



ENERGY & GENDER

a social sciences and humanities
cross-cutting theme report



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Executive summary

Considering the strict emission targets declared in the 2015 Paris Agreement, a gradual transition of our societies towards low-carbon energy systems seems likely. This energy transition will affect everyone, and to facilitate this move, the proposed solutions will need to engage most of the population. This will require a conscious and comprehensive perspective on gender to address matters of under-representation, differences in energy consumption, practices and transportation, and the underlying assumptions within the solutions presented. These are just some of the reasons why gender is recognised as an important, cross-cutting issue in all research done under the Horizon 2020 work programmes. Still, aspects of gender are currently not being sufficiently addressed in energy research as a whole.

As one of four cross-cutting theme reports delivered for the SHAPE ENERGY project, this report strives to explore what can be gained by explicitly focusing on gender when researching the consumption and production of energy. To accomplish this, we have scoped Social Sciences and Humanities (SSH) research that engages with this field to present a broad overview of the work that has been done thus far. The structure of these findings is inspired by the four central topics in the SHAPE ENERGY project: (1) Energy efficiency and using less; (2) Competitive, secure, low-carbon energy supply; (3) Energy system optimisation and smart technologies; and (4) Transport sector decarbonisation.

Based on the research reviewed, we aim to demonstrate the relevance of including 'gender' as a relevant category within energy research, not only for our fellow energy-SSH researchers, but also for policymakers, stakeholders, researchers from other disciplines and other interested parties. This will be concluded with a set of practical and concise recommendations addressing EU-research funding, other energy research projects and platforms, and SHAPE ENERGY platform activities.

Our main findings and recommendations are:

- The interplay of gender and energy is a worthwhile and important topic for research. A gender perspective can enhance energy research and improve mitigation measures. Overlooking facets of gender, can at worst, make for unsatisfactory analysis.
- More research on gender and energy is needed. There are interesting perspectives and hypotheses within this field, but there is a severe lack of more strenuous empirical explorations of the effects and implications of gender imbalance, and gendered stereotypes and assumptions within the research currently produced.
- Gender should also be considered when studying technologies intended for decreasing emissions. For instance, 'smart' household technologies, energy-saving refurbishments, and low- or zero-emission vehicles seem at the moment built on earlier culturally held assumptions, which also include gender. As these technologies will need a substantial adaptation rate if we are to achieve ambitious energy goals, we need to understand these cultural underpinnings.
- Energy projects should take into account not only gender balance, but also employ gender-reflexive research. This means that all researchers must question the gendered assumptions and stereotypes that their work may build on, and how this might affect the results produced.
- Gender is however not a simple binary and cannot be reduced to a single parameter in a questionnaire, or a solitary box in a checklist. It is instead crucial to devote time and resources, and to employ experts when implementing gender perspectives in research programmes and policymaking.



1. Introduction

This report presents an overview of the research done in the intersecting fields of 'energy' and 'gender' for the SHAPE ENERGY (*Social Sciences and Humanities for Advancing Policy in European Energy*) project. Through reviewing approaches and findings in previous research, we will illuminate *why* researchers conducting energy studies should be mindful of gender. Also, we will present suggestions about *how* gender can be integrated as a central part of our concerns when we address social aspects of energy. This will also serve as a useful tool for policymakers, stakeholders and other interested parties for considering gendered features of energy cultures, and how gender may be performed in such contexts. All this is especially important to bear in mind considering that the European Union is increasingly prioritising gender as an issue within, for example, its Horizon 2020 funding programmes (e.g. its advocacy for Responsible Research and Innovation (RRI), where gender is one of its core thematic elements - European Commission, 2017).

As a central concept in Social Sciences and Humanities (SSH) energy research, 'energy cultures' has proved to be a fruitful point of departure (Stephenson et al., 2010). Based on a critique of the idea of a purely rational consumer, driven mainly by information and economic calculations, this perspective introduces a more nuanced and comprehensive understanding of consumers' energy choices and practices. In this perspective, *"private energy consumption is a result of a combination of activities, preferences, values, technologies and material structures"* (Aune, 2007, p. 5463). In this report, we will follow this social and cultural train of thought and extend it to the cultures of energy production, the underlying assumptions of the proposed 'smart futures', and transportation. This will be done while striving to address the underrepresentation of women in research, technology development, business management and policymaking related to energy, and the possible consequences in terms of gender biases and lacking gender awareness in energy cultures.

