who consider themselves to be technically skilled, represent a large proportion of those who become prosumers. Women are therefore less likely to become prosumers, and represent a significantly smaller proportion of prosumers than men. There has also been some speculation that lack of experience in STEM fields made also limit the strength of women's candidacy for decision making roles in citizen participation schemes for renewable energy production. (Fraune, 2015) This has prompted questions in the literature concerning what constraints act upon women relative to men, and how they might be alleviated to increase women's participation in these areas.

Fraune (2015) investigated the contributing factors to gender differences in involvement in citizen participation schemes for renewable energy production. The analysis aimed to move beyond individual decision making processes and gain insight into how the wider cultural, political, and social context might influence and constrain individual agency, and so individuals' abilities to engage in these projects. Women were underrepresented as both investors and key decision makers within the schemes, and provided less capital though differences in per capita contribution by gender were inconclusive. Women were also found to be more likely to invest in certain corporate types: they tended to favour cooperatives (eG) over civil law associations (GbR), the latter of which are considered to be higher risk investments. Fraune situates these finding with relation to the fact that in the German context, the key to participation in citizens' renewable energy projects is the investment of equity. She argues that, therefore, analysing the influence of the wider context necessarily turns us to gender differences in employment: the gender wage-gap, and the gendered segregation of types of occupations and leadership positions. Fraune posits that the results of the study can perhaps be seen as reflective of an environment where women accrue significantly less capital and power than men, and therefore have less agency to take the financial risks necessary to engage with these projects. The German case proves that these projects are not automatically democratic and egalitarian, and it may be necessary to actively redress social imbalances within the schemes to ensure that different groups have the opportunity to benefit from them equally.

Gender norms and gender scripts are also an important focus, alongside considerations of differences in capital, economic and labour market segregation. It is argued that the 'masculinisation' of technologies, and, importantly, particular types of technologies can limit women's engagement by painting their engagement as at odds with gender norms and 'femininity.' However, the scripting of technologies like solar panels as 'masculine' is by no means intrinsic or set in stone, nor is this characterisation necessarily an impenetrable barrier to their adoption by women. (Offenberger and Nentwich, 2009; Henning, 2004) The point made here is that these categorisations are mutable and this points to the importance of developing policies that aim to engage and support women specifically. This includes presenting women in a greater variety of roles in promotional materials; roles which present women as experts and engaging

directly with technologies, alongside more traditional presentations of women in a family setting. (Standal et al., 2018) Meaningfully engaging with these issues is seen as key, not only for gender equity but also for achieving a wider uptake of decentralised energy systems. Engaging more women means having more advocates for the adoption of solar power within nuclear households, and could become more important in a society where single adult, childless households are on the rise, and currently account for 30% of households in the European Union. (Eurostat, 2015)

Gender and Energy Poverty

An important element to the discussion of energy and gender equality is women's increased vulnerability to issues regarding energy. Similarly to the global South, there are more women in poverty than men. Throughout the EU women have, on average, 16 % less disposable income than men, ranging from 23 % less in Germany, Estonia and the Czech Republic to 4 % less in Malta. (Röhr and Hemmati, 2008) Women are also more likely to head two-income single parent households or single person households at pensioner age. Low income households often face restrictions in accessible forms of energy, and pay higher tariffs for their energy access, which is therefore an issue that will disproportionately affect women. Lower income households are also more likely to live in buildings with poor insulation and heating systems, and purchase cheaper appliances. This means that poorer households are generally living in houses, and using appliances that have poor energy efficiency ratings. Ultimately, these factors can can lead to fuel poverty, as low income households essentially pay more to perform energy consuming activities with inefficient appliances, and to achieve adequate levels of heating or cooling. More women than men report not being able to adequately heat their homes, and beyond personal comfort, an inability to heat or cool the home can be a serious danger to health, with the elderly and the very young being most at risk. (Clancy & Roehr, 2003; European Institute for Gender Equality, 2012; Röhr & Hemmati, 2008) Women's overrepresentation in these at risk groups means that they constitute a significantly larger proportion of excess deaths due to extreme thermal conditions. (European Institute for Gender Equality, 2012; Röhr & Hemmati, 2008) For example, during the 2002-2003 heatwave in Portugal excess mortality was twice as high amongst women. (Nogueira, Falcão, Contreiras, Paixão, Brandão & Batista, 2005)

