STUDY

Requested by the FEMM committee

European Parliament

Women, Gender Equality and the Energy Transition in the EU

Policy Department for Citizens' Rights and Constitutional Affairs

Directorate General for Internal Policies of the Union

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Women, Gender Equality and the Energy Transition in the EU

STUDY

Abstract

This study, commissioned by the European Parliament's Policy Department for Citizens' Rights and Constitutional Affairs at the request of the FEMM Committee, examines the evidence on the role of women in the energy transition in the European Union and the extent of gender equality in the process particularly in respect of the renewable energy sector. The study identifies gender inequalities preventing women from the involvement in the energy transition and career advancement in this area and assesses how the transfer to the sustainable energy model will affect gender equality and the role of women as actors of change. It provides best practices in overcoming the barriers to gender equality in the energy transition and concludes with recommendations to the EU and national decision makers.

ABOUT THE PUBLICATION

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DISCLAIMER

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LIST OF ABBREVIATIONS

AGECC	Advisory Group on Energy and Climate Change
C3E	Clean Energy, Education and Empowerment Technology Collaboration Programme
CEM	Clean Energy Ministerial
C3E	Clean Energy, Education and Empowerment Technology Collaboration Programme
DG	Directorate General
EIGE	European Institute of Gender Equality
ENERGIA	International Network on Gender & Sustainable Energy
EU	European Union
FEMM	Committee On Women's Rights and Gender Equality
FHH	Female Headed Households
IEA	International Energy Agency
ILO	International Labour Organisation
IRELP	International Renewable Energy Learning Partnership
IRENA	International Renewable Energy Agency
IUCN	International Union for Conservation of Nature and Natural Resources
LEI	Local Energy Initiative
MS	Member State
MIT	Massachusetts Institute of Technology
MSCI	Morgan Stanley Capital International World Index
NGO	Non Governmental Organisation
OECD	Organisation of Economic Cooperation and Development
PV	Photovoltaic

RE	Renewable Energy
SDG	Sustainable Development Goal
SEforALL	Sustainable Energy for All
STEM	Science, Technology, Engineering and Mathematics
TCP	Technology Collaboration Programme
ToR	Terms of Reference
UK	United Kingdom
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WEF	World Economic Forum
WHO	World Health Organisation
WiRES	Women in Renewable Energy Sector
WISE	Women in Science and Engineering

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EXECUTIVE SUMMARY

Background

The energy sector is influenced by a set of persistent gender inequalities, which can be summarised as follows (EIGE, 2016):

- gender gaps in energy access;
- gender gaps in the energy labour market: women represented on average 35% of the European workforce in the renewable energy (RE) sector in 2016;
- gender gaps in energy-related education: within the European Union, in 2012, 11 % of women compared to 22 % of men in the 22-29 age group have graduated in science and technology (Eurostat data 2012 cited in EIGE, 2016);
- gender gaps in decision-making.

Aim

The objectives of the research study are:

- to analyse the impact of the transition to the renewable energy model in the EU on women and gender equality;
- to identify gender inequalities preventing women from the involvement in the energy transition and career advancement in this area;
- to assess how the transfer to the sustainable energy model will affect gender equality and the role of women as actors of change;
- to identify benefits for women deriving from the transition to the renewable energy, describing the most illustrious best practices/solutions;
- to provide policy recommendations for the EU Institutions and Member States on promotion of gender equality in the energy transition progression.

Methodology

Three research questions were formulated to reach the research objectives. As a methodology, a literature review was combined with policy documents analyses and complemented with key respondents interviews. Good practices in overcoming the barriers to gender equality in the energy transition were identified.

Gender gaps and inequalities within the renewable energy sector of the European Union

There is limited gender-disaggregated data in relation to employment in the renewable energy sector within the European Union. This makes monitoring of progress towards gender equality and evaluation of initiatives to move to gender equality difficult.

Based on the limited data available, it is possible to discern that there is a significant gender gap in the number of women in positions in both public and private sectors (including civil society initiatives) to influence the energy transition.

Women, particularly lone parents and above retirement age, are more likely than men to live in energy poverty at some stage in their life limiting their access to renewable energy services and hindering their participation in the energy transition.

Women working in the renewable energy sector

Decision about studying Science, Technology, Engineering and Maths (STEM) are formed early and become progressively more difficult to change as children grow older with girls losing interest earlier than boys which reduces the pool of talent to enter the RE sector.

Lack of support, encouragement (particularly to overcome negative stereotypes) and reinforcement by parents, teachers and career advisors is detrimental to girls' intention to study STEM and choosing STEM (particularly engineering) careers.

Women continue to face barriers to employment in the sector, linked to both personal behaviour towards job applications and recruitment policies.

Despite these barriers, within the EU, the numbers of women studying STEM subjects appears to be increasing (with the exception of Estonia, Latvia and Lithuania).

There are signs that more women are entering as professionals in technical functions within the renewable energy (RE) sector, although in the occupational trades there are still barriers often linked to stereotypes. The RE sector has a better representation of women employees than other branches in the energy sector.

There are a number of initiatives, both within Member States and globally, to encourage young women and girls to opt for STEM and to change employment practices.

Ensuring gender equality in the transition to the sustainable energy model

Women have three roles as change agents in the energy transition sector:

- **energy professionals**: the underrepresentation of women compare to men working in the energy sector;
- **energy decision makers**: the underrepresentation of women in energy policy making and decision-making bodies at all levels in the European Union and its Members States;
- **energy consumers**: the gender difference of energy consumption and demand.

Energy policies throughout the EU Member States appear to be gender blind and implementation appears not to adopt gender approaches which is exacerbated by the lack of gender-disaggregated data.

Empirical evidence that women's employment and income will benefit from modern energy access is limited and rather inconclusive.

There is some evidence to suggest that women are greener than men in terms of making decisions by household appliances. However, the same evidence indicates women are more likely to feel guilty about the impact of their ecological footprint.

Supporting the transition to gender equality in the renewable energy sector

Three areas of attention which can improve women's involvement in the renewable energy sector are:

- visibility of women in STEM is key to motivate girls to choose STEM education, women to work in STEM and female professionals to pursue their careers in the energy sector;
- mentoring and networking is creating a stimulating peer-learning environment and a supporting community for women in the energy sector;

- corporate responsibility is a key factor in ensuring a facilitating work environment for female professionals in the energy sector.

Recommendations

Creating a more gender equitable energy policy
A wide adoption of the "Define, Plan, Act, Check" methodology described by the EIGE in its document "Gender and Energy" is recommended. The starting point is collecting gender- and sex-disaggregated data. Sex-disaggregated data in this study refers to the definition of EIGE: sex-disaggregated data is any data on individuals broken down by sex.[1] In addition, gender-disaggregation when data are further disaggregated beyond the binary 'women and men' to reflect the diversity of EU citizens' lives is recommended.

Reducing the gender gap in the renewable energy sector employment
There are a range of initiatives currently underway at different points in women's education and employment in trying to overcome the barriers to more women being employed and remaining in the RE public and private sectors. An evaluation of a range of initiatives would help organisations identify what works for their situation.

Recognising and addressing the gendered nature of energy poverty
Women and men experience energy poverty in different ways and are unequally affected by energy poverty due to the gendered indicators such as income differences, housing conditions, care for depending family members and age.

Increasing gender equality in decision-making at the local level related to the energy transition.
Organisations which aim to increase gender equality in decision making need to take into account women's situation – firstly, recognising that women's motivational factors may be different to men's, secondly, by promoting the value of non-technical skills to the functioning of the organisation and thirdly by avoiding a reliance on voluntary contributions to the running of the organisation.

[1] https://eige.europa.eu/gender-mainstreaming/methods-tools/sex-disaggregated-data

1. INTRODUCTION

1.1. Background to the study

Energy plays an essential role in both women's and men's lives which differ in all societies with different needs and capacities to act. However, energy policy is formulated in a gender neutral manner, that is, it is assumed that women and men benefit equally. Achieving gender equality in the field of energy can be linked with human rights and social, environmental and economic development. Incorporating these dimensions into energy policy formulation and implementation is especially important given the role that women, as well as men, can often play as key drivers of innovative and inclusive solutions. However, as the data below show, women's involvement in the energy sector is more limited than men's involvement. Therefore the energy sector is underutilising a pool of talent and not meeting human rights obligations. There is evidence to show that gender diversity and the broad participation of women in the energy sector are needed for a successful clean energy transition.

In terms of employment, the energy sector remains one of the most gender imbalanced sectors in the economy globally and within the European Union (EU), despite recent efforts to promote and encourage women's participation. Women face structural and cultural barriers in participation in all aspects of delivering the transition. The lack of women in leadership positions at all levels in the clean-energy sector is considered to compound the difficulty in recruiting and retaining female leaders (EIGE, 2017). The problem starts with the small number of women with an educational background appropriate for a technical career in the energy sector. Eurostat data for 2012 show that in the 22-29 age group, which is the most likely age group for graduates, 11 % of women compared to 22 % of men have graduated in science and technology (EIGE, 2016).

Women represented on average 35% of the workforce in the renewable energy sector in 2016. This is higher than in the traditional energy sector but lower than the share across the economy. The numbers are especially low for decision-making positions. Globally, women represent only 6% of ministerial positions responsible for national energy policies and programs and account for less than a third of employees across fields within scientific research and development (EIGE, 2016).

The energy sector is influenced by a set of persistent gender inequalities, which can be summarised as follows (EIGE, 2016):

- gender gaps in energy access;
- gender gaps in the energy labour market;
- gender gaps in energy-related education;
- gender gaps in decision-making.

In this study, gender is defined as 'the system of socially defined roles, privileges, attributes and relationships between men and women which are learned and not biologically determined' (Khamati-Njenga & Clancy 2002). Gender is a social construct, as a consequence gender relations are a dynamic concept depending on time, space and context. Hence the gender-dimensions of energy access vary across social, cultural, economic and political context. The scope of this study covers the Member States of the EU. The empirical data related to the gender-energy nexus for the EU is limited, although it is a growing area of interest for researchers. It is the Global South where most of the research has been focused, therefore references from other countries outside the EU are used within this report. Section 1.3 discusses other limitations of the data.

1.2. Research questions

The study[2] has the following objectives :

- to provide an overview of gender inequalities in the energy sector (gender gaps in energy access, energy poverty, energy saving, labour market, decision making, education, etc) with a focus on a current situation in the renewable energy sector in the EU supported by the recent data;
- to identify obstacles to the involvement and career advancement of women in the energy transition process;
- to provide an analysis and assessment on how transfer to the sustainable energy model will affect gender equality and analyse the role of women as actors of change;
- to identify benefits for women deriving from the transition to the renewable energy, describing the most illustrious best practices/solutions;
- to provide policy recommendations for the EU Institutions and Member States on promotion of gender equality in the energy transition progression.

The objectives have been formulated as research questions to provide the framework for the study.

1. What are the structure and causes of existing gender inequalities within the energy sector of the European Union?
2. How will the transition to the sustainable energy model affect gender equality?
3. How can the role of women as actors of change within the transition to the sustainable energy model be enhanced to promote gender equality and a more effective transition?

The answers and data provided by these research questions are used to develop policy recommendations for the EU Institutions and Member States on promotion of gender equality in the energy transition progression.

The term 'energy poverty' includes issues related to energy access and energy saving. The focus in the energy sector will be primarily on renewable energy. However, other areas of the sector are used for examples such as sex-disaggregated data since these data tend only to be available for the energy sector as a whole with more limited data disaggregated per branch.

1.3. Research methods

In addition to a desk study drawing on existing statistics, literature (both peer-reviewed and grey) and official publications, a small number of key informant interviews was conducted. Key informant interviews assist in the understanding of the strategic issues and important themes for framing and articulating the analysis that is to be presented. In addition respondents help in identifying examples of best practices in ensuring benefits for women from the transition to the renewable energy as well as increasing their presence as professionals and their influence on decision making in the sector. Respondents provide fast access to examples of best practices which may not be available in the English language.

Semi-structured interviews were conducted with key respondents reflecting the broad range of the research area and the different actors involved in this topic. Respondents were found using contacts the existing network. Also based on the literature review and policy document analyses new contacts were added to the list of respondents. Furthermore, the list of key respondents were enlarged by using

[2] The study was critically reviewed by Dr Saska Petrova from the University of Manchester, UK.

snowball-technique, asking the interviewees to recommend other informants to contact for our research. A list of respondents in included in Annex 1. The questionnaire that was used guiding the interviews in included in Annex 2.

1.4. Limitations with the data

There are very few studies which focus specifically on the gender gap related to employment in the renewable energy branch of the energy sector which limits the data available.The available data about the energy sector in general and the engineering profession was used. To work in technical functions throughout the energy sector will require a qualification in a STEM subject. So it is assumed that this part of the journey women travel to enter which ever branch of the energy sector they choose will be very similar. It is also assumed that the experiences women have in entering and working in renewable energy will be similar to the energy sector in general, for example, the benefits and disadvantages of part-time work. As Baruah (2017) points out women entering and working in RE are doing so against a background of global employment trends (such as governments promoting a RE industry) and changes to social policy (such as state support for childcare) which can influence entry into specific areas of study or employment. There is insufficient data to make clear statements as to whether or not women are more inclined to work in RE. It is accepted that young people may be highly motivated by green issues which could be an influencing factor in encouraging a stronger interest in STEM subjects which could lead to a career in renewable energy. This may be an explanation of the demographics in the International Renewable Energy Agency (IRENA) survey[3] which show a significant number of young women in RE compared to conventional energy.

Caution is advised about the use of 'women' as a concept. Women are not a homogeneous group - they vary across a range of social categories (age, class, ethnicity, social status, economic group, sexual identity, etc.) and influenced by personal and contextual factors in choices they make. To treat women as a homogeneous group misses these differences which can result in some women having different or higher barriers to participation in influencing the energy transition. These differences may require specific targeted forms of action.

'Women' as a social concept recognises differences based on the way society shapes gender identity by determining which character traits can be characterised as "female" and as "male". These traits in a particular context to attribute value to certain types of behaviour and the type of social behaviour considered acceptable for women and men. Traditional "female" qualities include cooperation, nurturing, support, non-violence and sensuality, whereas traditional "male" qualities include competitiveness, individuality, assertiveness, leadership and intellectuality. However, there are women who are competitive and individualistic and likewise men who are supportive and non-violent. Therefore, it is important when analysing data not to take essentialist positions and to generalise about what a large group will or will not do/think/react.

The data of this study focus on the renewable energy sector. When discussing energy access the scope is household energy use, excluding mobility uses and transport. Describing the energy sector from an employment perspective, several areas of the energy sector are identified with an emphasis on the contribution of the sector to the energy transition. The term 'renewable energy sector' is also a nebulous term. The sector is a chain, such as design, manufacturing, construction, installation, operation and maintenance, which can be integrated to varying degrees or not at all. Some authors use 'green jobs' or 'clean jobs' (Baruah, 2017). Again this makes tracking and analysing the evidence complex particularly in view of the lack of data.