Understanding the potentially gendered aspects in transitional energy cultures, as social constructs and performative stereotypes, is an important and understudied endeavour (Sovacool, 2014). The domain of energy studies is still very much a field dominated by the language, practices and prescriptions of engineers, ICT-specialists and economists. These are not only arenas primarily concerned with the practical and quantifiable, but also still to a large degree dominated by men (Strengers, 2013). Following this, we might assume that the development of new energy efficient technologies might still be rooted in gendered assumptions and preferences, making them less efficient, or at worst counter-productive when dealing with energy reduction. With regard to the substantial changes a proposed decrease in energy consumption may entail with regard to both our personal lives and the organisation of our societies, engaging gender in energy research is therefore important. Indeed, according to Ryan (2014, p. 97) for instance, there is a potential for Gender Studies to be utilised by energy researchers to *"interrogate socio-cultural binaries, champion women as change agents, and problematize simplistic accounts of energy usage and policy"*.

Moving from a Northern to a Southern perspective¹, the gendered consequences of energy-consuming practices, shifts in energy availability, and choice of energy sources have shown to be even more crucial. Here, energy use and production have had potentially severe effects on women's health, safety and empowerment, for example with respect to harmful heating and cooking technologies, personal safety when gathering resources, and gendered disenfranchisement in matters of land ownership. While recognising that this report reflects a Northern perspective as a contribution to an EU Horizon 2020 project, these are still crucial issues to consider².

On a more general note, and to establish the central analytical concepts within this report, gender is traditionally used as a signifier and categorisation of the perception of differences between women and men³, and to the power relations based on these perceived differences (Scott, 1986). As these perceptions

1 This follows the perhaps simplistic two-camp-divide of the world, popularised by Independent Commission of International Development Issues and Brandt (1980), as this avoids value statements like 'developed' vs. 'developing'. Whilst we acknowledge it not as a perfect option, either geographically or economically, it will serve as a shorthand throughout this text.

2 See for instance Sovacool (2014) for a general insight into these issues, and Winther et al. (2016) for a comprehensive review of the connections between empowerment and electrification in the Global South.

3 Gender identities falling outside this binary has also recently received more academic attention. However, apart from a very few studies, this has not yet been included in energy research.



are culturally and socially constructed, the meanings ascribed to gender will vary across time, geographical location and context. As noted by West and Zimmermann (1987), there is also an element of performativity associated with gender. It is something we 'do', it is rooted in interpersonal and relational practices, but is also connected to the cultural values of the societies surrounding these interactions. As such, there is nothing inherently 'natural' and no self-evident 'truths' when it comes to gender roles. As social processes, the qualities ascribed to gender are both in flux, while also upheld by routinised performances, cultural institutions and collectively held assumptions, making it a relevant category of inquiry.

There has been a long line of inquiry into the links between gender and environmentalism, with some earlier research providing vague, essentialist, and stereotypically oriented accounts of women being more in tune with 'mother earth', more protective, spiritual, nurturing etc. Such research can be said to overlook differences among women (Ryan, 2014) and discount the social aspects of identity construction, as mentioned above. Nevertheless, these beliefs have served as a point of departure for notable research, especially when combined with a more nuanced, Constructivist perspective⁴. One strategy of connecting gender and environmentalism has been to consider how women in major parts of the world carry the responsibilities of providing for children and their households, enabling a closer connection to their environment (Bowman, 2013). Another has been to consider the obvious risks associated with climate change, and the strong correlation between gender and risk perceptions (Carlsson-Kanyama et al., 2010)⁵. The more general point here is, however, to show through these phenomena the fruitfulness of integrating SSH perspectives in energy research. Expertise in studying communality, socialisation, risk and gender, can in other words represent valuable points of entry for SSH researchers.

As the worked referenced in this report stem from different disciplinary, social and geographical contexts, and are also somewhat scattered when it comes to publishing years, the conceptualisations of gender employed will naturally vary throughout this report⁶. Without the time or room to comment on how gender is presented in each account, it seems more instructive to advise the reader to refrain from considering differences attributed to gender by the cited authors as natural phenomena, rooted in biological differences. Rather, the referenced findings would probably best be read as the result of social, cultural, economic and structural practices and processes. Not necessarily less imposing on individual choices, or social structures, but also phenomena that are never cast in stone.