Taking differing levels of income into account is important in and of itself, but it is also necessary to take into account its gendered nature. Recognising the difference in women's and men's economic statuses is essential for assessing how issues such as energy poverty should be addressed, as well as how the potential effects broader policies concerning energy might differentiate according to gender. Particularly essential, is scrutinising their potential for widening or narrowing gendered disparities in income and power. (European Institute for Gender Equality, 2012)

Gendered Effects of Energy Policy

The differences in average income, and financial assets between men and women give us our first insight into the importance of analysing the effects of energy policies according to gender. As with other areas of research on gender and energy, there are very few empirical studies. In

addition, discussions of the gendered effects of energy policy predominantly go no further than analysing the percentage of women that have changed their behaviour in response to a policy in comparison to men. Any further discussion of energy policies on the lives of individuals may call for more detailed analysis, but nonetheless often still remains purely speculative. (European Institute for Gender Equality, 2012)

There is a general, and not unreasonable, assumption that measures that lead to greater personal expense are likely to disproportionately affect women due to their lower average income, which perhaps explains women's greater responsiveness to economic disincentives. (Carlsson-Kanyama & Lindén, 2007; Lee, Park & Han, 2013; European Institute for Gender Equality, 2012) There is also a concern that these kinds of policies can only lead to reduced energy consumption when the individual in question has the means to do so. Impoverished individuals are likely to have already minimised their energy consumption to the greatest degree possible, and are often incapable of further reducing their energy consumption by upgrading their appliances or their homes to be more energy efficient. This may be due to cost constraints, or additionally, in the case of home renovations, the fact that a high-proportion of low-income households don't own their homes. Without meaningful policies aimed at supporting low-income groups, the majority of which are women, these types of energy policies can push people into energy poverty. (European Institute for Gender Equality, 2012) Similarly, low-income can act as a limiting factor for women adopting energy technologies like solar panels, which require a significant initial monetary outlay but may ultimately prove to be beneficial in the long-run. (Carlsson-Kanyama and Lindén, 2007; European Institute for Gender Equality, 2012; Fraune, 2016; Röhr & Hemmati, 2008; Standal et al., 2018) Difference in average income is not the only factor that has been identified in the literature as a potential dictator of the gendered impacts of energy policies. The still prevailing divisions of labour within the household, and the construction of energy efficiency upgrades or energy technologies as the purview of the 'masculine' will have important implications for how energy policies interact with gender. (Anfinsen & Heidenreich, 2017; Carlsson-Kanyama & Lindén, 2007; Standal, 2018 Vinz, 2009)

'Sufficiency' measures that focus on energy conservation have been almost exclusively directed at the household sphere, and very rarely industry. Instead industry is expected to reduce overall consumption through efficiency measures, and technological development. This has resulted in concern that these policies could result in the 'feminization of responsibility for the environment,' whereby women, who are still responsible for the majority of household labour, bear the brunt of policies that demand that energy savings should predominantly be made in the residential sector. (Vinz, 2009, pp.163) Carlsson-Kanyama and Lindén's (2007) study is one of the earliest, and one of the few studies that seeks to analyse how men and women may be affected differently by these kinds of policies. They conducted a gendered analysis of the experiences of households who participated in various different energy conservation schemes in Sweden, and found that gender differences did emerge with regard to acceptance of greater discomfort or workload. Gendered differences in discomfort and workload manifested themselves in two key aspects. The first is that women experienced greater discomfort than men, having lowered the thermostat to conserve energy, a finding which is consistent with findings that women have greater thermal sensitivity.

(Karjalainen, 2012) Women adapted to it by wearing extra clothing but, nevertheless, often still experienced discomfort. The second finding was that gendered divisions of labour in the household meant that the burden of changing these practices fell predominantly on women. The use of clothes driers was abandoned in an effort to save energy, and the timing of doing laundry was altered in order to take advantage of lower energy tariffs. This led to increased labour for women as they had to hang out clothes to dry, and often got up early to do so as they had to deal with laundry that they put on overnight. In many cases this task needed to be performed before they went to work, meaning that it became a much more time-consuming and labourious task. In this case, the burdens of reducing household energy consumptions fell predominantly on women due to their disproportionate responsibility for household work, a situation that is only exacerbated for women in the labour force.