[3] See section 3.1 for more detailed discussion of the IRENA survey.

There appear to have been a number of initiatives to encourage women's involvement either working in RE or in the governance of RE systems. However, there is very little independently generated data which evaluates these schemes to see if they achieve their objectives. Indeed, methodologically, it is difficult to attribute causality to such a single intervention since there may be other confounding factors at play which contribute to success. Therefore, the examples of best practices included are presented only descriptively.

1.5. Data protection and ethical approval

In order to comply with European legislation on data protection, an ethical approach to data acquisition, use and storage as recommended by the University of Twente in the Netherlands[4] was used. All respondents gave their consent to use their input. In case they prefer to be anonymous, their names are not published. All respondents received a report of their interview for approval.

1.6. Gender equality in the context of this study

Equality of citizens is a fundamental right within the European Union. Equality must exist across all aspects of life, including employment and the capacity to influence policy formulation and implementation. Gender equality is one dimension of the foundations of equality. In the context of employment a European Parliament's resolution of 7 September 2010 on developing the job potential of a new sustainable economy recognises gender equality as a key component in a sustainable economy. The resolution calls on the EU, the Member States and the social partners to "create work environments that attract and retain women, promote work-life balance through adequate, high-quality childcare and adaptable family-friendly workplace arrangements, create opportunities as well as conditions under which both men and women can participate in the labour market on equal terms, promote female participation in male-dominated representative bodies, reduce gender-based job segmentation and wage gaps" (European Parliament, 2010). The study is focused on gender equality in technical and decision making functions in the renewable energy sector that contribute to promoting the energy transition.

In understanding the impact of energy policy decisions on gender relations, gender analytical frameworks provide insights and knowledge. The value of gender analysis in energy policy development is that the gender analytical framework seeks to understand the differentiated needs and pre-dispositions of men and women. It enables an understanding of the existing gender situation, before and after a policy intervention through assessing the impact of the intervention on the access to and control over resources (Khamati-Njenga & Clancy 2002). Considering free market economy and non-discrimination law, the assumption is made that industrial countries have gender-neutral energy policies. In the definition of Khamati-Njenga and Clancy (2002), a gender-neutral energy policy is based on the assumption that a good policy, programme or project will benefit both male and female equally in meeting their everyday needs.

1.7. Structure of the study

The study starts with describing the gender gaps and inequalities within the energy sector of the EU using a framework of women as energy users, energy professionals and energy decision makers. Chapter 3 provides an analysis of women working in the Renewable Energy Sector in the European Union and explores some of reasons why there is still a gender gap with women under-represented. Chapter 4 describes the gender and energy nexus in energy policy and analyses through a gender lens

[4] https://www.utwente.nl/en/bms/research/ethics/

the global commitment towards sustainable energy for all, implemented in European policies addressing energy poverty and energy transition. Chapter 5 provides some examples of best practices which can help to reduce the gender gaps in the RE Sector. The study closes with conclusions and recommendations.

2. GENDER GAPS AND INEQUALITIES WITHIN THE ENERGY SECTOR OF THE EUROPEAN UNION

KEY FINDINGS

- There is limited gender-disaggregated data in relation to employment in the renewable energy sector within the European Union. This makes monitoring of progress towards gender equality and evaluation of initiatives to move to gender equality difficult.
- There is a significant gender gap in the number of women in positions to influence the energy transition, both in the corporate sector as well in the public energy sector and civil society initiatives.
- Women, particularly lone parents and above retirement age, are more likely than men to live in energy poverty at some stage in their life limiting their access to renewable energy services and hindering their participation in the energy transition

2.1. Energy access in Europe through a gender lens

Within the energy sector gender gaps and inequalities are persistent across the European Union. The Gender Equality Index of European Institute of Gender Equality (EIGE) measures the gender gap (a score of 100 is full gender equality between men and women). With an overall gender gap in the EU of 66.2 (EIGE, 2017)[5] the energy sector is unfortunately not an exception. Gender gaps in training, education and labour market are persistent throughout the energy sector. This section describes the gender inequalities, identifies indicators to measure the gender gap and analyses the existing data. In general, a lack of gender-disaggregated data and infrequent monitoring and updating of data is a limitation in analysing the gender-energy nexus.

With a globally high energy access rate in the European Union of 100%[6] it is assumed that all EU citizens have the same energy access and that there is not a gender inequality concerning energy access. The mistake is to equate availability with access. Although on paper it appears that all EU citizens have access to the energy services and electricity services from a technical perspective (that is availability and 100% connectivity), this does not mean that EU citizen experience energy access in an equal way. If we move beyond availability to take affordability into account, we see inequalities in access appearing. Energy prices across Member States differ enormously. European retail prices rose in the period 2008-2015: the average electricity price rose by 15 to 25%, the average gas price increased by 10% (Ecofys, 2016). Increasing shares of electricity production from renewable energy sources are having an impact especially on distribution grids, but connection costs are often covered by special levies, or they are included in renewable energy surcharges. Therefore, the impact that renewables will have on addressing the issue of gender in energy poverty, which is price related (see Section 4.3) will depend on future energy pricing policies. Decentralisation of energy supply opens up opportunities for civil society to be involved in delivering energy to communities which has implications for gender equality in the energy transition (see Section 2.3).

[5] https://eige.europa.eu/gender-equality-index
[6] https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?view=chart

Figure 1: How much do we pay to power a lightbulb in 2017?

Source: Eurostat 2017 (https://ec.europa.eu/eurostat/documents/10186/8482435/Q12017_electricity_prices_graphics.pdf)

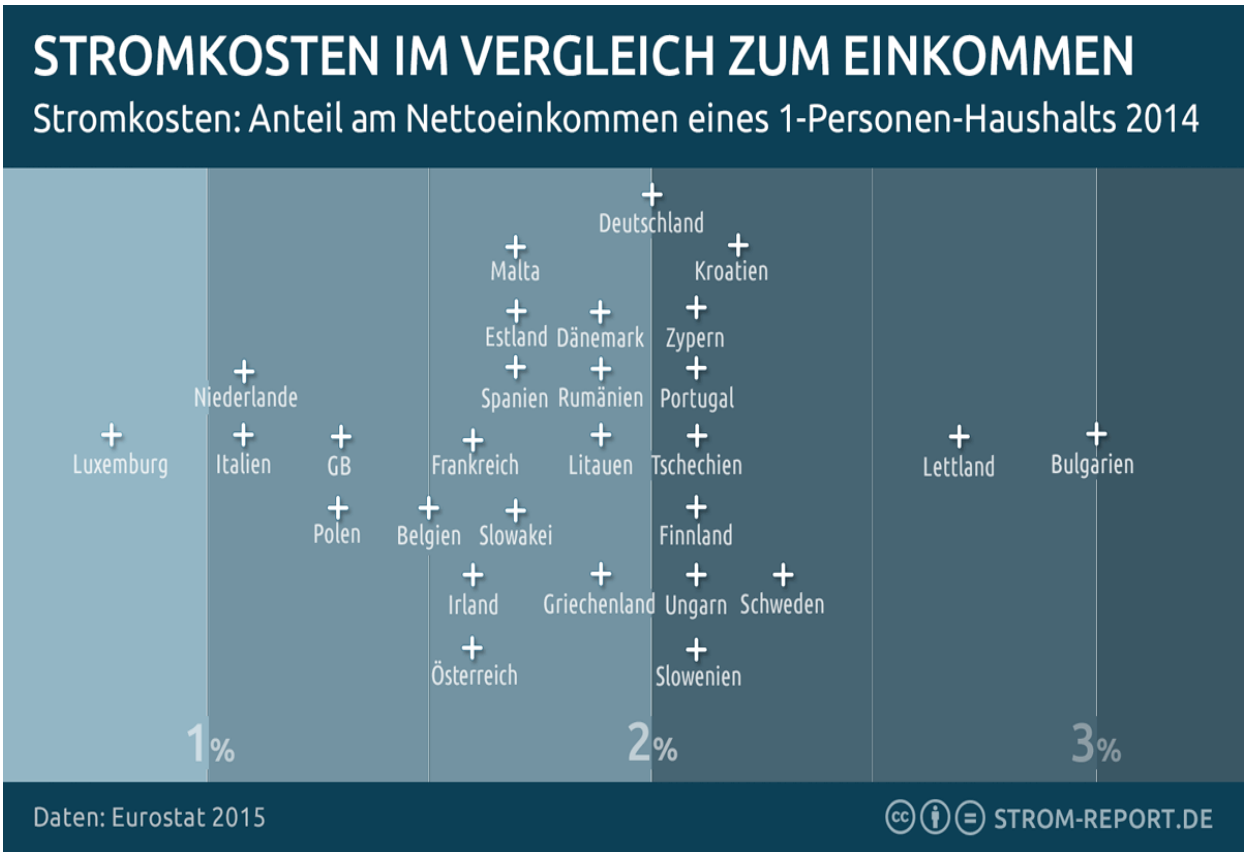
Figure 1 shows that the average annual energy price in the EU to power a lightbulb for 3 hours a day is 2.04 euro. However, the prices differ between Member States, partly due to tax differences, with Danish and German customers paying the most taxes (67% and 54% of their energy prices). The taxation on energy is one of the major reasons for unequal access to energy in the EU. Households in Denmark and Germany pay by far the highest prices per kilowatt hour, while people in Bulgaria pay the lowest. Residential energy prices in Europe have been continuously rising since the beginning of 2010 (Ecofys, 2016). There are large differences between Member States regarding the proportion of income that households have to pay for their electricity bills. When expressed in relation to purchasing power, Bulgaria is the place with the most expensive electricity followed by Latvia and Sweden. At the other end of the scale, Luxembourg has the cheapest electricity followed by Italy and the Netherlands (Eurostat 2017).

The data from an overview of electricity prices compared to income for single-person household when viewed through a gender lens highlights a gender issue when linking the gender pay gap to the fact that women are overrepresented in single-person households (EIGE 2017). The European average monthly amount spent on electricity by a single-person household is 1.9% of their income. A typical Bulgarian single-person household spends 3% of their monthly income on electricity bills. In contrast, a Luxembourgian single-person household pays only 0.7% of their salary, because their average income is the highest in Europe and energy prices are relatively affordable partly due to the relative low tax of 28% .[7] The numbers are only for expenditure on electricity and do not include heating costs (usually gas). Heating plays an important role in energy consumption for households, which can be seen especially in cold winters. Depending on the country, residents keep their homes warm using

[7] https://1-stromvergleich.com/electricity-prices-europe/

natural gas, heating oil, wood or electricity. Price changes in natural gas, for example, have had a large impact on energy expenditures in the Netherlands, Italy and the UK; while changes in oil prices have mainly affected households in Ireland and Luxembourg (Ecofys 2016). Similarly, households in the Mediterranean are faced with trying to cool their homes. Eurostat's Statistics on Income and Living Conditions show that in the eight states bordering the Mediterranean, 30% of the population reported that they are unable to keep their homes adequately cool in summer. 70% of this group are above 65 years of age (Bouzarovski, 2014).

Figure 2: Electricity compare to household income 2014



Source: Eurostat 2015 (https://1-stromvergleich.com/electricity-prices-europe)

With increasing energy prices, more European households have difficulties to afford their energy consumption need. Eurostat calculates that an average of 1 out of 7 European households are struggling to pay their energy bills on time. One third of the population in Bulgaria is not paying their utilities bills on time. In the Netherlands, energy bills are the fourth cause (after rent/mortgage, health insurance and tax) of households' debts.

Energy poverty analysed through a gender lens reveals a strong gender dimension to energy access (Clancy et al. 2017). Not only do women have a higher risk to live in poverty due to income disparities, they also live longer and are over-represented in single-headed households often with the responsibility for children. According to the EIGE Gender Equality Index data from 2015, women on average earn 565 euro a month less than men in the European Union.[8] A slightly higher percentage (1%) of women are more at risk of poverty than men (17.1 % women against 16,1% men). Over the ten

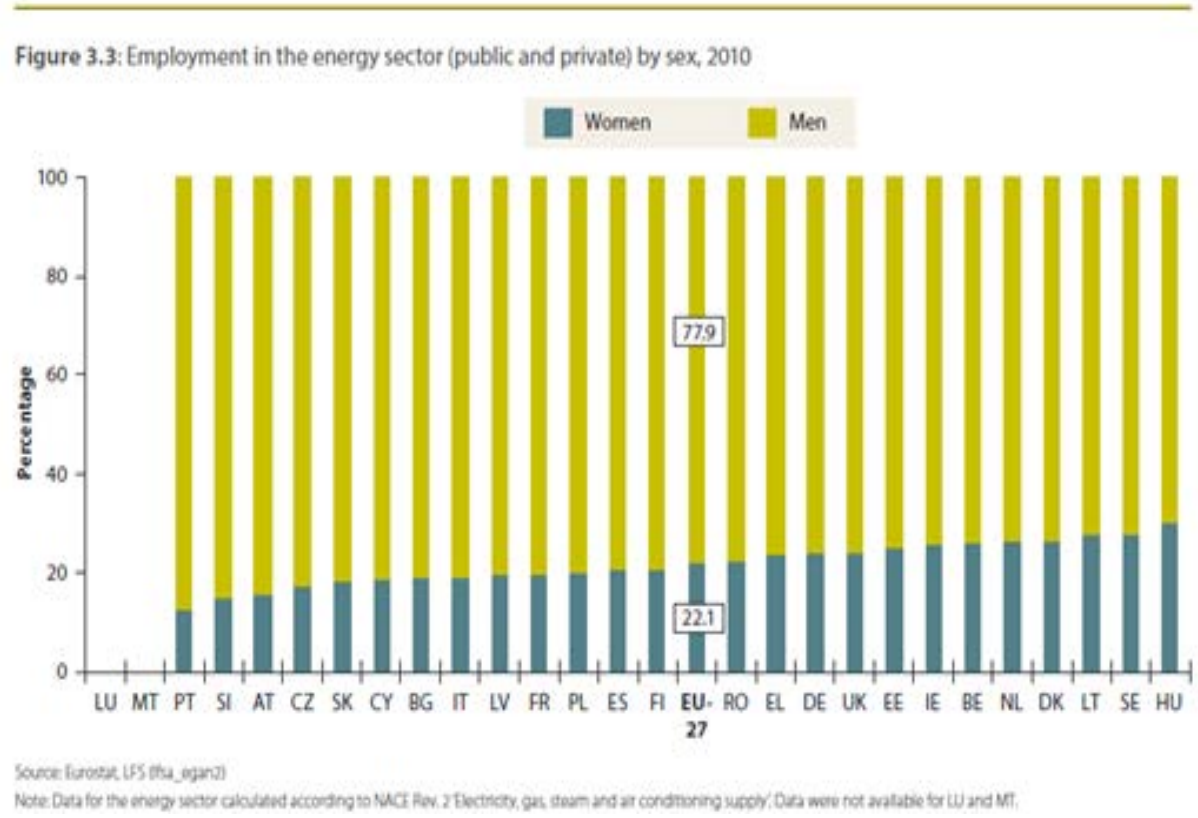
[8] https://eige.europa.eu/gender-equality-index/2015/domain/money

years that the EIGE has monitored the gender gap in income disparity, the income gap between men and women have narrowed. Nevertheless, women still earn significantly (20%) less than men. The disparities in income over the life courses of men and women, result in a major gender gap in retirement pensions (40%) in the EU. Since women often work part-time, perform unpaid work, have lower wages and an average of 5 years shorter working life than men, women face a significant risk of poverty in old age. In the EU, 18% of women and 12% of men aged 75+ are at risk of monetary poverty (EIGE, 2017). On average women live longer than men, so it can be assumed that they also live longer in (energy) poverty than men. The impact of the gender income gap on energy poverty is discussed in Section 4.3.