The reviewed articles and books were chosen based on the criteria of perceived impact (in form of citation scores), relevance, and our judgement of their quality. Central academic databases - specifically: Scopus; Web of Science; and Google Scholar were employed - and we have also extensively followed the reference lists in the works that these initial search results produced (as part of a literary snowballing technique). One of our underlying goals for this undertaking is to show the scope of this interesting and important strand of energy-SSH research. This also entails being mindful of the full (inter)disciplinary potential of SSH research, scoping articles from fields as diverse as Sociology, Science and Technology Studies, Gender Studies, Social Anthropology, Human Geography, and the spaces where disciplines intersect. It is also important to emphasise that not much has been done within this intersection of gender and energy research yet, and that most of the work referenced in this report raises far more questions than is explored empirically. This is the underlying realisation that powers this reports central call: more insights are needed on the interplay between gender, energy production and energy consumption.

The structure of this report is based on the four energy topics of SHAPE ENERGY: 'Energy efficiency and using less'; 'Competitive, secure, low-carbon energy supply'; 'Energy system optimisation and smart

4 'Constructivism' or 'Social Constructivism' is a theory of knowledge in the Social Sciences that emphasises the situatedness, relationality and construction of knowledge. Seminal work within Constructivism include Berger and Luckmann (1966).

5 The findings of Finucane et al. (2000), that white men in particular perceives risk to a significant lower degree than white women, non-white men, and non-white women, also suggest that there are benefits of adopting an intersectional perspective on the interplay between risk and environmentalism. See for instance McCall (2005).

6 This research is generally also lacking when it comes to gender identities falling outside the established binaries of 'women' and 'men', while heteronormative assumptions (especially in research on households) seem to be common.



technologies'; and 'Transport sector decarbonisation'⁷. While we will use these to categorise the reviewed literature, some of the headers are modified according to the available literature. Finally, we finish the report with recommendations for other researchers conducting energy research (both within SSH and other fields), for the funding of EU energy research, for other SHAPE ENERGY activities, and for the development of energy saving technologies.

7 These topics have been selected based on their relevance for EU-policy; in particular, they are inspired by the priorities set out in the Strategic Energy Technology (SET) Plan and consequently the Horizon 2020 energy work programme priorities (European Commission, 2015). SHAPE ENERGY has additionally published annotated bibliographies on each of these topics, freely available at www.shapeenergy.eu.



2. Gender and energy: Overview of an emergent field

In an early attempt to summarise the research on gender and energy from a Northern perspective, Clancy and Roehr (2003) observe that most of the research done up until that point had primarily focused on women in the South. While the following fourteen years have seen a marked increase in research done on gender and energy in the North, this research is still quite scattered with regards to scope and approach. We can interpret this positively as demonstrating a broad scope regarding possible research questions and empirical observations. However, this feature also reflects that the field of gender and energy is still emerging, and thus lacking with respect to a shared conceptual understanding of the problem area, while propositions are lacking for common conceptualisations and approaches.

2.1. Gendered energy efficiency

While household energy use has traditionally been explained by income levels (Räty and Carlsson-Kanyama, 2010), there has been an increasing amount of research on the gendered aspects of household energy use. Räty and Carlsson-Kanyama (2010), for instance, find clear gender differences when it comes to energy use in Sweden, Norway, Germany and Greece. Specifically, they find that women use slightly more energy than men do, when it comes to consumption categories such as food, hygiene, household effects and health. However, these differences are small. Whereas when it comes to restaurant visits, alcohol and tobacco, men's energy usage is significantly higher than women's. Based on a review of existing literature on household carbon emissions, Zhang et al. (2015) confirm that gender is a factor influencing the energy consumption of households. Woman-headed households, for example, are found to have higher emissions than man-headed households, which is explained by pointing to a gendered division of labour and women spending more time at home, while men have higher emissions related to transport and leisure activities. In addition, Roehr (2001) finds that it is generally men who make more 'environmentally dubious' purchasing decisions, such as audio and communication equipment. However, as these results stem from the combined energy consumption in households, it may signify a gendered diversification when it comes to purchasing responsibilities.

A vast amount of energy use today is however directly related to the buildings we occupy. Considering the number of older structures that will still be standing for a long time to come, as well as the energy embodied in new, energy efficient constructions, renovations are crucial initiatives. Relatedly, in research on the renovation of Danish homes, Tjørring (2016) explored the interactions between the energy advisors appointed by a local energy company, and the families considering renovation projects. This study illuminates how priorities in renovation are perceived differently by men and women as a consequence of different everyday practices, and that these gendered practices affect decisions concerning energy renovations. Tjørring (2016) also found that cultural norms generally place household renovation under the men's sphere of interest, as a result of traditional gender roles and work division. Here, a change in the gendering of responsibilities, or an active targeting of women when it comes to engagement in energy renovation projects, might increase the willingness to commence such projects. Related to this, Broberg and Persson (2016) find that gender played a role for preferences with regards to different degrees of external control of heating and electricity in Swedish households. In terms of homeowner's satisfaction with low-carbon heating systems, however, gender and other socio-demographics factors did not seem to be important indicators (Michelsen and Madlener, 2017).