In a similar study, and in contrast to Carlsson-Kanyama and Lindén, (2007) Tjørring, Jensen, Hansen and Andersen found that women didn't report an increased workload, as the timing of their use of washing machines and tumble driers changed, not the amount that they were used. However, they did note that female participants explained their behaviour by saying they didn't want to deal with 'wet clothes late at night when they were tired.' (2018, pp.15) This arguably suggests that women experience increased discomfort when performing this practice late at night to take advantage of lower energy tariffs. However, the different results reported by these two studies could perhaps take on more significance if they are compared more closely, as the two interventions looked at in the studies were actually very different. Tjørring, Jensen, Hansen and Andersen's (2018) study looked at households who were encouraged to change their patterns of energy consumption to take advantage of cheaper energy tariffs. In contrast, the participants of the 'New Energy Habits' scheme who were interviewed by Carlsson-Kanyama and Lindén (2007) were aiming specifically for an 10% absolute reduction in energy consumption. In this respect, comparing the two studies might provide an insight into what circumstances and for what reasons individuals might reduce their consumption, as well as indicating what types of policies might exacerbate existing inequalities and how they might do so. This illustrates the importance of building gender into analyses of the effects of a wider range energy interventions, and bringing them meaningfully into conversation with each other. These kinds of analyses will open the door to designing more effective energy policies and interventions, and can also be used to produce more equitable ones. Both energy-related, and gender equality goals could be served by encouraging changes in the distribution of energy practices by gender as a component of changing household energy practices overall. Not only could this result in a more equitable distribution of labour, it could act to reduce barriers towards changing energy behaviours in the household by distributing any increase in workload across two or more individuals. (Anfinsen & Heidenreich, 2017)

Concluding Remarks

A number of interesting findings and areas for further research have been identified in the literature covered in this review; however, gender and energy in the context of the global North is

still clearly an emerging research area. As it was when Clancy first asked 'is there a Northern perspective?' (2003, pp. 44) the field is characterised by a lack of empirical research, and particularly empirical research that meaningfully engages with the question of gender. Moving beyond this point means continuing to build a body of research that move beyond treatments of gender as an analytical category, or quantitative studies that take a gender-related difference as 'ipso facto saying something so obvious about men and women that one can report a statistically significant gap without further comment.' (Henwood & Pidgeon, 2015, pp. 11) This particularly means engaging in more research that analyses the effects of power imbalances in gender relations, and of gendered stereotypes and assumptions regarding gender. There is a particular call for increasing the proportion of qualitative research in this field, as it has been argued that it has potentially more power to explain why gender differences might occur. Currently, studies that are not based on survey methods tend to be fairly limited in scope and focus on a single energy technology, intervention or only concern a handful of individuals or households. There is also a strong focus on the Nordic context; however, studies have begun to emerge which focus on other European countries and conduct comparative analyses across different contexts.

During the course of this review we've seen evidence that women are responsible for a larger proportion of household energy consumption, and report a higher willingness to change their energy practices and to encourage change in others. This has made women as a group an increasingly attractive target for energy interventions, and while the differences in their situations should not be understated, we can see echoes of the same trends in literature focusing on the global North that were criticised when they emerged in the literature concerning women and energy in the global South. (Cecelski, 2004) Namely, that women and their experiences are only of interest when they are to be instramentalised as a means to ensure the success of a project, in this case, the 'energy transition.' We find ourselves in a problematic situation where the household, and therefore women, are expected to bear the brunt of demands to reduced energy consumption, often without this being specifically recognised. 'The household' and 'the consumer' being preferred terms, which actually mean 'women' when considering the distribution of labour in the household. This 'feminization of responsibility for the environment' (Vinz, 2009, pp.163) occurs despite the fact that women have very little participation in the decision-making that distributes responsibility in this fashion, and ultimately experience very few of the benefits offered by the energy sector. Women still hold a very low proportion of jobs in the energy industry, and their share in the renewable sector remains small despite early optimism. (Fraune, 2018) Low representation continues into areas like investment in renewable energy schemes, despite evidence that women are perhaps more willing than men to engage in other environmental schemes. Similar issues appear when considering women's engagement with decentralised solar energy. Women report themselves as less likely to install solar panels, and evidence has shown that this holds true in practice. Building an energy system, and an 'energy transition' that embodies gender equality is not only about designing policies and energy interventions that don't disadvantage one gender over the other. Instead, as much is possible, it should mean changing gender relations and improving women's position in society relative to men.

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