2.2. Gender inequalities in the energy sector workforce in Europe

The energy sector is Europe is, as many other technological sectors, dominated by male professionals. Engineers, mainly men, are overrepresented in the technical posts in the energy sector (77.9%). Women make up 22.1% of the energy sector workforce usually in administrative positions with limited decision-making power. The energy transition is creating new jobs and positions. However, in the renewable energy sector the traditional distribution of technical jobs hold by male engineers and women in administrative positions continues to exist. Occupational trades in the renewable energy sector that require more skilled work, such as metal workers, insulations specialists, plumbers and pipe-fitters, electricians, heating and cooling experts are also mostly male-dominated (Sustainlabour, 2013). The better paid jobs within the sector, such as engineering and business services are dominated by men. If women are working in the renewable energy sector, they tend to be employed in lower-skilled jobs, primarily in administration and communication (EIGE, 2012).

Figure 3: Employment in the energy sector



Source: EIGE 2012, data originally from Eurostat 2015

Possible explanations for this gender gap in the energy sector include:

- lack of appropriate skills due to the gender gaps in energy-related education;
- the perception of the energy sector as a male domain and persisting gender stereotypes;
- the difficulty of achieving a work–family life balance which discourages women from taking on jobs that involve unpredictable work schedule or emergency travel;
- insufficient career promotion opportunities and mentoring programmes for women.

Organisation of Economic Co-operation and Development (OECD) data estimate that in Spain, Germany and Italy 20–25% of jobs in the RE sector are held by women. These jobs are mostly lower paid, non-technical, administrative and public relations positions (Pearl-Martinez, 2014). This situation is not reflective of the fact that women represent more than 50% of university students as well as making up nearly half of the labour force in these countries (Pearl-Martinez, 2014). Part-time work[9] is often seen as an option for women to combine career and care work. There is very little data about part-time work in the RE sector. A study in Spain in 2006 found that 2% of jobs in RE are part-time of which 67% are held by women (Arregui et al., 2010 cited in Baruah, 2017). Section 5-points out some of the disadvantages of part-time work, for example, more limited illness benefits compared to full-time work. If this is a growing trend for women's employment in RE, steps are needed to ensure that the disadvantages do not become part of the norm.

Figure 4 demonstrates the gender diversity in the energy sector. Female professionals in OECD countries are underrepresented in the traditional energy sector, with a slight improvement for the renewable energy sector. Slowly the gender difference in STEM education and university degrees in OECD countries are changing. However, women with an university degree in STEM are not all starting a career in the energy sector. Several factors, like gender stereotypes, lack of mentoring and career-opportunities are possible explanations. Section 3 analyses in more depth the gender inequality in the renewable energy sector and educational choices which influence the possibilities for working in renewable energy. An extensive study financed by the EU, is the WiRES (Women in Renewable Energy Sector) project. The main objective of the study has been to investigate the role of social dialogue to stimulate more women into the renewable energy sector in Europe and to improve their working conditions (WiRES 2010). WiRES concluded that ensuring the participation of trade unions and employers' organisations in the elaboration and monitoring of the EU Climate and Energy Package implementation is crucial to ensure social cohesion and equal participation in the renewable energy sector.

[9] The ILO reports an increasing diversification of the forms of part-time work which can be classified as: "substantial part-time" (21–34 hours per week); "short part time" (20 hours or less); and "marginal" part-time (fewer than 15 hours per week). Part-time work has a gender bias: globally women make up less than 40 per cent of total employment, however, their share of part-time work is 57 per cent. Within Member States gender differences with respect to part-time work are especially high in the Netherlands, and the Nordic European countries, with Germany being identified as one of the global leaders in marginal part-time work for women (ILO, undated).

Figure 4: Gender diversity in the energy sector

Source: I EA, https://www.iea.org/topics/energyandgender/gendercleanenergy

2.3. Gender gap in energy decision-making

A global study analysing 72 countries found that women represent only 6% of ministerial positions responsible for national energy policies and programs (Pearl-Martinez, 2014). This reflects the situation within the European Union by March 2019 when only four Member States have a female Minister of Energy (Belgium, Bulgaria, Estonia, Germany). A project[10] which aimed to promote within the EU the participation of women in decision-making related to climate change found low participation of women throughout the EU with only a slight differences between Member States (EIGE, 2012).

Women gaining positions of political influence can be seen as a step towards gender equality, however, expectations about the potential achievements of single individuals need to be treated with caution - particularly in respect of delivering more gender aware energy policies. While there is positive evidence from South Africa and Uganda that when women have held senior posts in ministries of energy gender issues have tended to have a higher profile in energy policy (Feenstra, 2002), there is no conclusive evidence that women are more likely to represent women's interests then men are (Childs and Krook (2009) cited in O'Neil and Domingo, 2016). Indeed, the assumption that women will enact gender aware (energy) policies actually places the burden for achieving gender equality on the shoulders of individual women and takes away any responsibility from men. Indeed, focusing on the achievements (or not) of individual ministers potentially draws attention away from the gender barriers within formal and informal institutions (Clancy, 2016).

[10] The European project 'Climate for Change – Gender Equality and Climate Policy' was carried out between 2003 and 2005 in Germany, Italy, Finland and Sweden. The project aimed to promote within the EU the participation of women in decision-making related to climate change.

Part of energy sector transition is the increased opportunity for decentralised generation of energy with the possibilities for new forms of governance which allows actors not normally participating in the energy sector to be involved in influencing the system. Supporting energy communities is recommended by the Right to Energy to eradicate domestic energy poverty and to involve citizens in climate change (Right to Energy, 2019). One form of delivering decentralised energy is through local energy initiatives which can be organised in the form of cooperatives with input from community members. It is recognised that women often prefer to opt for working in groups, such as cooperatives, where they find solidarity and support to overcome challenges including a lack of technical knowledge. Research in Europe, in respect of the gendered nature of participation in LEIs, found that women participate less than men. In Germany, this was linked to women's and men's agency and capabilities, related to the technical issues that arose, continuing to be shaped by both paid and unpaid labour (Fraune, 2015).

LEIs often rely on voluntary labour. In the Netherlands, research which looked at the gender differential in participation in LEIs in the north of the country found that women considered themselves to be time poor and so did not want to be involved in committees, even when they were involved they did not volunteer for leadership roles (Clancy et al., 2017). Indeed, the required highly-specialized expert knowledge of regulations, business models, financing to run a decentralised energy system was outside of many women's and men's experience. A gender difference in motivation for being involved or supporting LEIs was found: women tended to be motivated by environmental issues whereas men tended to be motivated by economic issues. Of the 32 LEI boards surveyed, all but one had been established by men and men dominated decision-making (26 of the 151 board members were women). Men in Germany are also reported to dominate decision-making in decentralised electricity production using renewables (Fraune, 2015).

If cooperative membership requires a financial investment, this can be a barrier to women if they have insufficient assets to pay the subscription or that women's income levels are sufficient to allow them to undertake voluntary work (Fraune, 2015). As the EIGE Index shows, the real barrier for women to be engaged in decision-making is time. With a gender gap score of 65.7 on differences in time use between men and women, the score in 2015 decreased compare to 2005 (EIGE, 2017). Gender inequalities in time use for housework and caring responsibilities for depending family members (children, elderly and people with disabilities) are persistent and growing at least in 12 Member States between 2005 and 2015. Almost one working woman in two spends one hour a day on caring activities compare to one out of three working man. This leaves women with a lack of time to engage in social activities and volunteering, like participation in LEI.

3. WOMEN WORKING IN THE RENEWABLE ENERGY SECTOR

KEY FINDINGS

- Decision about studying STEM are formed early and become progressively more difficult to change as children grow older with girls losing interest earlier than boys which reduces the pool of talent to enter the RE sector.
- Lack of support, encouragement (particularly to overcome negative stereotypes) and reinforcement by parents, teachers and career advisors is detrimental to girls' intention to study STEM and choosing STEM (particularly engineering) careers.
- Women continue to face a variety of barriers to employment in the sector, some of which are attitudinal (for example decisions about responding to vacancies), some of which relate to conditions of employment (for example flexibility of hours to accommodate care responsibilities at home) and some of which are procedural (for example, recruitment policies shaping selection of candidates for interview).
- Despite these barriers, within the EU, the numbers of women studying STEM subjects appears to be increasing (with the exception of Estonia, Latvia and Lithuania).
- There are signs that more women are entering as professionals in technical functions within the RE sector, although in the occupational trades there are still barriers often linked to stereotypes. Indeed, the RE sector has a better representation of women employees than other branches in the energy sector.
- There are a number of initiatives, both within Member States and globally, to encourage young women and girls to opt for STEM and to change employment practices.

3.1. Setting the scene

There are a number of arguments for gender equality in the renewable energy sector. At the bottom line, a skills shortage across the value chain – from project planning and equipment manufacturing to construction and installation, facilities operations and maintenance, and a broad range of support services (such as finance, information technology, human resources, administrative support, business development and marketing skills, legal knowledge, etc.) - is predicted as a consequence of the energy transition (IRENA, 2013). The skills shortage is attributed to the nature of the RE sector in which the design and deployment strategies can require different skills to those found in traditional engineering industries (Thomas et al., 2008) as well as the rate of change since the RE sector is considered to be the fastest growing branch of the energy sector (Lucas et al., 2015). If the skills shortage prediction is found to be valid, the industry cannot afford to miss drawing on a pool of under-utilized talent as well as the additional benefits that diversity in the workforce is considered to bring. A better overall organisational performance has been linked to an increase in the number of qualified women in an organisation's leadership (Noland, et al., 2016). Women can have different ways of working compare to men, for example, they are more likely to act collaboratively in the workplace (Moodley et al., 2016) which can contribute to the improvement of working conditions and general work culture for both men and women, with positive effects on well-being and a greater fairness in relation to promotion which contribute to improved productivity (WISE, 2017).

IRENA has estimated that global employment in the renewable energy sector has increased from 7.1 million jobs in 2012 to 10.3 million in 2017, with the solar photovoltaics (PV) industry, providing around 3.4 million jobs (IRENA, 2019). Although it appears that sex-disaggregated employment data are difficult to find (IRENA, 2019), it is generally accepted that there is a distinct gender gap in employment in the sector. Little appears to be known about the level and nature of jobs occupied by women, although it generally assumed that men dominate the technical and decision making positions with women found in administration and other non-technical functions. In 2016, IRENA conducted a survey of 90 companies involved in the renewable energy value chain from which it is estimated that women made up approximately 35% of the workforce in the renewable energy industry, which appears to be better than in the traditional energy industry where women make up between 20 and 25% of the workforce (IRENA, 2016). A detailed study comparing wage differentials between the renewable energy branch with the conventional energy branch in Germany found that the number of women professionals in RE is higher than in the other energy branches (Antoni et al., 2015).

The findings from the IRENA survey are less positive when the nature of the posts men and women occupy is analysed. Of the companies surveyed, women made up 46% of the administrative posts, 28% of the technical staff and 32% of senior management posts. These findings are in agreement with the literature which supposes that women are primarily found in non-technical posts and men dominate decision making. An explanation as to why women are better represented among the technical and decision makers in the renewable energy industry compared to the oil and gas sector, comes from research conducted in non-OECD countries where it is found that women are able to more easily take up employment opportunities in newly emerging, rather than long-established, sectors (Pearl-Martinez, 2014). If this supposition is correct, then the following question is: why are there not more women in the renewable energy sector? To answer this question at least three areas of explanation can be identified: 1) perceptions of gender roles and the nature of work in the sector; 2) opting for (or not) a STEM qualification; 3) employment practices in hiring and promotion.

3.2. Perceptions about the nature of the renewable energy sector

If we focus on the gender gap in technical jobs, while data specific to the renewable energy are hard to find, we can gain an insight into the nature of the problem by looking at data for engineering in general. A survey in the United Kingdom carried out between 2015 and 2016, found that women were only 16% of entrants into first year engineering or technology degree programmes (Engineering UK, 2018). The consequences of which follow through into employment. In the United Kingdom while women make up nearly half of the total workforce (47%), only 12% of engineers are women (Engineering UK, 2018). Young women are not attracted to engineering. A survey of girls aged 16-19 found that 25% would never consider a career in engineering (Engineering UK, 2018). Similar barriers of perception or interest have been identified in other EU Member States (Belgium, Finland, Poland, Spain and Sweden) (OECD Higher Education Programme, 2014). Research in Canada found that secondary school students associate engineering with "construction work, outdoor work, working in a cubicle and relating primarily to computers and machines rather than to people" (Baruah, 2017:21).