Also interesting related to comfort, heating and gender are Karjalainen's (2012) findings regarding gendered aspects of indoor thermal comfort. Through a literature review of both laboratory and field studies, Karjalainen found that women are more likely to express dissatisfaction than men in the same thermal environment and concludes with a call for primarily using women as subjects when examining indoor thermal comfort requirements. The impact of reduced temperatures on women is also found by Carlsson-Kanyama and Lindén (2007). This is potentially important when evaluating measures for energy saving with



regards to heating, which in everyday lives is likely to always be balanced against thermal comfort⁸. Still, the described gendered aspects of indoor temperature are disputed. Vávra et al. (2016), for example, find that gender did not have explanatory power for people's heating habits. Hence, the claim that energy saving measures might – as Carlsson-Kanyama and Lindén (2007) state – produce different outcomes for women and men should be researched more. Indeed one might, for instance, find energy reduction schemes with less of a gendered impact to be more effective in reducing energy demand.

Another salient point raised by Carlsson-Kanyama and Lindén (2007) is that the workload for women increases in households saving energy, e.g. when not employing clothes dryers, and in homes with dynamic energy pricing, when the washing of clothes and dishes are moved to nights and weekends when electricity is cheaper. It seems not unreasonable to expect this unevenness in shared responsibilities to operate as a gendered barrier against energy reducing measures in households. Gender dimensions of energy saving in households are addressed by several further studies. Based on the theory of planned behaviour, Chen et al. (2017), for example, examine how socio-psychological variables predict energy conservation intentions in low-income households. Although other variables were stronger predictors for energy conservation intentions, gender “*predicted intentions when other variables were not included in the model*” (Chen et al., 2017, p. 61). Thus, in this case gender did not seem to be an important indicator when it comes to energy saving. Similarly, Streimikiene (2015) finds that gender did not have an impact on environmentally friendly behaviour in Lithuanian households, only environmental awareness seemed to impact energy saving.

Another important strand of research examines the gender-differentiated impacts of energy poverty – particularly related to the situation of poor woman-headed households and the above-mentioned uneven distribution of workload and risks. However, these studies mainly focus on the global South (e.g. Pachauri and Rao, 2013; Sovacool, 2012).

To summarise, the gendered aspects of energy use and energy efficiency are understudied and the existing research provides partly contradictory conclusions about the role of gender in these areas. Some of the findings reported here – that energy use can be influenced by gender, and that energy savings can have different outcomes for men and women – can, as Carlsson-Kanyama et al. (2010) point out, enrich mainstreaming efforts in the EU and tailor a more nuanced suite of efforts to stimulate energy saving. There is also a need for further insight into the possibly uneven distribution of burdens as a result of energy saving in households, to evaluate both the effectiveness and equality of these measures.

2.2. Gender and low-carbon energy supply

Moving from the consumption to the supply of energy, a gender imbalance is found to be particularly acute in the energy industry workforce and in energy decision-making (Pearl-Martinez and Stephens, 2016; Ernst and Young, 2016; Carlsson-Kanyama et al., 2010; Norman, 2015). Some studies have looked into whether this gender imbalance has implications for the environmental footprint of the energy produced.

Longstreth et al. (1989), for instance, contribute interesting research on the assumptions of gendered environmentalism and the possible interplay with voter preferences in the United States on a variety of energy policy options. This qualitative work started on the assumption that women would rather choose a ‘soft path’ (e.g. solar, wind, biomass, hydropower) over the assumption that men would favour a ‘hard path’ (e.g. nuclear, coal, oil)⁹. The ‘soft’ preferences were linked to environmental concerns and the needs of present and future generations, while the ‘hard’ were associated with control and power over nature. The authors' hypothesis was partially confirmed and linked to ideas about the different socialisation of men and women with regard to security and risk. However, the results were far from uniform. Men were, for instance, found to be more in favour of solar energy and hydropower (‘soft energy’), while gender difference in the

⁸ The balancing act between sustainability and efficiency on the one hand, and comfort, health and wellbeing on the other hand is also addressed by Amorim et al. (2017), who study the effect of different lighting technologies in facilities for the recovery of women who have been victims of gender violence. Their study indicates that daylight – the cheapest and most energy efficient option – also improved the women's health and wellbeing more than the other lighting options.