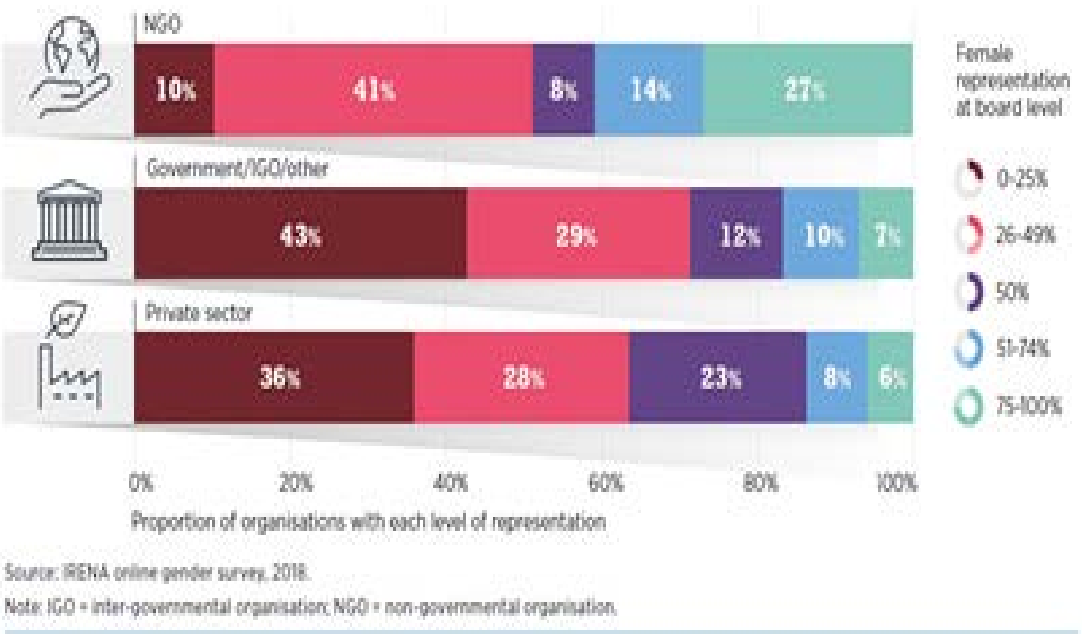
There are also negative perceptions (for example, the work is too physically demanding) about women undertaking the trades associated with construction, such as carpenters, electricians, heavy duty mechanics, crane operators, metal workers, millwrights, plumbers, pipefitters, steamfitters and sheet metal workers, which act as a barrier to considering employment in RE such as wind energy. Women working in engineering trades report a range of forms of harassment designed to denigrate and create a feeling of exclusion ('you are not one of the boys') (see for example: McFarland, 2015; Young Women's Trust, 2016). At the apprentice level, data for the UK show a decline between 2002 and 2014 in female

apprentices in engineering (from 4.6% to 3.8% (Young Women's Trust, 2016). Women, at least in the UK, are in virtually every aspect of an apprenticeship at a disadvantage compared to men[11]: they receive lower pay than men (an hourly average of £4.82 compared with £5.85); they are less likely to receive training as part of their apprenticeship; they are more likely to be out of work at the end of their apprenticeship).

Nevertheless, there do seem to be some positive signs in progress. First, that the number of women studying in STEM fields within the EU (with the exception of Estonia, Latvia and Lithuania) appears to be increasing. In Germany the number of women studying engineering has increased by 10% between 2001 and 2011 (Blau, 2011). While the number of women applying to engineering in Estonia, Latvia and Lithuania has declined since joining the EU, the World Economic Forum (WEF) continues to recognise Estonia as the country with the highest per-capita number of female engineers. The ratio of female to professional and technical workers in engineering is 68 per cent compared to 32 per cent (Anderssen, 2018).

The trend in more women applying to do engineering can be discerned in terms of gender equality in technical jobs in the renewable energy sector. An analysis of the access statistics of the International Renewable Energy Agency (IRENA) Renewable Energy Learning Partnership (IRELP) database which tracks the RE training and education available globally and forms a resource for people wanting to upgrade skills suitable for employment in the RE sector found that there was considerable interest from women (in the period April 2012 to April 2017, 54.2% of access to the database was by men and 45.9% by women) (Lucas et al., 2015). The same study conducted follow-up key informant interviews with 10 companies in the branch, who reported an increasing percentage of suitably qualified female candidates applying for posts.

Figure 5: Female representation at the Board Level in the renewable energy sector



Source: IRENA, 2019

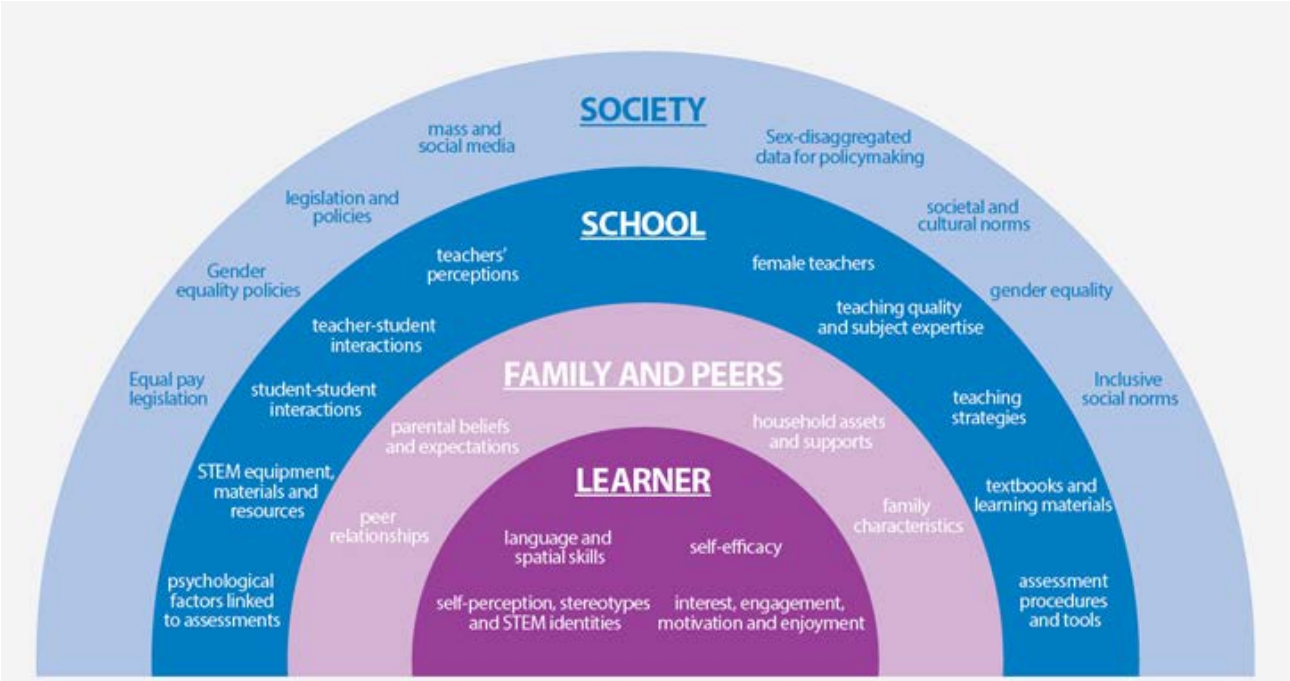
[11] Please note these findings should be taken as indicative since they are based on a survey.

At the board level, female representation in the RE branch, with the exception of the non-governmental organisations, still appears to be male dominated (see Figure 5). This means that companies have not taken on board the evidence emerging from the business literature which finds that, on average, companies with a high percentage of women on their board tend to outperform those with only a small or zero percentage of women.

3.3. To STEM or not to STEM

There are a range of factors which influence girls and women in the choices about studying STEM subjects which then influence the possibility for careers in RE. These factors are summarised in Figure 6.

Figure 6: Ecological framework of factors influencing girls' and women's participation, achievement and progression in STEM studies



Source: UNESCO, 2017: 40

There are two significant development periods in the life-cycle which can influence women's interest in STEM subjects: (a) childhood and adolescence and (b) emerging adulthood. Childhood is when we begin our socialisation and learn what society expects in terms of behaviour of girls and boys, women and men. There is evidence to suggest that children understand gender stereotypes by the end of the first year of their lives, by the age of two they want to behave like other children of the same sex and have internalised gender stereotypes by age four (UNESCO, 2017). As part of their socialisation, boys are encouraged to explore the physical world, discover how things work and solve problems. Girls are encouraged to be more social and engage in group activities. Girls are often brought up to believe that STEM subjects are "masculine" topics - that it is something boys do (UNESCO, 2017). It is possible that attitudes are shaped by the time that children reach the age of 6 (Brian et al., 2017)[12].

[12] Please note that the sample of this study was white, middle-class. The researchers recommend that the study is extended to include other social and economic characteristics.

It appears that the influence mothers have on their daughters to opt for STEM subjects is important and possibly more influential than their fathers. Mothers influence their daughters' motivation to persist in science and math (Leaper et al., 2012). On the other hand, mothers, on average, are more likely than fathers to apply gender stereotypes about math and science to their children (Yee and Eccles, 1992). When children enter adolescence peer-group pressure becomes more important. It is female rather than male friends that influence girls' decisions about STEM subjects. In respect of mathematics, working in collaborative environments results in girls appearing to show more interest in the subject, get better grades and exhibit stronger aspirations than boys do (Wang, 2012). Given their earlier socialisation, it is not surprising that girls find maths more interesting when it is taught from an applied perspective rather than theoretical perspective (Geist and King, 2008; Halpern, 2004).

The influence female STEM teachers have on girls opting for STEM is well documented (UNESCO, 2017). For example, having a female STEM teacher can help dispel myths about the innate abilities among boys for STEM. Also female teachers in STEM subjects provide role models for girls. Role models are considered to enhance girls' and women's self-perceptions and attitudes toward STEM, making STEM careers an acceptable choice (Su et al., 2009). Somewhat worryingly, research in the UK indicates that a significant percentage of male teachers surveyed (29%) considered that STEM careers are a more appropriate choice for boys rather than girls (Engineering UK, 2018).

All teachers play a role in influencing STEM choices. Teachers may not be aware that they hold stereotypical views in relation to STEM which influences their views about whether or not girl can become an engineer and these can be passed on in class. A study in the United Kingdom and Ireland found that 57% of teachers held subconscious gender stereotypes (Accentuate (2017) cited in UNESCO, 2017). Research in the US shows that there are also negative stereotypes about ethnicity and STEM, which when combined with views about gender stereotypes (held by both staff and students) influenced mathematics outcomes for girls of African-American origin (Campbell (2012); Pringle et al. (2012) cited in UNESCO, 2017).

Young people begin to make decisions about the type of career they would like to follow, when they enter adolescence (age 11-17). A study in the United Kingdom (UK) shows that when entering secondary education (age 10-11 years) boys and girls expressed an almost equal interest in things that they had learnt in STEM (75% of boys and 72% of girls) (Kearney and YourLife, 2017). However, by the age of 18, this interest, measured by participation in STEM advanced studies, had declined significantly in both sexes (33% for boys and 19% for girls) with girls dropping out much earlier than boys. A longitudinal study in Sweden, found that young people's career aspirations were largely formed by age 13, trying to change these becomes progressively more difficult after that age (Lindahl (2007) cited in UNESCO, 2017). It appears that girls may also receive less careers education than their male peers which will not help girls to overcome their negative perceptions about STEM education and its appropriateness for girls (Engineering UK, 2018).

The decisions about what subjects to study are shaped by early socialisation. Girls are inclined to orientate towards careers which are perceived to have strong social goals (such as social work, nursing, teaching and human resources) and distance themselves from careers seen to be dissociated from social goals (such as astronomy and engineering). (Su et al., 2009; Diekman et al., 2010). The stereotyping of STEM related careers as not having social goals is of course incorrect since STEM research is a group activity oriented to solving social problems. Another dimension of STEM stereotyping is that STEM subjects and careers are seen as something for the 'boys' related to stereotypes that 'boys are better at maths and science than girls' (linked to another stereotype that

boys in general have a higher-level intellectual ability than girls[13]) and 'science and engineering careers are masculine domains' (Hill et al., 2010). The triennial survey[14] by the OECD in respect of the reading, mathematics and science capacities of 15 year olds around the world, found that girls continue to have a low self-belief, compared to boys, in their innate ability to achieve goals in science. The gender gap was found to be particularly large in Denmark, France, Germany, Iceland and Sweden (OECD, 2015).

Women who venture into STEM subjects often find themselves in a minority and can feel out of place which has other consequences. In an academic setting feelings of not belonging can lead to demotivation and lower grades, with thoughts about leaving the course or programme (Cheryan et al., 2009; Murphy et al., 2007; Stout et al., 2011). As will be discussed in the next section, professional networks can be a key resource in a feeling of belonging to a group and in finding employment. These networks can be formed during education. For example, a key informant recounted the influence of the École des Ponts ParisTech which trains engineers who become the elite in the public engineering institutions in France. Graduates have created strong networks, which are male dominated, that can support each other in strategic positions within the public sector.

3.4. Women working in the renewable energy sector

Those women who graduate from STEM courses and begin to look for a job face a set of barriers. First is identifying vacancies. Personal networks are considered a key source of information, particularly about job openings, and contacts which facilitate entering and succeeding in many professions. When women try to enter non-traditional occupations they are disadvantaged since they are competing with men who have much better professional networks (UNESCO, 2015). One of the reasons why women are better represented in the renewables branch of the energy sector compared to the other branches of the energy sector may be linked to the fact that networks in renewable energy tend to be more open. Women who participate in these networks may attract more women to the sector (Lucas et al., 2018).

The next barrier to overcome is to actually get the job. There is some evidence from the conventional energy sector and other non-traditional occupations, such as mining and transportation, that women and men tend to have different approaches to job applications. Men tend to apply for jobs even when they meet only some of the requirements, but women tend only to apply for jobs when they meet all of the requirements (Asia-Pacific Gateway Skills Table, 2015). Women appear to face unintentional bias in job applications. A research experiment in the UK has tested for gender-based discrimination in hiring. The researchers submitted CVs in response to advertised job vacancies for engineers and secretaries. The CVs for both types of vacancies were similar in respect of qualifications, experience and age - only differing in the sex of the applicant. Statistically significant discrimination was found against women for the engineering post and against men for the post of secretary. The finding was explained by the employer's subconscious preferences based on what is familiar. If the employer's experience of the job has been that it was done competently by a middle-aged white man then the characteristics of age, race and sex become subconsciously associated with competence to fill that function and the employer may tend to favour an applicant of the same age, race and sex (Riach and Rich, 2006).

Also supporting references appear to work inadvertently against women. A study which made an analysis of 312 reference letters for a medical position found that there was a tendency to emphasise research skills, publications and career aspirations for male applicants whereas for female applicants

[13] There is no scientific evidence to suggest that there are any differences between women and men in the biological factors which underpin learning, cognitive ability and behaviour and hence academic/intellectual ability (UNESCO, 2017).
[14] Every three years the OECD's Programme for International Student Assessment (PISA) tests 15-year-old students from 80 countries in reading, mathematics and science. http://www.oecd.org/pisa/ (accessed 28 February 2019).

teaching skills, practical clinical skills and personal attributes were highlighted (Trix and Psenka, 2003). The referees were nearly all men.

The gender gap in respect of occupational trades associated with energy industry (for example, wind turbine technician, solar energy system installer, electrician, energy auditor) bears a similarity to the traditional energy sector, with men making up the majority of employees (McFarland, 2015). The conventional route to qualify for a trade is through an apprenticeship. One channel of information about availability of apprenticeships for a particular trade is through the informal social networks of those working in the trade which in the energy industry are predominantly men. If men hold to a gender norm about what they consider appropriate employment for women and men, they may not pass information about apprenticeships to young women (IRENA, 2019).

Once in the job, gender differential exist in pay. Data for the energy sector in OECD countries indicate that average wages in the RE branch may be higher than in other parts of the energy sector, however, women continue to earn less than men across all occupational categories (IRENA, 2019). This could be due to a number of a factors, such as age and experience (Antoni et al., 2015). There may also be a lack of awareness of the gender pay gap. An interesting finding from the IRENA survey is that 60% of the male respondents consider that both women and men are paid equally while 70% of the female respondents consider that men are paid more (IRENA, 2019). It should be kept in mind that this survey is not a statistically significant sample and it is an indication of perception not fact. However, it does indicate, at least in the organisations where the respondents work, that women perceive inequality of pay in these organisations. This should signal to management that they have problem within their employment practices and that they run the risk of losing quality staff.