⁹ This work is based on Amory Lovins' (1977) ‘hard’ versus ‘soft’ path paradigms, where these paths not only differ technologically, but also in the values they embody.



acceptance of nuclear power was far more marked (Longstreth et al., 1989). This link between gender and attitudes towards nuclear power has since been confirmed by a number of studies (Kenar, 2013; Sundström and McCright, 2016; Gutschik and Sturm, 2012; Henwood and Pidgeon, 2015; Puranen, 2000; Melber et al., 1977; Solomon et al., 1989), which all observe that men have been more in favour of this energy option than women. This is often associated with the lines of thought mentioned in this report's Introduction, concerning socialisation and risk, particularly with different perceptions of health and safety risks.

Karlstrøm and Ryghaug (2014) have conducted similar research that shows a link between gender and environmentalism. In line with the work of Longstreth et al. (1989) the exception also here is hydropower, which they attribute to the impact of hydropower on nature. Gendered environmentalism has also been addressed by Keskin et al. (2012) who find that women teachers score higher on pro-environmental attitudes than their men colleagues do. Further, Cherryman et al. (2008) conclude that women are more accepting of hydrogen energy than men. Taking the area of interest from perceptions and attitudes to active engagement with energy, Willow and Keefer (2015) study women grassroots activists' motives for shale energy opposition and how these women both confirm and challenge established gender roles in their activism. Further, Fraune (2015) looks into the gender differences related to citizen participation schemes in renewable electricity production. Taking the research on gendered technology preferences and environmentalism further, Fraune (2016) shows that these differences also are evident in energy policymaking where women legislators show different preferences in speeches and voting than men members of parliaments.

In sum, gender has been deemed a salient factor for assessing preferences for energy sources with lesser environmental impact. The referenced studies also illustrate the perhaps trite point that environmentalism is more complex than evaluating pollutants and emissions, and that the gendered aspects of environmentalism are far more complex than assumed in some earlier work.

Moving from the public to researchers, while seemingly following a similar hypothesis of gendered environmentalism, Clancy et al. (2001, quoted in Clancy and Roehr, 2003) find that women scientists in the EU held a stronger preference for research on renewable energy and energy conservation, compared to men in their field. This qualitative study also finds that women scientists were more concerned with integrating social issues into energy research. In the nuclear research sector, they also find that women scientists prioritised researching safety aspects and medical applications to a larger degree than men (Clancy et al., 2001, quoted in Clancy and Roehr, 2003). This parallels the above-mentioned gender differences in public attitudes towards nuclear energy.

Carlsson-Kanyama et al. (2010) follow this risk-related line of energy research, noting the severe lack of gender diversity in energy companies in Germany, Spain and Sweden. They subsequently discuss the possible benefits of a more equal representation in changing energy-systems. Based on evidence that women are more risk averse than men, and that attitudes on climate change and willingness to take mitigation measures is gendered, the authors conclude with an urgent call for more research into these processes. At the moment, we are lacking data on women's impact on company governance and performance, as is also noted by Carlsson-Kanyama et al. (2010). This call is also reiterated by Pearl-Martinez and Stephens (2016), who maintain the importance of studying the complex social dynamics of energy transition while also noting the same lacking knowledge into gendered impact into company governance as Carlsson-Kanyama et al. (2010). The call for more research on these issues becomes particularly evident when considering studies, such as Wallhagen and Magnusson (2017), which do not find evidence for gendered environmentalism.

Cech and Pham (2017) address a different aspect of gender balance in energy-related workplaces with their study of the disadvantages that lesbian, gay, bisexual, and transgender (LGBT) individuals face for example in the Department of Energy and the Environmental Protection Agency in the U.S.. Furthermore, McKee (2014) examines gender balance in the American oil and gas industries, and observes that the increasing inclusion of women in the workforce lead to a better distribution of wealth. However, the paper by Foss et al. (2013) paper demonstrates that gender balance is not just about increasing the number of women in the workforce. The authors study the generation and implementation of new ideas in a large Norwegian energy corporation and find that men's ideas are implemented to a greater degree than women's. Hence, they argue that women's ideas should get more attention in men-dominated workplaces, such as most energy-related workplaces, and that gender-neutral innovation measures are needed. Prietl (2017)



makes a related point when highlighting that engineers in the German renewable energy industry associate professional engineering with masculinity in contrast to alternative engineering practices, which are both feminised and devalued.

The main takeaway from this subsection is thus, that the inclusion of women in the energy workforce, energy research, and energy decision-making is not just a question of fairness, or the possible economic benefits found for instance by Herring (2009), but may also be a question of environmental related effects: *"a sector dominated by one gender will tend to make decisions which reflect the norms and values of that gender, hence masculine dominated industries will reflect male agendas in terms of both the policies they pursue and the work environment"* (Clancy and Roehr, 2003, p. 20-21). This, combined with the insight from the research reviewed, forms a convincing argument, but further inquiry into the interplay between gender, and energy-production is needed to establish what is at stake and how this can be understood. Additionally, the issues of fairness and gender equality are important on their own terms.

Fairness and diversity are obviously always worth fighting for in and of themselves, but when it comes to representation in energy production, the current research also suggests that the transition towards more sustainable energy systems might potentially be enhanced by an improved gender balance, while also producing other possible benefits. To quote Pearl-Martinez and Stephens (2016, no pagination): *"Greater understanding of the gender gap in energy-related industries, as well as more widespread acknowledgement of the positive potential of gender diversity in this sector, would likely promote more sustainable energy practices, accelerate energy innovation, expand opportunities for women, and encourage greater social engagement in energy-system change."*

2.3. Gender, energy system optimisation and smart technologies

Social engagement in energy systems is also highlighted by Strengers (2013), whose work on the underlying ontologies of what she brands 'the smart futures' has become a central point of departure in recent SSH research on gender and smart technologies. For Strengers, these ontologies entail conceptualisations of the near-future where smart technologies are posed to solve complex policy problems - such as climate change, peak electricity demand, energy security and rising infrastructure costs - through ICT-enabled technology in the individual household. It is within this framework that Strengers coins the term, 'Resource Man', to concretise the ideal user in these technologically advanced feedback systems. According to Strengers (2013, p. 36): *"His aim is total control and choice over his use of energy, so that it is operating as efficiently as possible, in a way that suits his lifestyle"*.

The explicit use of the male noun, 'man', throughout Strengers' account of this consumer category is of course not a coincidence, as *"[The Resource Man] is cast in the image of the male-dominated industries of engineering, economics and computer science, and because visions of him exclude most household labour which is still predominantly carried out by women"* (Strengers, 2013, p. 37). This is where we return to the aspect of social engagement, as one of the implications of Strengers' research is that household energy consumption is primarily placed under men's sphere of interest, possibly excluding women as agents of change in energy systems. The concept of the 'Resource Man' has also recently been employed by Skjølsvold et al. (2017), and Verkade and Höffken (2017), which have thereby expanded the empirical richness of Strengers' arguments with examples from a Norwegian and Dutch context respectively. In particular, this recent research has shown the viability and aptness of 'Resource Man' as an analytic construct.

Smart technologies and gender is also investigated in Berg's (1991) study on the development of smart house concepts in the late 1980s. This study argues that these smart houses were also designed without an awareness of the gendered work division in households. Thus, similar to the more recent research, Berg highlights how smart technologies may be considered as gender neutral in the eyes of the designers, in spite of those designs actually being built on the assumptions of men being more interested in and knowledgeable of their designed technologies. Indeed, when it comes to the underlying assumptions driving the innovation and dissemination of the technologies posed to optimise energy usage in households, recent studies - like Strengers (2013), Skjølsvold et al. (2017) and Verkade and Höffken (2017) - indicate that not much has really changed since the studies of the 1980s and 1990s' smart houses.



These conceptualisations of our future dwellings will rather need to incorporate a comprehensive understanding of the people that are intended to occupy, use, and make them into their homes. This will also necessitate grappling with gendered energy practices, gendered preferences and gendered assumptions concerning the imagined users of these homes, and the technologies within them. A lack of such an understanding, and the reproduction of technologies primarily conceptualised with men's interests in mind, might create possible barriers for the dissemination of both these technologies, and the energy efficient houses of the future.

2.4. Gender and transport sector decarbonisation

The previous three sections raised a broad set of partially understudied complexities in the intersection between gender and different strands of energy-SSH research. This complexity is indeed maintained when shifting viewpoint towards the transport sector¹⁰. Personal mobility practices – how we transport ourselves and those related to us – is firmly integrated with most of our modern, everyday lives. These mobility practices can be described as a complex stew of consumption and consumerism, mobility patterns, ideologies, cultures, resources and habits, which again connect to the organisation of our work and private lives. Here, factors and considerations like lifestyle, leisure, commitments, technological advancements, individual preferences, environmental concern, status, economy and geography come together and are again adapted and formed by societal infrastructure (roads, sidewalks, bike lanes and systems of collective transport). As such, mobility is connected to a considerable portion of our daily lives, with all its complexity, and also with the organisation and cultures of our societies. As we will show, this complexity also includes assumptions of gendered preferences, gendered mobility patterns and gendered practices. This is of course all fertile grounds for energy-SSH researchers, and the task of understanding gendered mobility, and how this is entwined in social, economic and structural factors is a necessary one, considering the changes needed to reach ambitious reduction in traffic related emissions.