Finally, for the career-minded women the barrier exists in staying in the profession and getting promoted. Becoming a mother confronts women with a difficult choice. They can continue to work while balancing work and family responsibilities, particularly for young children and elderly relatives, in a way that it ensures woman is able to meet the promotion criteria (Mason and Goulden, 2002). Women who take a career break to be full-time carers can then find that they no longer have up-to-date skills and lack familiarity with the latest techniques or scientific breakthrough. In academic careers, publications are important for promotion and winning grants. As a consequence, reputation and recognition are being built which can play a role in grant applications and job promotion. Being a carer can restrict women's ability to participate in conferences and professional meetings. Women who take multiple career breaks can have their commitment to their employer questioned which has negative influences on career advancement (UNESCO, 2015). Women who prefer to work in groups can be interpreted as having a lack of self-confidence which in turn is identified as a personality weakness and even as a lack of intelligence[15] (Etzkowitz et al, 1994). To change these perceptions and the use of behavioural traits as promotion criteria requires a change of work culture. Some researchers have argued that a critical mass of people[16] is needed to change the work culture - although there is no agreement on the size of this critical mass (see for example, Greed 2000).

There is also the issue of keeping women in the job. Above was pointed out that a feeling of belonging is an important factor in motivation to stay within a group. Women academics in STEM subjects are

[15] This type of assumption can be linked to gender stereotypes of intellectual ability (see footnote 16).

[16] Term 'people' rather than 'women' is used deliberately. 'Women' are not a homogeneous entity. There are women who see no need to change the existing 'rules of the game'. Likewise there are men who recognise the inherent inequalities in employment opportunities and would also like to change the work culture. Also leaving the sole responsibility to women to change the culture of work takes away any responsibility from men. Indeed, there is no conclusive evidence that women are more likely to represent women's interests then men are (Child and Krook (2009) cited in O'Neil and Domingo, 2016).

more likely to feel isolated and lack friendship, feel excluded from social gatherings (Massachusetts Institute of Technology, 1999; Rosser, 2004). Similar feelings are also reported by women in engineering apprenticeships (Young Women's Trust, 2016). A study examining reasons for leaving STEM careers found that women cite more frequently than men that their reasons are family-related issues and time (Frehill et al., 2008).

3.5. Do it yourself

This section concludes with a positive case study about women who decided that another path for women to work in the renewable energy sector and to influence the energy transition is to take literally matters into their own hands and collectively run decentralised RE systems. In 1991, a small group of German women with technical backgrounds, who had grown disillusioned with the unsupportive male-dominated working environment they had encountered in the energy sector, established a women only wind energy co-operative (Windfang). Currently the cooperative owns and operates eleven wind turbines and three solar plants feeding into the grid just to the north of Hamburg. The co-operative has more than 200 all-female members of all ages and a range of disciplines including non-engineering ones such as theatre and economics. For women with a non-technical background, the motivation for involvement in the cooperative is being able to make a positive contribution to providing clean energy, for example, by providing finance. An original objective is to increase the work experience of women in energy projects. A number of the original members have now moved on to establish their own renewable energy businesses. (Delfs, 2000; The Women and Gender Constituency, 2017). Windfang uses a cooperative structure[17] that pays board members so women are not burdened with voluntary work as has been a barrier in the LEIs described above. A measure of success of Windfang is that it pays 4% return on investment (The Women and Gender Constituency, 2017).

[17] There are a range of cooperative forms using different governance structures.

4. ENSURING GENDER EQUALITY IN THE TRANSITION TO THE SUSTAINABLE ENERGY MODEL

KEY FINDINGS

- Women are underrepresented in their roles as change agents in the energy transition sector:

1. Energy professionals: more men than women are working in the energy sector.

2. Energy decision makers: women are in minority in energy policy making and decision -making bodies at all levels in the European Union and its Member States.

3. Energy consumers: the gender difference of energy consumption and demand is not recognised be energy services.

- Energy policies throughout the EU Member States appear to be gender blind and implementation appears not to adopt gender approaches limiting gender equality in the energy transition.

- The lack of gender-disaggregated data is a barrier to ensuring gender equality in the transition to sustainable energy.

- Empirical evidence that women's employment and income will benefit from modern energy access is limited and rather inconclusive.

- There is some evidence to suggest that women are greener than men in terms of making decisions by household appliances. However, the same evidence indicated that women are more likely to feel guilty about the impact of their ecological footprint.

- Energy poverty is gendered, with a distinct age and social bias.

4.1. Gender equality and energy transition: a global commitment

There is a global commitment, including by the EU, to the Sustainable Development Goals (SDGs), including access to sustainable energy for all by 2030. The gender dimension of the energy transition is integrated into both SDG 5 (gender equality) and SDG 7 (affordable and clean energy). Being a multidisciplinary policy field, a gender just energy transition is serving at least eight SDG's which is in line with the intention that the SDGs are mutually reinforcing. With indoor and outdoor air pollution mainly caused by fossil and wood fuels use, the energy transition to clean and sustainable energy sources are contributing to SDG 3 (Good Health and Well-being). Indoor-air pollution by cooking fuels is claiming roughly 3.8 million deaths a year, off which the majority are small children and women (WHO)[18].

It is erroneous to consider that the indoor air pollution effects are only applicable outside of the EU. Within the EU there are households using wood for cooking and heating, especially in Eastern Europe (Clancy et al. 2017). Anecdotal evidence collected by En-Act tells for example the story of a family living in Poland. The son (age 62) has lost his job but has the responsibility to take care of its paralysed father. The son has to steal firewood for heating and cooking. While using wood for cooking and heating is linked with poor indoor air quality, there are other factors such as poor housing and poor health which

[18] https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health

also play a role. People living in unaffordable, poor-quality or insecure housing are more likely to report poor health and to suffer from a variety of health problems. Another link between health and energy poverty is the ability to adapt to extreme temperatures. Heat waves and extreme cold spells are associated with decreases in general population well-being and with increases in mortality and morbidity, especially in vulnerable population groups (Clancy et al. 2017). There are additional concerns about how a changing climate will affect these temperature extremes and the impacts that extreme temperatures will have throughout the EU.

Figure 7: SDG's addressing gender and energy nexus

Source: https://www.un.org/sustainabledevelopment/news/communications-material/

Injustice and unequal access to energy efficiency policies is one of the reasons of the so-called 'Matthew-effect' of energy transition: those who can afford to invest in energy efficiency benefit from such policies, whereas the poor stay in energy poverty. Social inequalities and energy justice, including in respect of the EU and Member States, are two key emerging streams in the energy policy literature (Sovacool and Dworkin 2015).

The assumption is made that industrial countries have gender-neutral energy policies. The definition by Khamati-Njenga and Clancy (2002) of a gender-neutral energy policy is a policy based on the assumption that the policy, programme or project will benefit both women and men equally in meeting practical needs. Only a small number of research publications on gender and energy policy have been published. These studies contest the assumption that industrial countries, such as the EU Member States, have gender-neutral energy policies (Clancy and Röhr 2003, Clancy et al. 2017, Fraune 2016, Wiliarty 2011). Although energy policy may claim to be gender-neutral, it does have a differential impact on men and women and by neglecting these differences can be described as gender blind. Establishing an energy system that reflects gender differences and that is aware of gendered relations in society can begin with an energy policy that acknowledges the socially constructed and dynamic nature of gender relations, and reflects cultural differences and the social context. However, there is an increasing recognition first of the existence of energy poverty within Member States and secondly that energy poverty has a strong gender component (Clancy et al. 2017).

4.2. The role of women as actors of change within the transition to the sustainable energy model

There is a growing interest in the gender-energy nexus literature in the potential role of women as agents of change, either as energy entrepreneurs, or as decision-makers in energy policy, or as employees in the energy sector. However, there is limited evidence related to the European Union, as to whether or not the energy transition is benefitting from greater gender equality. Due to the limited research on the correlation between gender equality and energy transition and since the numbers of

women actively involved as agents of change in terms of professionals and decision makers is small, it might be too early to draw conclusions on the gender impact of energy transition policies. While there are positive examples, these tend to be isolated which makes judging the impact of scaling up women's involvement, beyond a commitment to gender justice for equality, difficult to predict. What the evidence does show is that involving more women in the energy sector is not detrimental to the transition.

Very recently reported research conducted in the Netherlands indicates a strong gender difference in voting motivation. A survey was conducted of 1,994 voters and their motivation for choosing particular parties in recent elections. The researchers concluded that women tend to add more importance to issues like healthcare, environment, climate change, sustainability and social welfare. Men have a stronger interest in safety issues, economy and immigration (Van Engeland 2019)[19]. It is a concern that 51% of the female respondents in the survey do not feel that they are equally represented in parliament. 36% of the female respondents consider that many male politicians do not sufficiently address the issues that women care about.

These findings from the Netherlands are in agreement with the finding by the EIGE, that women tend to be more sustainable consumers than men (2012):

- they are more likely to buy eco-labelled products;
- they pay more attention to green procurement;
- they attach more importance to energy-efficient transport and fuels;
- they are more willing to change their behaviours to achieve sustainability goals, including energy efficiency.

Looking from a consumers' perspective, women represent a major target group as energy users. Some preliminary consumers behavioural research shows that greener choices related to consumption are more likely to be made by women rather than men. In Sweden, women are more likely to feel guilty about their ecological footprint[20] (61 % of women compared to 43 % of men) (EIGE 2012), and are therefore more willing to reduce their emissions and to buy products from companies and producers that support climate change initiatives or offer organic products. Additionally, women are more likely to accept higher prices for such products. However, sustainable consumption goods are not always the cheapest option, so it is a matter of affordability rather than conviction as to whether consumers purchase a green option. Given that more women than men within the EU live in income poverty, this type of assumption about women's green preferences can result in the blame for a slow energy transition resting with those who have the least capacity to respond. A project[21] between the social entrepreneur working for the social welfare service in the Brussels region and the Bosch company aims to enable low income households to access more energy efficient domestic appliances such as dishwashers, dryers and washing machines and by allowing households to lease appliances. As a consequence, households who would have to rely on energy-inefficient second-hand appliances can now access higher energy efficiency options. This type of intervention is addressing women's household tasks and may help to reduce women's feelings of guilt about their ecological footprint.

[19] https://ioresearch.nl/Portals/0/Rapport%20Volkskrant%20-20De%20vrouwelijke%20kiezer.pdf

[20] The World Wildlife Fund defines an ecological footprint as the impact of human activities measured in terms of the area of biologically productive land and water required to produce the goods consumed and to assimilate the wastes generated. In other words, it is the amount of the environment necessary to produce the goods and services necessary to support a particular lifestyle. https://wwf.panda.org/knowledge_hub/teacher_resources/webfieldtrips/ecological_balance/eco_footprint/ (accessed 6 March 2019).

[21] www.samenlevingsopbouwwvl.be (accessed 5 March 2019)

Within the EU, the decarbonisation and climate change policy as formulated in the EU Cohesion Policy 2014-2020 pursues a Triple-Helix innovation model which involves co-creation and cooperation between three stakeholder groups: public sector, academia and business. In some regions, the model has become the Quadruple Helix when civil society is added as the fourth stakeholder group. This is an essential element of all programmes and projects funded by the EU. In achieving the decarbonisation ambition of the EU, many energy efficiency projects are receiving EU grants as a catalyst. Within the Triple- and Quadruple-Helix cooperation, the role of the public sector is becoming less dominant. The corporate sector and NGO's are increasingly working together in energy efficiency projects, leaving government actors to a more facilitating and stimulating role. Social innovation projects from the Schneider Electric Foundation[22] are an example of this type of policy implementation change in which NGO's are making business cases for energy efficiency and developing policy solutions. Feminists and gender advocates support this type of development on the basis that they consider that at the institutional level more attention is paid to social inclusion. NGO's involved in the energy debate have a strong advocacy background in social justice, with the possibility for more equitable energy access. However, there is no equivalent in the European Union of ENERGIA[23] - a network which focuses on gender and sustainable energy in the Global South[24] including many advocacy activities for more gender aware energy policies and programmes. It was not possible to identify any research about the involvement of NGO's in Triple-Helix (Quadruple Helix) projects which lead to more gender equitable energy interventions.

The principle of subsidiarity of Article 5 (3) of the Treaty on European Union is what determines the interpretation of EU policy. This brings implementation of the EU decarbonisation and climate change policy as close to the citizens as possible which was commented on by key informants as opening up the involvement of the local, municipal level in the energy transition. However, the extent to which they take a gender approach is in question. For example, the 7383 EU municipalities which are part of the Covenant of Mayors[25] have pledge action to support implementation of the 40% greenhouse gas-reduction target set by the EU to be achieved by 2030. Nearly 80% of the Mayors of European cities who have signed the covenant have submitted their plans that need to be adopted by their local councils. A small number of projects focus on energy poverty but none of them have a specific gender approach or a social inclusion focus.

An example of best practice in Spain demonstrates the importance of the ongoing public dialogue on energy conservation. In the city of Madrid, local communities clustered by neighbourhood are coming together once a month to discuss energy efficiency, sustainable consumption and green behaviour. An NGO trains community members to become local energy agents, promoting energy efficiency within their own community. Women are as much involved as men in this programme. The project managers consider that women are more successful than men in counselling other women to improve energy efficiency behaviour. Peer-learning is proven to be essential in energy efficiency literacy programmes, in which energy saving solutions are shared by social media and networking events.

While there are examples of gender equitable approaches in energy policy, a recent review of the empirical evidence on the gender differentiated impacts and determinants of the energy transition remains weak (Pachauri and Rao, 2013). A lack of sex-disaggregated data on the gendered impact of

[22] https://www.schneider-electric.com/en/about-us/sustainability/foundation/
[23] www.energia.org
[24] Global South is a term used to specify those regions in the world formerly called the Third World and sometimes referred to developing countries.
[25] https://www.eumayors.eu/about/covenant-initiative/covenant-in-figures.html

the energy transition is strongly related to the fact that empirical studies evaluating gender relevant factors are scarce. This is a reason why decisions makers are unaware of the gender related impact of energy policies. When searching for the benefit of a gender approach in energy transition, the correlation of women's income and renewable energy sources are mentioned. However, empirical evidence that women's employment and income will benefit from modern energy access is rather inconclusive. The studies providing data stating this positive correlation are often case studies in non-industrialised countries which makes generalisation of this correlation in the EU context rather limited. These studies tend to focus on a single factor which can be misleading. For example, a study in South Africa of women's employment and access to modern energy found an increase of 9% in women working (Dinkelman, 2010). However, other impact factors such as finance and availability of child care can also play a role.