Unafraid to grapple with complexities, there have been some academic endeavours to unpack these phenomena concerning gender and sustainable transportation. Hanson (2010) for instance, conducts a detailed mapping of the earlier social geographic literature concerning gender and mobility. Here, Hanson identifies two disparate strands of thinking within this field: (1) How does mobility shape gender, and (2) how does gender shape mobility? While the first strand has provided interesting findings on the interplay between mobility and identity construction, it is the second strand, and Hanson's conclusions that is most central for the purposes of this report. The central finding was that researchers on gender and mobility need to synthesise these two strands, with an emphasis on geographic, social and cultural context. A poignant example is Hanson's account of feminist scholars with a tendency to account women's lower mobility as an obvious negative, while also being closer to the ideal of sustainable mobility. This makes the endeavour to understand the contextual and social aspects, in addition to the meanings ascribed to gendered mobility an important one. Through this example, Hanson shows that without the combination of both strands of gender and mobility research, the resulting research might lack the necessary nuance to grapple with aspects of gender, on the road towards sustainable mobility.

This account should probably not be taken as a blanket indictment of these isolated strands of gender and mobility studies however, as accounts of how gender influences mobility still may prove to be useful. This even while acknowledging that the underlying understandings of how gender relates to mobility might be lacking. Just scoping Hanson's original article for instance, we find Polk (2003; 2004), who through quantitative oriented studies of gendered mobility in Sweden finds that (compared to men) women: drive less; use more public transportation; travel more by foot; are more critical of automobile usage; and are more likely to associate automobile use with environmental harm than men. The conclusion being that women are potentially more adaptable to a sustainable transportation system than men are. Polk's findings regarding gendered mobility is also supported by a wealth of other research, and in several other

¹⁰ This report will focus solely on private transportation, as preferences in employing transportation in one's personal lives is more likely to be influenced by gender roles, gendered assumptions, and gendered preferences. After extensive scoping, we have also yet to see any accounts of gender as a particular relevant variable in the transportation of goods.



geographical contexts. Simićević et al. (2016) for instance, find through studies of parking survey data in Serbia that men drive more, and cover further distances, mostly explained by work-related travel. Women on the other hand are found to use the car less, and more often related to household and family duties. Similar results are also found in Spain (Miralles-Guasch et al., 2016), Germany (Vance and Iovanna, 2007), and the U.S. (Rosenbloom, 2006). Several studies additionally find substantial gendered differences when it comes to employing cycling as means of transportation, but this varies markedly in differing geographical contexts. In Denmark, Germany and the Netherlands for instance, the gender balance appear approximately equal (45%, 49% and 55% of women cyclists, respectively) (Pucher and Buehler, 2008), while the same numbers for Australia, the UK and the US is reported as 21%, 28% and 24% (Garrard et al., 2008; Pucher and Buehler, 2008). The main difference between these countries seems to be substantially differing injury rate, suggesting that risk (perceived and actual), might influence both the gender balance and the overall amount of cyclists (Pucher and Buehler, 2008).

Just the fact that we can observe diverging mobility patterns in regards to sustainability makes the endeavour to understand these gendered differences an important one for several reasons. Polk (2004), for instance, finds that traditional attitudinal models of car use explains men's automobility to a much larger degree than women's, implying that gender should be accounted for in mobility research. A similar conclusion is also reached by Vance and Iovanna (2007, p. 54), and extended to policy making: *"These results suggest that policies targeted at reducing automobile dependency and associated negative externalities, such as congestion, are unlikely to have uniform effects across the sexes"*. This conclusion is also likely to be transferable to matters of sustainability.

Combined, these findings are of importance for both researchers and policymakers in dealing with the shift towards sustainable mobility. For instance, providing bike-friendly infrastructure will seemingly not only raise the total amount of cyclists, but also improve gender balance, making the increase in cyclists more substantial than expected. Also, as it appears that women employ sustainable transportation to a larger degree than men, we should strive to scope the underlying causes for this gendered sustainability, to explore if this can be mainstreamed. This also suggests, as noted by Kronsell et al. (2016), that women can become more active as change agents within the shift towards sustainable mobility.