The question is whether women in decision making positions can act as change agents for promoting gender equality in the energy transition. As Fraune (2016) points out, women and men reveal different preferences for energy policy options, especially when it comes to the energy transition and the adaptation of renewable energy. There is a stronger opposition to nuclear energy by women than by men (Clancy et al., 2004). Empirical evidence shows gender differences in choosing energy technology options. Also energy consumption is not gender-neutral (Clancy and Röhr, 2003; Räty and Carlsson-Kanyamaa, 2010). Purchasing power, preferences, needs, everyday practices and routines are shaped by the norms of social institutions (Fraune 2016). Whether this gender difference in energy preferences is reflected in energy policy-making is under-researched with inconclusive results to allow for generalisation. An analysis of who sets the agenda in energy policy in the German and USA context found that party affiliation affects legislator's energy policy priorities more than the legislator's gender (Fraune, 2016).

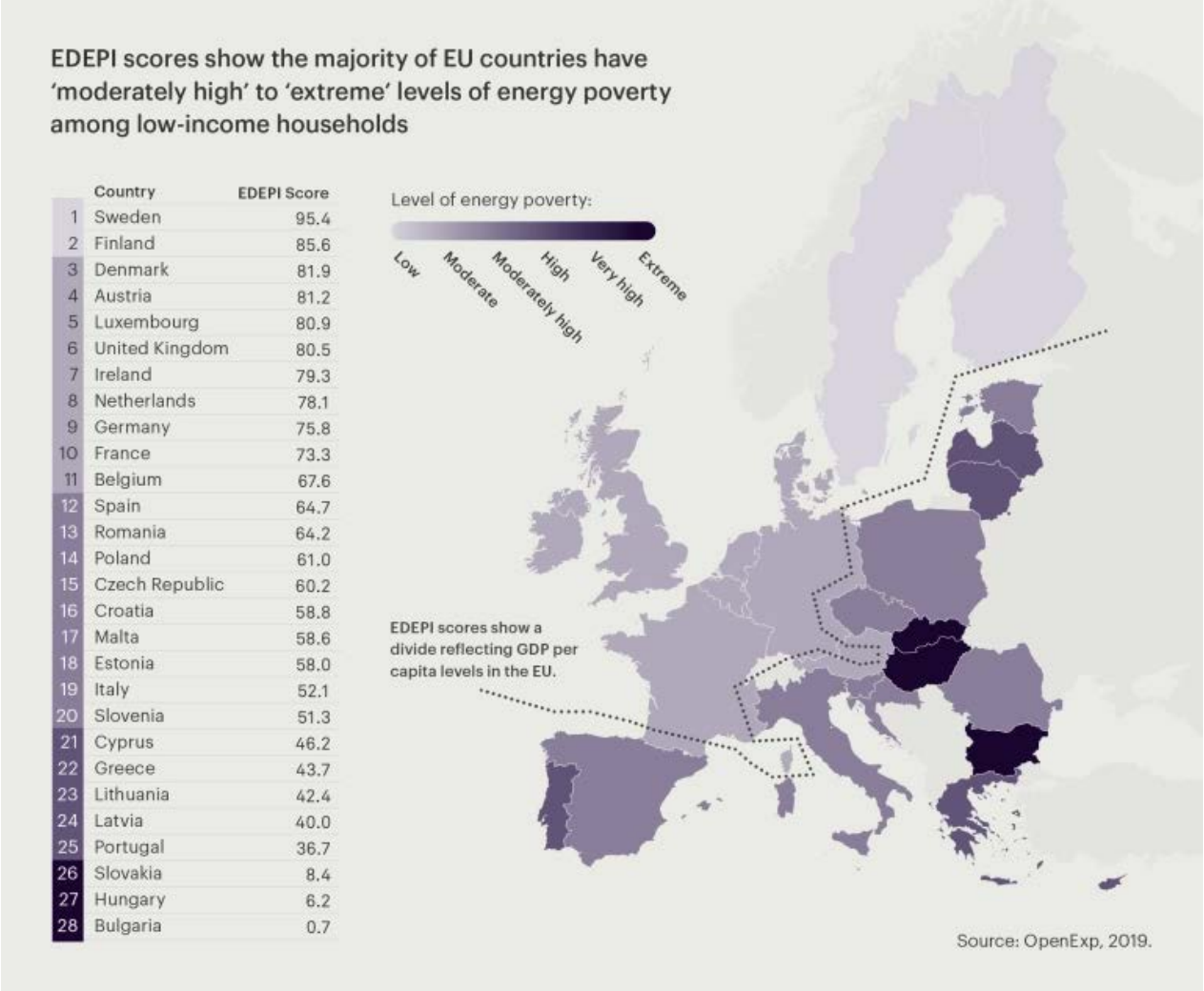
4.3. Gender and energy poverty in the European Union

Within the EU a significant part of the political discussion in the energy sector is dominated by two interlinked themes: energy security and climate change which has led to focusing on policies to promote the transition to more sustainable energy systems. However, an emerging policy theme, linked to the EU's commitment to the SDGs, is whether or not all Europeans can afford sustainable energy services.

It has been estimated by Eurostat that one in seven households within the European Union is living in or at the margins of the condition known as energy or fuel poverty.[26] Using as a measure of energy poverty the inability to pay a household's energy bill or have limited access to high quality energy, it is estimated that in the EU more than 54 million people can be classified as living in energy poverty (Pye and Dobbins, 2015). Many people living in energy poverty inhabit poorly insulated homes, use inefficient appliances (particularly for space heating/cooling, cooking, and heating water). There are households within the EU using wood for cooking and heating which is considered the most financially attractive option.[27] A recent report by Right to Energy (2019) found that the majority (17) of the EU Member States have households in energy poverty. The geographical spread of energy poverty levels among low-income households in the EU is demonstrating a distinction between Northern-Western and Southern-Eastern countries in Europe (see Figure 8).

[26] There is no consistency in terminology. Some authors use the term 'energy poverty' while 'some use 'fuel poverty'. This study uses 'energy poverty' unless quoting directly from a source which uses 'fuel poverty'.
[27] There are households who choose to cook and heat their homes with wood because they consider this to be a better alternative to fossil fuels in terms of a lower carbon footprint and hence impact on climate change.

Figure 8: Levels of energy poverty among low-income households in the EU countries



	Country	EDEPI Score
1	Sweden	95.4
2	Finland	85.6
3	Denmark	81.9
4	Austria	81.2
5	Luxembourg	80.9
6	United Kingdom	80.5
7	Ireland	79.3
8	Netherlands	78.1
9	Germany	75.8
10	France	73.3
11	Belgium	67.6
12	Spain	64.7
13	Romania	64.2
14	Poland	61.0
15	Czech Republic	60.2
16	Croatia	58.8
17	Malta	58.6
18	Estonia	58.0
19	Italy	52.1
20	Slovenia	51.3
21	Cyprus	46.2
22	Greece	43.7
23	Lithuania	42.4
24	Latvia	40.0
25	Portugal	36.7
26	Slovakia	8.4
27	Hungary	6.2
28	Bulgaria	0.7

Source: Right to Energy (2019)

Recently the attention of policy makers in the EU institutions has been drawn to the issue of energy poverty in the EU, as can be seen in the vocabulary adopted by the EU institutions when preparing in 2009 for the Third Energy Package (Bouzarovski et al., 2012). European Parliament resolution of 1 December 2016 on access to energy in developing countries acknowledged the existence of vulnerable consumers in energy poverty and called for the EU to include a gender dimension in all its energy policies. However, the Insight Policy Report (Pye and Dobbins, 2015) concluded in its main findings, that less than a third of the Member States explicitly recognise energy poverty. Those that do acknowledge energy poverty in their legislation and energy policy see it as distinct yet interlinked problem of vulnerable consumers. But since definitions of vulnerable consumers differ between Member States, approaches to eradicate energy poverty from a vulnerable consumer perspective vary strongly within the EU. The use of the term 'consumers' is gender neutral and so there is continued lack of recognition of the gendered dimension of energy policy.

In January 2018, the EU Energy Poverty Observatory was launched.[28] This website creates a knowledge database of existing publications on the topic of energy poverty in the European Union. It shares best practices, statistical data and training tools. Also it promotes networking among professionals, policymakers and academics working on energy poverty issues. With a database of over 500 publications on energy poverty, only nine are identified by the search engine when searched using the term "gender".

The Energy Poverty Observatory identifies indicators to measure and monitor energy poverty in the EU. A distinction is made between primary indicators (e.g. arrears on energy bills and hidden energy poverty) and secondary indicators (e.g. poverty risks, energy expenses, equipped with heating or cooling). Although the indicators are chosen carefully based on the existing body of knowledge and research experience, none of the indicators consider gender inequalities or are providing sex-disaggregated data.

One of the main challenges of developing energy poverty eradication policy at the EU level is the absence of a pan-European definition of energy poverty. Although a small number of Member States define energy poverty in their national legislation (such as the UK and Bulgaria) or are in the progress of developing one (e.g. Spain, Italy), there are countries in which energy poverty is not yet on the political agenda (such as the Netherlands and Sweden) hence lacking a national definition of energy poverty (Clancy et al. 2017). In research and policy documents a variety of definitions of energy poverty are used. However, they focus either on 1) households that spend a high share or income on energy; or 2) households that have insufficient expenditure in energy. The terms 'high' or 'insufficient' are problematic to measure and there is no consensus across the Member States.

In supporting Member States with their own strategies to tackle the problem of energy poverty, the European Commission has been considering a comprehensive and cohesive approach. However, it can be questioned as to whether a pan-European definition of energy poverty will be able to reflect the meteorological and cultural differences between the Member States (WHO-Europe, 2007). Furthermore, as is shown in Section 2.1 there is a large difference in energy prices across the Union, since Member States use their sovereignty to independently decide on energy taxation. The principle of subsidiarity of Article 5 of the Treaty on European Union is leading policy formulation at the national level.[29] Therefore, in respect of the issue of energy poverty, as with other policies, the European Commission leaves the development of policies to the Member States. The implications for gender and the energy transition are that measures for gender equality have to come at the Member State level.

A growing concern is the social dimension of energy efficiency measures. The so called "Climate Change gap" between those that can invest in sustainability and those that cannot afford a sustainable lifestyle is growing. The energy transition has a Matthew-effect, making the rich richer and the poor poorer. Energy efficiency is not only about changing attitudes and household energy consumption. It is as much an affordability and a capability issue. For example, many municipalities provide subsidies and tax benefits for housing insulation and retrofitting. However, only home-owners and those that have the means to invest in energy efficiency can profit from these policy instruments. Knowing the gender dimension of energy poverty and the fact that women in Europe have an average lower income then men and are over-represented as tenants, women have limited access to energy efficiency

[28] https://www.energypoverty.eu/
[29] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=URISERV:ai0017&from=EN

retrofitting programs. This gap may contribute to women's feelings of guilt if they are not able to personally meet their concerns about the environment.

4.4. The gendered face of energy poverty: a hidden issue

However, limited recognition of the problem of energy poverty by Member States is partly due to a deficit in understanding the issue of energy poverty in general and a lack of awareness of the gender dimension of the problem. This ignorance of a gender perspective on energy policy is widespread, not only with national and regional authorities, also within civil society organisations and academics. This is partly caused by the lack of evidence and gender-disaggregated data. There are some EU funded projects, such as the Energy-Action programme hosting the website www.coldathome.today, which are collecting and sharing the narratives of the energy poor that illustrate the statistics. They demonstrate the vulnerability of customers but more they are a testimony of a hidden problem.

A case study in Scotland[30] revealed that people feel isolated who live in cold and not efficient heated homes. The ethnographic study mentioned that people are reluctant to invite guests to their homes because they feel ashamed not to be able to afford heating their homes at a comfortable level. This finding is particularly linked to elderly people, who live alone, consider their poverty as a burden to interact with people and they feel lonely and isolated. The data would suggest that it is more likely to be women than men who experience this isolation. In 2013, in the EU 18.2% of women were living alone as compared to 13.5% of men. People living alone aged 65 and over formed 13.4% of all private households in the EU-28. The situation of isolation is exacerbated by a strong cultural belief in many European countries to keep up appearances. You do not show that you are struggling and you do not ask for help.

In the city of Madrid, Spain, a study is carried out assigned by the Urban Planning Department on locating energy poverty in neighbourhoods. This study is the baseline for an action plan for retrofitting as an energy efficiency intervention in the existing housing stock of Madrid. The methodology focused on analysing the existing housing stock, the architectural features of the buildings and linked with social-economical characteristics like income of the residents. Sex-disaggregation of the data identified a strong feminisation of energy poverty in the city of Madrid. Female headed households in which the woman is the main breadwinner, were disproportionately affected by the high energy prices. In general, 23% of the households in Madrid are at risk of energy poverty, while 32% of the Female Headed Households (FHH) can be considered energy poor. Within the FHH group, the energy poverty rate of single-parents-households is 51% and elderly women (65+) have 45% energy poverty rate (Fernandez et al. 2017).

Energy poverty in the urban climate of Madrid entails coping with extreme heat temperatures in the summer. Policy interventions coping with extreme summer temperatures are often developed by the Health Department. Heat protocols are creating higher social alert for heat strokes and heat-waves-related health symptoms. Within the urban climate resilience programmes, attention is drawn to higher ambient temperature in cities compared to rural areas (in Madrid in the summer the city temperature is 8C higher than the surrounded countryside) (Fernandez et al. 2017). But when analysing mortality rates during extreme temperatures, more people died during long periods of cold temperatures in the winter than a relatively shorter heat wave in the summer (Eurostat, 2017).

[30] http://www.coldathome.today/energy-diary

However, ambient indoor temperatures are not the only factor which influences health. Poor housing conditions with limited ventilation and insufficient heating can cause damp and mould which also have an effect particularly on older people, people with limited mobility and children. Evidence suggests that people with existing health conditions and disabilities are more susceptible to the effects of insufficient heating (such as cold, damp or the presence of mould) than people who do not have these conditions (Snell et al., 2015). There is a substantial body of research which links fuel poverty with a range of mental health issues such as anxiety, stress and depression which are associated with living in poor housing conditions, balancing bills, heating needs and debt. The population identified as energy poor are considered statistically more likely to report poor health and emotional well-being than the population not considered to be energy poor (Thomson et al., 2017). According to one of the key informants, Ute Dubois[31], energy poverty is not a retrofitting or energy efficiency issue but a health problem and should be considered so by policy makers.

[31] Dr. Ute Dubois is Associate Professor of economics at ISG International Business School in Paris, France.

5. EXAMPLES OF BEST PRACTICES SUPPORTING THE TRANSITION TO GENDER EQUALITY IN THE RENEWABLE ENERGY SECTOR

KEY FINDINGS

- The lack of gender-disaggregated data is hiding women's underrepresentation in the renewable energy sector.
- Visibility of women in STEM is key to motivate girls to choose STEM education, women to work in STEM and female professionals to pursue their careers in the energy sector.
- Mentoring and networking are creating a stimulating peer-learning environment and a supporting community for women in the energy sector
- Corporate responsibility is a key factor in ensuring a facilitating work environment for female professionals in the energy sector.