However, to achieve this, to understand the underlying dynamics of gendered mobility, we will need to move past treating gender as a simple statistical binary, and the sort of large-scale quantitative studies mainly cited in this section. This is also noted by Hanson (2010) and Pucher et al. (2011). If, for instance, women's reduced mobility implies a lack of access, this could also be a matter of social injustice and inequality. Insight into the interplay between gender and mobility is also crucial if we are to move from acknowledging differences towards acting upon them. Untangling these matters will necessitate understandings of how gender and mobility intersects, and why, requiring a greater repertoire of qualitative methods and more nuanced understandings of gender, socialisation and how all this links to our societies as a whole.

This will also include grappling with the cultural and symbolic meanings of car use and mobility, and what these constructions might entail. Here SSH research contains a vast repertoire of historical work, specifically on car cultures and masculinities, and the intersecting cultural associations between mobility, power, and status¹¹. There is, however, a distinct possibility that the transport sector is now rapidly approaching a marked transformation as the electric vehicle gains momentum, possibly transforming the cultural connotations associated to the technologies of personal mobility. If this shift implies a movement from the realms of noise, grease, self-maintenance and combustible engines, towards the sleeker and perhaps more user-friendly aesthetics of consumer electronics¹², it is probable that the gendered assumptions concerning mobility also could change. If, and how this shift will happen, and the social and symbolic meanings associated with a transformation like this, will however necessitate more research.

At the current time - as with all the topics covered in this report - more research into the interplay between gender and energy is indeed needed.

11 See for instance: Walsh (2008); O'Connell (1998); Scharff (1991); and Massey (1993).

12 Which also brings a whole other set of gendered assumptions into play.



3. Recommendations

For the funding of EU energy research

- The intersecting fields of gender and energy is a worthwhile and important topic for research. A gender perspective can enhance energy research, and missing facets of gender can at worst make for unsatisfactory analysis. Moreover, changes in energy consumption, energy production and transportation will require updated studies as a consequence of said changes. Gender will represent fertile grounds in these studies.
- More research is needed on gender and energy. As shown through this review, there are interesting perspectives and hypothesis to be found. What is often lacking are rather more strenuous empirical explorations of the effects and implications of gender imbalance, and of gendered stereotypes and assumptions.
- Every Horizon 2020 project is required to include a gender dimension in research and innovation. More research is therefore needed on how the expertise developed in the field of Gender Studies can be integrated into gender mainstreaming efforts. These are also complex efforts that will necessitate funding from the EC.
- Existing research indicates that women scientists may tend to focus more on renewable energy, and to integrate social issues into energy research to a higher degree than men in the same field. As a result, achieving gender balance in science may have the potential to increase the focus on environmentalism. More research is needed to confirm this hypothesis. Research is also needed on how gender balance can be achieved within research institutions.
- Gendered assumptions need to be accounted for when it comes to the development, implementation and practices surrounding 'smart' household technologies, energy-saving refurbishments, and low- or zero-emission vehicles. These technologies will need a substantial adaptation rate if we are to achieve ambitious energy goals.

For interdisciplinary energy projects and platforms

- Gender balance in research teams should be a priority. In addition to the matter of representation in research, diverse research teams can also produce stronger work.
- Every energy project and platform should pay attention to gender as both a factor possibly influencing what is investigated and also the results produced.
- It is important to recognise that an integration of gender awareness is a complex endeavour and can thus require significant resources and expertise. As such, projects and platform co-ordinators must be wary of tokenism that does not fully, or appropriately, address the issues at hand.

For SHAPE ENERGY activities

- Every SHAPE ENERGY activity should strive to be gender-reflexive and to achieve gender balance. As the consortium has partners with expertise in Gender Studies, the projects should actively draw on this competence.
- In terms of gender balance, all activities and events should strive to have a gender balance, e.g. in terms of speakers, lecturers and participants. Mechanisms should ideally be embedded so that this is acknowledged and followed up by all partners, so that no-one has to take on the role of 'gender police'.
- Issues of gender reflexivity and gender perspective are relevant for all activities, but they need particular attention in the *Multi-stakeholder Workshops* and the *Online Debates*, and should also be addressed regarding the *Summer School* and *Horizon 2020 Secondments*.
- In particular, the Evaluation work package (WP4) should pay attention to gender. Gender aspects should be considered in the partners' *Participant Observation Diaries*, with an emphasis on: gender balance (who is attending?); gender domination (who speaks, who is heard, and whose perspectives are represented?); how gender is discussed (is gender discussed in an activity, and if so, which aspects? Do gendered phenomena appear as 'naturalised', or are they overlooked altogether?).



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