This section looks at examples of best practices initiatives that support the transition to gender equality in the energy sector.

5.1. Gender- disaggregated data

IRENA in their survey of gender in renewable energy mentioned the lack of data to make any comprehensive analysis of progress towards gender equality. Policy makers require data to make policy.

The International Energy Agency (IEA) is working with the Clean Energy Ministerial (CEM)[32] to address the lack of data by combing the former's Technology Collaboration Programme (TCP)[33] and the latter's Clean Energy, Education and Empowerment Technology Collaboration Programme (C3E). The aim is to promote 'concrete, visible and measurable actions that encourage women's participation and leadership in the energy sector' (Tan, 2018). The C3E TCP is developing indicators to monitor the progress of women's participation in the clean energy sector workforce.

Indeed, diversity is not only about the binary of women and men, but it should reflect, as recommended in the UK's Royal Academy of Engineers Diversity and Inclusion Toolkit[34], other social indicators such as gender, age and ethnicity, as well as other aspects of personal development and progression at all levels.

5.2. Getting women into STEM

The first step is to encourage more girls to study science at school. Parents have the earliest influence on children about the suitability of STEM subjects at school and beyond. Involving parents in school activities is found to be particularly effective (Van Voorhis et al., 2013) as well as providing them with more **information about STEM** which helped to promote more informed discussion between parents and secondary school students. These approaches have been particularly influential on mothers who as we report above play an important role in influencing daughters about career choices (Harackiewicz

[32] http://www.cleanenergyministerial.org/
[33] Italy and Sweden are founder members of the initiative.
[34] https://www.raeng.org.uk/policy/diversity-in-engineering/diversity-inclusion-toolkit-resources (accessed 5 March 2019).

et al., 2012). An example of information about careers in STEM designed to appeal to young women is the 'People Like Me' information pack developed by WISE[35].

Specific teaching strategies have been shown to particularly help girls and to reduce the gender gap in STEM achievement (UNESCO, 2017). These strategies are also considered beneficial for all students which reduces the risk of groups of students being identified as 'different' and developing negative stereotypes of insufficient intellect to do STEM. These approaches include: **student-centred, inquiry-based and participatory strategies**. There are also strategies for improving girls' self-confidence and efficacy which are taking account of their specific interests and learning styles (Baker, 2013; Hughes et al., 2013; OECD, 2015). While group work is considered to match girls' preferences for ways of working, care needs to be taken in mixed sex groups since boys can adopt leadership roles and girls adopt more passive roles. Boys are more likely to speak out to defend their views whereas girls tend to avoid confrontation with their peers (Baker, 2000; Leman et al., 2016). Teachers can adopt strategies to ensure girls can make equal contributions to boys.

Giving girls informal and experiential learning spaces to visualise their future as STEM professionals can strengthen their interest in STEM and their ability. In this respect an example of best practice, from the UK, is an informal learning intervention (Discover!) designed to stimulate the imagination and interest of secondary schools girls aged between 12 and 13. The girls have an opportunity to 'try-on' STEM roles in girls only[36] interactive workshops led by female tutors[37] a variety of occupational roles, including as scientists, with a view to their future careers.

Mentoring has been found to benefit girls and young women in a range of ways to encourage them into studying and eventually careers in STEM**.** Mentors can support girls in increasing their self-confidence, self-esteem and motivation, as well as dealing with a range of life experiences. Mentors can also prove to be a source of information, such as about scholarships, introduce girls and young women to networks (which can be a key resource in finding jobs) and provide contacts with other girls and women who share a similar socioeconomic or ethnic background and who have faced similar obstacles in their STEM careers (Bystydzienski et al., 2015). **Mentorship programmes** have been found to improve girls' and women's participation and confidence in STEM studies and careers. Indeed, a study in Denmark found that mentoring was a more significant factor for influencing women to choose a career in engineering, whereas men were more influenced by financial rewards (Kolmos et al., 2013). When secondary level school girls were mentored by female role models during summer activities which introduced them to STEM careers, they were found to show a greater interest in science and mathematics (Sadler et al., 2013).

Young women are for a number of reasons reluctant to consider STEM subjects at university. There are a range of approaches to help address this reluctance. King's College London responded to the finding that only 30% of the students of the Faculty of Natural and Mathematical Sciences were female which they consider are due to a number of in biases women face over the course of a lifetime. As one approach to overcoming these biases the University offers scholarships for women taking first degrees in mathematics, physics, computer science or chemistry (King's College, undated). The offer of significant tuition incentives to encourage female secondary school into fields such as engineering is a

[35] https://www.wisecampaign.org.uk/what-we-do/expertise/inspiring-girls-with-people-like-me/downloads-and-posters/ (accessed 5 March 2019).
[36] There is a similar programme for boys.
[37] http://www.careerswales.com/prof/server.php?show=nav.7497 (accessed 28 February 2019). The programme has twice been finalists in annual awards presented by Women in Science and Engineering (WISE). WISE is a UK Community Interest Company which provides Business to Business services to employers, educators and training providers (https://www.wisecampaign.org.uk/).

factor crediting Estonia with its high percentage of women in professional and technical posts in engineering (Baruah, 2017).

Breaking down gender myths that STEM is a 'boy's only area'. The feeling of being in a small minority can act as a barrier to participation. To encourage women to consider STEM subjects as a degree subject requires a conscious pro-active strategy by the university. This needs awareness among teaching staff as well as with the offices responsible for recruitment and promoting the university. For example, a well-known US University, the Massachusetts Institute of Technology (MIT)[38], recognised that even though nearly 50% of undergraduates was female, the public perception was that it was predominantly men. The University was concerned it was missing out on good quality female students. So the University developed a varied strategy to encourage women students to apply. Giving female school students the opportunity to experience life on campus and take courses as part of summer programmes is felt to have had a positive influence of women enrolling for STEM degrees (O'Leary, 2017). The use of social media has also proved successful in women having a more realistic perception of the campus as a place for women.

In France, to change the attitude of girls to STEM, the Ministry of National Education and the Ministry of Higher Education and Research are working together with the L'Oréal Foundation to create 100 **'Science Ambassadors**'. The role of these Ambassadors is to join classes 'to share their passion about science' while serving as role models to combat prejudices about women in science. As a measure of effectiveness of the programme a survey in 2015, of 2,000 participating students 75% reported being 'more interested in scientific careers' after the intervention, compared to 46% at the outset (UNESCO, 2015: 69).

Make university curricula more women-friendly by recognising what motivates women students. Given the finding that women tend to prefer group work, including this type of approach in courses and highlighting it in promotional material can encourage women to sign up for STEM courses. When the University of California, Berkeley, promoted the use of group work in an introductory computer science course more women than men enrolled for the programme (Finley, 2014). Compensation for earlier subject choices in which women were channelled into non-STEM courses could be through STEM foundation year programmes, which allows applicants with qualifications in non-traditional subjects to change career direction. Such an approach could allow more women to enter STEM degree programmes.

5.3. Getting women in RE jobs and keeping them there

Getting women to apply. Women appear to only solicit for a job if they consider they meet all of the criteria. MIT increased the number of female academics by cold calling suitable female candidates and encouraging them to apply. This strategy is credited with increasing the number of women on the academic staff of STEM departments (O'Leary, 2017). It is also possible that women self-select to apply for a position on the basis of the benefits that the employer offers particularly in terms of flexibility in working hours that enables them to meet their family needs and obligations outside of the workplace (USAID, 2018).

[38] The Massachusetts Institute of Technology (MIT) is ranked globally as one of the leading universities for its teaching and research in physical sciences and engineering (see for example: https://www.topuniversities.com/university-rankings-articles/world-university-rankings/top-universities-world-2018) with, in 2014, a total student population of 11,574 (4,602 undergraduates). (https://en.wikipedia.org/wiki/Massachusetts_Institute_of_Technology#cite_note-Enrollment_Statistics-5: accessed 23 March 2019).

Broadening the pool. RE firms could compensate for the smaller pool of female graduates from the 'traditional' engineering degree subjects (mechanical, electrical, civil, chemical) that they would normally expect to recruit from by switching to 'associated' STEM degree subjects in which there are a larger number of female graduates (such as maths, physics, chemistry and environmental sciences). Cummins, a UK diesel engine manufacturer, adopted this type of recruitment policy and increased its potential female pool of candidates by over 40,000 per year (that is 800%). In 2016 and 2017, women represented 37% of the company's new intake of employees (Engineering UK, 2018). Furthermore, with an emphasis on quadruple-helix cooperation in achieving energy efficiency, other disciplines than traditional STEM are needed within the sector. Possibilities for women with a degree in psychology (consumer behaviour), law, communication, economics and policy are opening up in the renewable energy market.

Providing work experience. The IEA has, as part of its gender diversity strategy, recently established a Fellowship programme to provide on-the-job experience for a female student to 'work on leading energy issues related to women's education and skills development, energy access or clean energy deployment' (Tan, 2018). This type of action provides knowledge, builds confidence and develops networks.

Setting goals and targets. Having clear goals and targets for increasing gender diversity within a workforce is seen a useful tool for achieving objectives. It commits an organisation to achieving goals.[39] Targets can be used for monitoring progress. A review of 118 companies in the United States found that companies setting gender targets made the most tangible progress toward gender balance and equity, compared to those without targets (McKinsey et al., 2015 cited in IRENA, 2019). Making gender quotas mandatory seems to be more effective at achieving a significant number of women in the boardroom than allowing organisations to set their own agendas. France and Germany are two Member States which have made gender quotas mandatory. An analysis of the companies in France included in the Morgan Stanley Capital International World Index (MSCI), found that in 2015 women held 37.6% of the seats on boards which has increased from 9% in 2009, making reaching the country's mandatory 40% quota by 2017 highly probable (Lee et al., 2015). Indeed, two Member States (Sweden and France) were considered to have the second and third highest percentage of women board members globally. However, the figures for CEOs are less positive. Only one French company in the Index has a woman as CEO.

While quotas have been successful in increasing the numbers of women in a particular function, quotas can also lead to negative perceptions about people hired under this type of scheme. The perception may be created that an individual hired under a quota scheme is hired not for their qualifications but because they represent a particular category. An alternative approach[40] in the United States which could help to ensure that women and other underrepresented groups at least make it to the interview stage is to require that every candidate pool for a position has a qualified candidate from an underrepresented group (DuBois and Whitemore Schanzenbach, 2017).
There have been some innovative approaches by energy sector **companies to declare their commitment to gender equality**. In Iceland, Reykjavik Energy was able to reduce its gender pay gap from 8.4% in 2008 to 0.3% by the end of 2017. It used specially developed software to show in real time the effects of each pay decision on the gender pay gap (USAID, 2018).

[39] A business network of corporate lawyers includes a template which organisations can use as a policy statement committing the company to a gender policy https://www.webmerge.me/capture/5244/osler-diversity-policy (accessed 20 February 2019).
[40] Known as the Rooney Rule and is used in the National Football League in the US. It only applies for senior functions which has led to criticisms that this is too restrictive since all levels of employment need greater diversification.

Research shows gender differences in perceptions about pay which can be considered to represent a lack of transparency about salary scales. Individuals are often reluctant to make public their take-home pay. **Anonymised salary data** grouped by qualifications, skills and years of experience could be an approach to making pay differentials more transparent. In a sector where women are unevenly distributed between junior, middle and senior levels how gender pay gap data are presented is also important for tracking and monitoring progress. Good Energy, a UK company that buys and distributes 100% renewable electricity from independent generators, considered that it was doing well compared to other UK energy companies in terms of its gender pay gap at 8%. However, this figure is based on average earnings and when expressed in terms of median earnings the rate rises to 23%. The disparity exists because while women make up 52% of the total staff, they are less well represented in middle management (61% are in the lowest pay quartile and 42% in the highest quartile) (Good Energy, 2018).

Reykjavik Energy and Good Energy have another factor considered significant in addressing the gender pay gap: the **proactive commitment of senior leadership**, such as the CEO (Orser, 2001). By making public commitment to specific actions to address gender equality, for example, gender inequalities are to be addressed by introducing targets and managers will be held accountable. **Training** employees at all levels about the benefits for all of a diversified workforce helps to reduce negative attitudes. For example, the Botswana Power Company has a gender policy which includes granting men paternity leave which is credited with making male employees more receptive to the policy when they realise that men can also benefit (Clancy et al., 2016). Training for those staff members involved in the recruitment process is not only to raise their gender awareness but also to provide tools to use for addressing gender bias in recruitment (for example, photographs or pictures in advertisements in engineering which show men in hard hats sends a subliminal message to women that this job is not for them).[41]

5.4. Keeping women in RE

The challenge of the work-life balance is more acute for women than men when responsibility for young family members and increasingly older family members is part of the daily routine. Employers can offer the option of **part-time or flexi-work** (including working from home) as a means of reducing stress and keeping their workforce. However, availability of gender sensitive employment policies varies with the type of employer. The IRENA survey in the RE sub-sector found that NGOs appear to be the type of employer most likely to have gender sensitive employment patterns (84% of respondent's organisations offered part-time or flexi-work), followed by the private sector (62%) and public sector organisations the least gender sensitive (40%) (IRENA, 2019). It appears that the larger the percentage of women in the organisation, the more likely it is to have gender sensitive employment policies.

A note of caution should be issued about part-time work since this can have negative consequences for women's career development. The International Labour Organisation (ILO) has flagged the negative aspects of part-time employment. While it seems obvious that part-time work implies lower total earnings less prominent negative aspects are the link with reduced or no benefits (such as holidays, sick leave with pay, health insurance, contributory pension schemes, social security benefits, etc.) enjoyed by full-time employees (ILO, undated). There are also other disadvantages for career development (such as reduced status, questioned commitment, and lack of training and profiling opportunities) as has been pointed out above.

Adequate **paid parental leave** policies are an instrument to encourage gender equality in the responsibility for child-rearing. While some Member States allow flexibility in which parent takes long-

[41] This approach has been adopted by Amey a UK infrastructure services provider (Young Women's Trust, 2016).

term leave, the gender-pay gap means that it will most likely be the parent who earns the highest salary, usually the man who returns to work full-time from which accrues career development benefits. An important task is to ensure that women do not incur unfair disadvantages from childbirth and can get help in this regard. Public policy measures or corporate undertakings have to allow women (and men) to resume the positions they held previously without side-lining their career prospects. In addition, on-site childcare facilities can provide a good transition back to the workplace after a period of parental leave.

Women who return to STEM jobs after a career break can face promotional barriers linked to missing out on changes in skills and knowledge that have developed while they have been out of the workforce. **Career restarts** can be in the form of returnships which enable returnees to update their knowledge and skills. For example, the STEM Returners programme organised in the UK by the Institute of Marine Engineering, Science and Technology and the Women's Engineering Society offers paid short-term employment placements for female and male professionals returning to work after a career break[42]. The programme also provides advice, career coaching, networking opportunities and mentoring. There is also the possibility of a permanent position on completion of the programme.

Networks of female professionals in the renewable energy sector are creating a stimulating and supportive environment for women working in the sector. For example the Scottish organisation WiRES (Women in Renewable Energy Scotland[43]) and the Spanish women's network Navarre[44] are organised to promote the visibility of women working in the renewable energy sector. Another women and energy network is the Lights on Women Initiative, bringing practitioners and academics working on energy policy issues together[45]. These networks are often run by volunteers and financed by membership fees, sponsorships from energy companies or subsidies. The outreach activities, like fieldtrips, symposia and educational activities, are often open to men. However, the networking meetups are exclusively for women. Many networks of female professionals run a student bursary program and an award recognition program.

Award programmes for outstanding female professionals in the energy sector create more visibility of women in the sector and provide role models. The Clean Energy Education & Empowerment (C3E) initiative was launched in 2010. The C3E consortium represent 24 industrialised countries plus the European Commission[46]. The U.S. C3E awards are acknowledging mid-career women who have an outstanding leadership and accomplishments in clean energy. A group of more than 40 distinguish senior professionals represent the C3E initiative as ambassadors.

[42] https://www.stemreturners.com/the-programme/ (accessed 5 March 2019).
[43] https://www.scottishrenewables.com/directory/listing/women-in-renewable-energy-scotland-wires-/#main
[44] http://www.navarra.es/home_en/especial/Encuentro+mujeres+y+cambio+climatico/
[45] https://medium.com/lights-on-women
[46] http://www.cleanenergyministerial.org/initiative-clean-energy-ministerial/clean-energy-education-and-empowerment-c3e

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Structure and causes of existing gender inequalities within the energy sector of the European Union

The energy sector in the EU is influenced by a set of persistent gender inequalities, which can be summarised as follows:

Gender gaps in energy access. Women are disproportionately affected by energy poverty and struggling to afford their energy consumption. This limits women's involvement in the energy transition, by not being able to afford energy efficiency investments to decrease their energy consumption. Within the current energy efficiency debate, the focus is on consumption patterns and consumers behaviour. Although women tend to choose for the greener and sustainable option, it is more a question of affordability then female consumers' behaviour and preferences.

Gender gaps in the energy labour market. Although the renewable energy sector is an emerging market with growth potential for investment and employment, female professionals are still underrepresented in the energy sector. In Europe, the energy sector workforce is composed mainly of men (77.9%) with women representing only 22.1%. The same trend seems to apply to the renewable energies sector, where women are also underrepresented. In the renewable energy sector, women represent less than 30% of positions (EIGE, 2012). When women are working in the energy sector, they found primarily in administration and communication.

Gender gaps in energy-related education. There are very few studies which focus specifically on this topic, which limits the data available. Therefore, we have had to draw on data about the energy sector in general and engineering. To work in technical functions throughout the energy sector will require a qualification in a STEM subject.

Gender gaps in decision-making. As women are underrepresented as energy professionals and STEM students, women holding decision-making positions in the energy sector are low too. The situation is the same for both the corporate sector as the public sector. EIGE (2012) researched 295 energy companies showing that only 36% of the surveyed energy companies had women on boards or management groups. According to the same study, only 17.3% of women in the public energy sector are employed in high-level positions.

6.2. Women as change agents in the European Union energy transition

Three roles of women as change agents in the energy transition sector can be identified:
Women as energy professionals: the underrepresentation of women compare to men working in the energy sector.
Women as energy decision makers: the underrepresentation of women in energy policy making and decision-making bodies at all levels in the European Union and its Members States.
Women as energy consumers: the gender difference of energy consumption and energy demand.

Energy plays an essential role in people's lives. However, in order for energy policy to be gender equitable energy policy cannot be gender neutral. First, there needs to be a recognition that women and men have different energy needs in their daily lives. Second, that women and men differ in a number of ways as to how they are able to access energy which is influenced by a range of social characteristics such as age, ethnicity, status in the life-cycle (child, working age adult, retired) and civil

status (single, married, single parent, divorced, widowed) as well as economic status. Women are often more likely than men experience at some point in their lives energy poverty – particularly older women and single parents. The situation that there is gendered energy poverty throughout the European Union is an indicator that energy policy is not gender neutral – it is gender blind. Without sex-disaggregated data awareness of the gendered nature of energy poverty will remain limited. It is important to stress that data which are further disaggregated to reflect a wider range of social characteristics would contribute to more effective policy making since policies will better reflect the reality of people's lives.

It is not only the content of energy policy that lacks gender equality but also its formulation and implementation. The data show that the political influence of women in the energy sector is limited since a critical mass of representation of women's voices is lacking. There are only four women ministers of energy within the EU. However, a caution should be used about a focus on gender equality being represented by equal numbers. Firstly, women are not a homogeneous group. They have different experiences, different world views and different aspirations. It is dangerous to assume that equality of numbers will mean gender aware energy policy. A woman in a position of power may not always represent the views and aspirations of all women. So even if half of the energy ministers with the Member States are women, energy policy could still remain gender blind. Secondly, it is also unfair to expect from women to assume the entire responsibility for a gender equality in energy policy. Gender equality is the responsibility of **women and men**. Focusing on having women in positions of power to achieve particular policy objectives removes men's equal responsibility to deliver gender equality.

There is a similar situation in terms of the gender gap in respect of women involved in the supply side of renewable energy. While the percentage of women in the technical professions involved in renewable energy is better than for the conventional energies, this is not a cause for complacency. There continues to be a very large gender gap in the occupational trades, which, to a significant extent appears, from the anecdotal evidence, to be rooted in negative stereotypes about women with unacceptable methods of sexual harassment to discourage female apprentices. There is also a large gender gap in the board rooms of engineering companies. If the predictions about skills shortages in the RE industries are correct, the sector cannot afford to neglect the pool of female talent which can not only bring significant benefits to the functioning of their companies and thereby contributing to delivering the energy transition.

Another positive sign that could lead to a reduction of the gender gap in RE is that , the numbers of women within the EU studying STEM subjects, which make them eligible for careers at all levels in RE are increasing. However, a cause for concern is the situation in Estonia, Latvia and Lithuania where since accession to the EU the number of women studying STEM has declined. It is an encouraging sign that there are a significant number of initiatives within the EU and other OECD countries which aim to address the barriers to girls studying STEM subjects and women taking up careers in the RE sector.

Gender equality in energy policy also means that the content of the policy should reflect the views of women and men equally. There is some academic evidence to support the supposition that women are more motivated by environmental issues than men are – particularly in respect of nuclear power: women are more negative than men about its contribution to the energy transition. Studies which have looked at the workings of citizens' initiatives linked to decentralised RE systems find that women are interested but are often deterred from involvement by lack of technical knowledge and lack of time particularly as relates to involvement in committees and leadership positions.

There is some evidence to suggest that women are greener than men in terms of making decisions on household appliances. However, the same evidence indicates women are more likely to feel guilty about not being able to afford 'greener' options. Again, given that more women than men within the EU live in income poverty, assumption about women's green preferences can result in the blame for a slow energy transition resting with those who have the least capacity to respond.

When analysing women as energy consumers, the issue of energy poverty is described to analyse the gender differences in energy access. Addressing energy poverty is enabling achieving sustainable energy access for all Europeans. Empowerment of vulnerable households creates potential for upscaling energy transition, but be aware of the Matthew-effect of energy efficiency policy: the poor getting poorer, the rich getting richer.

6.3. Recommendations

Creating a more gender equitable energy policy

A wide adoption of the "Define, Plan, Act, Check" methodology described by the EIGE in its document "Gender and Energy" is recommended. The starting point – which has been made many times in many reports on gender mainstreaming - is collecting sex-disaggregated data. In addition, these data should be further disaggregated beyond the binary 'women and men' to reflect the diversity of EU citizens' lives.

Reducing the gender gap in the renewable energy sector employment

Section 5 describes a range of initiatives currently underway at different points in women's education and employment in trying to overcome the barriers to more women being employed and remaining in the RE public and private sectors. There appears to be no available independent evaluations of these initiatives which makes an analysis of what works and under what circumstances difficult. Therefore, an evaluation of a range of initiatives would help organisations identify what works for their situation.

Recognising and addressing the gendered nature of energy poverty

The collection of gender-disaggregated data of household energy use in an intersectional way to represent a typology of energy users at the household level. Both quantitative data and qualitative data should be collected. The former gives an indication of the scale of the problem while the latter provides insights into the reality of people living with energy poverty. Energy poverty is as a multidisciplinary policy issue which requires an integrated approach. For example, heat stress is dealt with by the medical profession – however, is treating the symptom not the cause which may be the condition of the building where the patient lives and/or insufficient income to afford to buy and run a cooling system. An appropriate solution requires cooperation between a range of actors dealing with social policy, urban planning, and housing as well as energy companies.

Increasing gender equality in decision making at the local level related to the energy transition.

Organisations, such as cooperatives, involved in decentralised energy systems which aim to increase gender equality in decision making need to take into account women's situation – firstly, by recognising that women's motivational factors may be different to men's, secondly, by promoting the value of non-technical skills to the functioning of the organisation and thirdly, by avoiding a reliance on voluntary contributions to the running of the organisation.

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ANNEX 1. KEY RESPONDENTS

Marine CORNELIS	Executive Director Next Energy Consumer, former Secretary General National Energy Ombudsman Network
Ute DUBOIS	Associate Professor of economics at ISG International Business School in Paris
Ana SANZ FERNÁNDEZ	Researcher at Technical University of Madrid
Carmen SÁNCHEZ – GUEVARA	Researcher at Technical University of Madrid
Marilyn SMITH	Executive Director The Energy ACTION Project

ANNEX 2: INTERVIEW OUTLINE

Interview Questions Energy Transition & Gender
Women, gender equality and energy transition in the EU

The overall research questions for this research report are:
1. What are the structure and causes of existing gender inequalities within the energy sector of the European Union?
2. How will the transition to the sustainable energy model affect gender equality?
3. How can the role of women as actors of change within the transition to the sustainable energy model be enhanced to promote gender equality and a more effective transition?

Methodology

Semi-structured interviews will be conducted with key respondents reflecting the broad range of the research area and the different actors involved in this topic. Respondents are found using contacts within our existing network. Also based on our literature review and policy document analyses new contacts are added to our list of respondents. Furthermore, the list of key respondents will be enlarged by using snowball-technique, asking the interviewees to recommend other informants to contact for our research.

Ethical approval

An ethical approval for conducting elite interviews is given by the Ethical Committee of the University of Twente. All respondents need to give their consent to use their input. In case they prefer to be anonymous, their names will not be published in the report. All respondents will receive a report of their interview for approval.

Informed consent form for interviews

I declare to be informed about the nature, method and purpose of the study. I voluntarily agree to take part in this study. I keep the right to terminate my participation in this study without giving a reason at any time.
My responses may be used solely for the purpose of this study. In its publications, they may:

- Be cited with my name or function revealed
- Be cited anonymously, thus without identifying context
- Only used as information source

During the course of the interview I keep the right to restrict the use of (some of) my answers further than indicated above.

Name of the participant:
Date:
I declare to fully adhere to the above.
Name of the researcher:
Date:

ANNEX 3: INTERVIEW QUESTIONS

RQ1: Gender inequalities with the energy sector

Can you start by telling us about your work related to the energy sector and the energy transition?

At all levels within the EU, you find evidence of gender inequalities in the energy sector, for example as consumers (more women are affected by energy poverty than men), as employees (gender pay gap) or as policy influencers (more men hold senior decision making positions in the public and private organisations within the energy sector). Do you agree with these observations? Have you examples? What do you think are the causes? Do you have examples of how inequalities are being challenged and overcome?

1. How would you assess the existing gender equality within the energy sector of the EU?
    a. How do you define a gender equal energy sector?
    b. What indicators would you use?

2. What is in your opinion the connection between gender equality and energy transition in the EU?

3. In your opinion what are the causes of the existing gender inequality within the energy sector of the EU?
    a. Can your provide examples?
    b. How could this inequality be overcome?

RQ2: Gender equal energy transition

There are a range of arguments that for energy transition to succeed it has to incorporate gender equality. These can be related to having more women in senior decision making positions in the public and private organisations of the energy sector – there is some evidence to suggest that a more diverse workforce has more positive outcomes. That women and men are affected differently by the energy transition and as a right both women and men should be able to influence these decisions.
We are interested in identifying how greater gender equality can be promoted in the energy transition with the EU.
Do you agree with the proposition that for the transition to be sustainable it has to incorporate gender equality in policy formulation and implementation?

4. What policy measures can you suggest to promote greater gender equality in the energy transition?

5. What could be the role of the EU institutions in improving a gender equal energy transition?
    a. Could you please note what is lacking in existing EU energy transition policy from a gender equality perspective?
    b. debate?
    c. How effective do you think the following policy instrument of the EU are in addressing gender equality within energy transition?
        - Developing awareness programmes and communication
        - Supporting research and information dissemination of good practices

- Financing innovative projects and stimulating experiences
- Drafting legislation on gender equality in energy transition policy?

6. What obstacles could you identify in achieving a gender equal energy transition?
    a. How can the EU overcome this obstacles?
    b. Are these obstacles different within MS (Member States of the EU)?
    c. Do you have examples from MS of policy instruments for overcoming gender differentials in access to sustainable energy?

7. Wat opportunities could you identify in achieving a gender equal energy transition?
    a. How can the EU enhance or promote these opportunities?
    b. Are these opportunities different within MS (Member States of the EU)?
    c. Do you have examples from MS of policy instruments that successfully promote gender equal access to sustainable energy?

RQ3: Women as actors of change

The energy sector tends to be dominated by men in decision making positions. Does this matter?
Do you think women have a distinct contribution compared to men's contribution to make to promoting this transition? For example as consumers or as professionals in the energy sector? Can you give any examples?
Do you know of any women in political positions who stand-out as advocates of an energy transition that takes gender equality into account?

8. How do you think that women could use their role as actors of change within the sustainable energy transition?
    a. Women as consumers
    b. Women as energy professionals
    c. Women as decision makers

9. How can women's role be acknowledged within the energy transition policy of the EU and its member states?

10. What would you recommend to promote women's role in the energy transition debate?

11. What do you think are the benefits of involving women in the energy transition debate?

Concluding remarks:

12. Is there anything you would like to add to the discussion?

13. Could you recommend other respondents or organisations we can approach for our research?

This study, commissioned by the European Parliament's Policy Department for Citizens' Rights and Constitutional Affairs at the request of the FEMM Committee, examines the evidence on the role of women in the energy transition in the European Union and the extent of gender equality in the process particularly in respect of the renewable energy sector. The study identifies gender inequalities preventing women from the involvement in the energy transition and career advancement in this area and assesses how the transfer to the sustainable energy model will affect gender equality and the role of women as actors of change. It provides good practices in overcoming the barriers to gender equality in the energy transition and concludes with recommendations to the EU and national decision makers.

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